

DAY5-1

Activities Text Editor Fri 09:36

Open Firefox Web Browser Save

1. Install ares-cli
<https://www.webosose.org/docs/tools/sdk/cli/cli-user-guide/>

2. vi ~/.profile

```
# add CLI path
if [ -d "$HOME/ares-cli/bin" ]; then
    export PATH="$PATH:$HOME/ares-cli/bin"
fi
```

3. source ~/.profile

4. ares-generate -l

5. ares-generate sampleApp

6. ares-package sampleApp

7. ares-setup-device --list

8. ares-setup-device --listfull

9. ares-install --device target com.example.sampleapp_1.0.0_all.ipk

10. ares-install --device target --list

11. ares-launch --device target com.example.sampleapp

12. ares-launch --device target --running

13. ares-launch --device target --close com.example.sampleapp

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Activities

Text Editor

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Open



Firefox | Commands

Save

<https://www.webosose.org/docs/tools/sdk/cli/cli-user-guide/>

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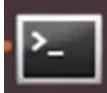
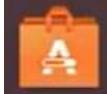
9. ares-install --device target com.example.sampleapp_1.0.0_all.ipk

10. ares-install --device target --list

11. ares-launch --device target com.example.sampleapp

12. ares-launch --device target --running

13. ares-launch --device target --close com.example.sampleapp



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[luna-send Usage Guide](#)[ls-monitor Usage Guide](#)

Installing CLI

This section describes how to install CLI on your host machine.

Download the Package

First, download the CLI package for your operating system from the [SDK download page](#).

Unzip the Package

Unzip the downloaded CLI package. After unzipping the package, you can execute the CLI commands located in the following directories.

- Windows: `ares-cli\bin`
- Linux & macOS: `ares-cli/bin`

⚠ Alerts for CLI Installation on Windows

Due to recursively nested directory structure of Node.js modules used by CLI, the resulting path length may exceed the [maximum path length of Windows](#). To prevent issues while installing and

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⚠ Alerts for CLI Installation on Windows

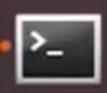
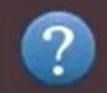
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webOS

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Note

Emulator is created as a virtual machine image when you build webOS OSE platform source code with `qemux86` option configured. For more information, see [Building webOS Open Source Edition](#).

Command-Line Interface

- Version: v1.12.0

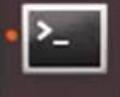
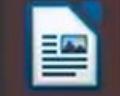
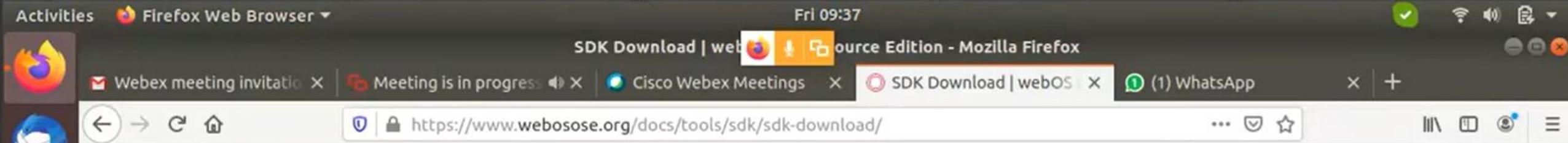
Platform	CLI Package	Size
Linux	ares-webos-cli-linux-1.12.0.tgz	27.6 MB
macOS	ares-webos-cli-mac-1.12.0.tgz	14.8 MB
Windows	ares-webos-cli-win-1.12.0.zip	15.5 MB

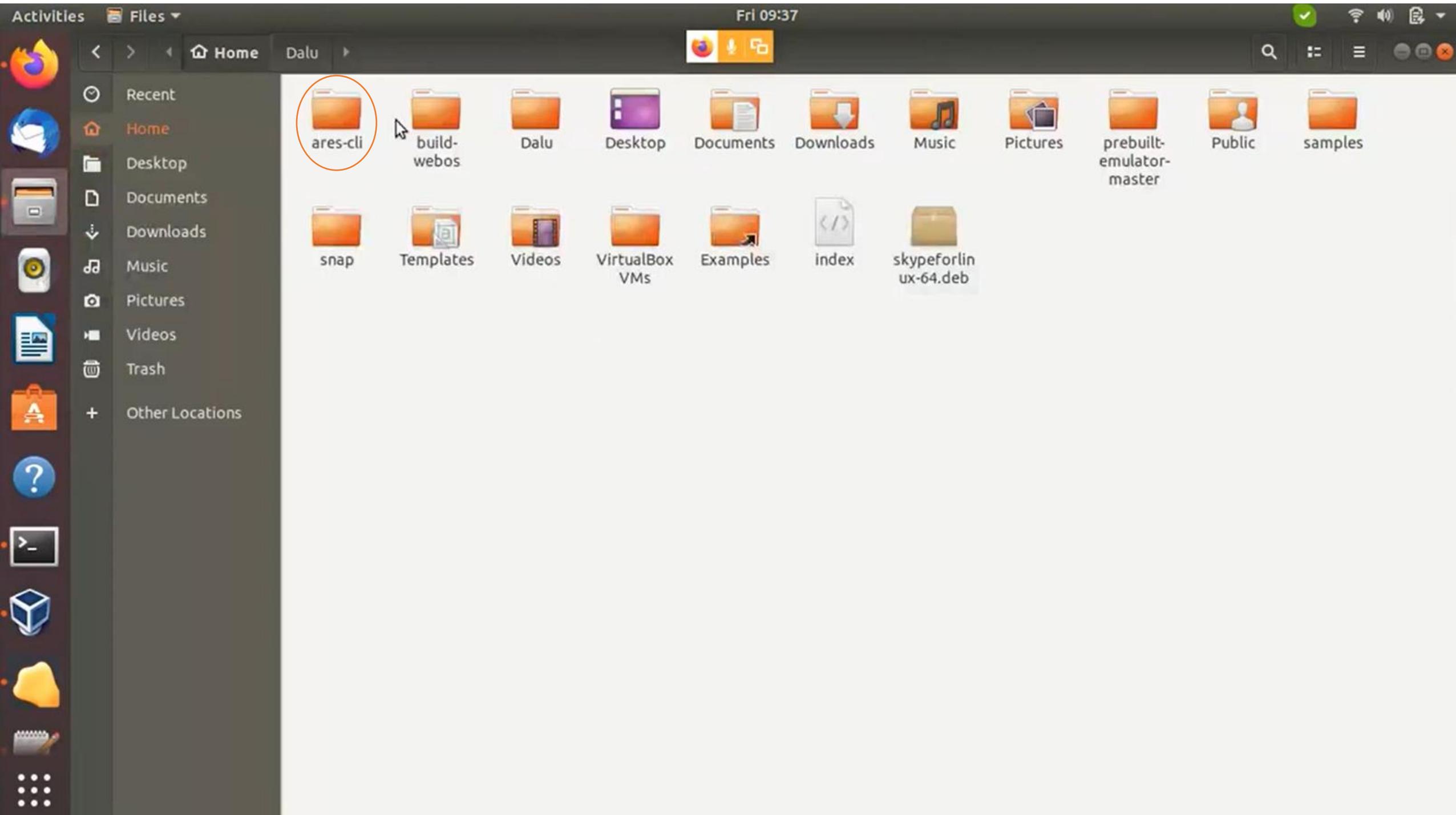
See the [CLI release notes](#).

Beanviser

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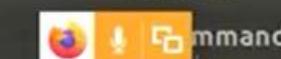


Activities Terminal

Fri 09:38



Open



Save



dalia@dalia-HP-ProBook-450-G3: ~

```
1. In: File Edit View Search Terminal Help
https:dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile

2. v

# add
if [
ex
fi

3. s
4. a
5. a
6. a
7. a
8. a
9. ares-install --device target com.example.sampleapp_1.0.0_all.ipk
10. ares-install --device target --list

11. ares-launch --device target com.example.sampleapp
12. ares-launch --device target --running
13. ares-launch --device target --close com.example.sampleapp
```

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ls-monitor Usage Guide

First, open the `.profile` which is located in the home directory. If the file does not exist, the command will create one.

```
$ vi ~/.profile
```

Add the lines below at the end of the file.

```
...
# add CLI path
if [ -d "$HOME/ares-cli/bin" ]; then
    export PATH="$PATH:$HOME/ares-cli/bin"
fi
```

이 부분 copy해서 profile 파일
맨 마지막 부분에 붙이기

To make the changes take effect, you must execute the following command or restart the shell.

```
$ source ~/.profile
```

CLI Workflow

Contents

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CLI Workflow

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ares-generate

ares-package

ares-setup-device

ares-install

ares-launch

ares-inspect

ares-server

ares-shell

ares-push

ares-pull



Activities Terminal

Fri 09:43



Open



Save



```
dalia@dalia-HP-ProBook-450-G3: ~
1. In: File Edit View Search Terminal Help
https://dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ source ~/.profile

2. vi

# add
if [
ex
fi

3. so

4. a

5. a

6. a

7. a
I
8. a

9. ares-install --device target com.example.sampleapp_1.0.0_all.ipk

10. ares-install --device target --list

11. ares-launch --device target com.example.sampleapp

12. ares-launch --device target --running

13. ares-launch --device target --close com.example.sampleapp
```

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Ln 17, Col 5

INS

Activities Terminal

Fri 09:46



Meeting i... - Mozilla Firefox

Webex meeting invitatio... X Meeting is in progress X Cisco Webex Meetin... X User Guide | webOS Ope... X WhatsApp X +

```
dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ source ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ ares-generate -l
```

Meeting/download/7748795ac ...

Sharing

Chat

Chat with All

On windows only that one command needed
for path ma'am?

A_1760338_Midhun Josey 09:42

Done

C_1760482_shubham 09:43

done

C_1760468_Prachi Sajwan 09:43

yes

B_1760363_Shara... 09:43

not able to do

Harsha BM 09:44

can you specify how you are not able to
proceed

D_1760495_Rohit prasad 09:46

done sir

Enter your message

DANIEL D COMPUTER SCIENCE AND ENG... X



PE

JN

AM

AT



DANIEL D... (Host)

PRAVEEN KUL...

Junseok Noh

A_1760304_AK...

A_1760310_AN...

Activities Terminal

Fri 09:47



Open ▾



```
dalia@dalia-HP-ProBook-450-G3: ~
1. In File Edit View Search Terminal Help
https://
dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ source ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ ares-generate -l
2. v webapp Web App - (default) web app for webOS
v hosted_webapp Web App - hosted web app for webOS
webappinfo Web App Info - appinfo.json for web app
# add js_service JS Service - js service for webOS
if [ jsserviceinfo JS Service Info - services.json, package.json for JS service
    icon Icon - app icon files [80x80]
    qmlapp QML App - QML app for webOS
fi qmlappinfo QML App Info - appinfo.json for QML app
3. s
dalia@dalia-HP-ProBook-450-G3:~$ ares-generate sampleApp
4. a
5. a
6. a I
7. a
8. a
9. ares-install --device target com.example.sampleapp_1.0.0_all.ipk
10. ares-install --device target --list
11. ares-launch --device target com.example.sampleapp
12. ares-launch --device target --running
13. ares-launch --device target --close com.example.sampleapp
```

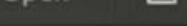
Plain Text ▾ Tab Width: 8 ▾

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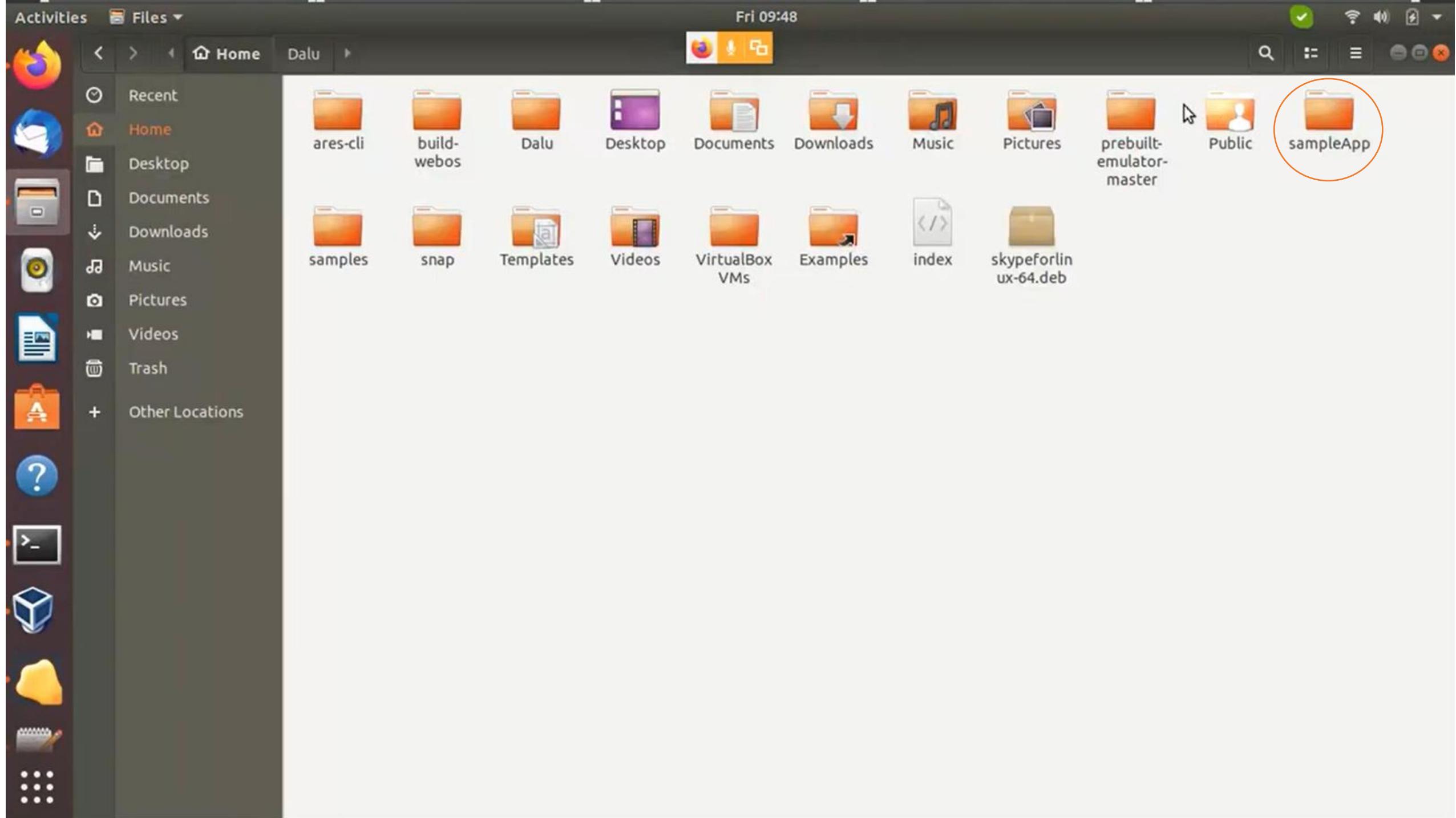
Open ▾

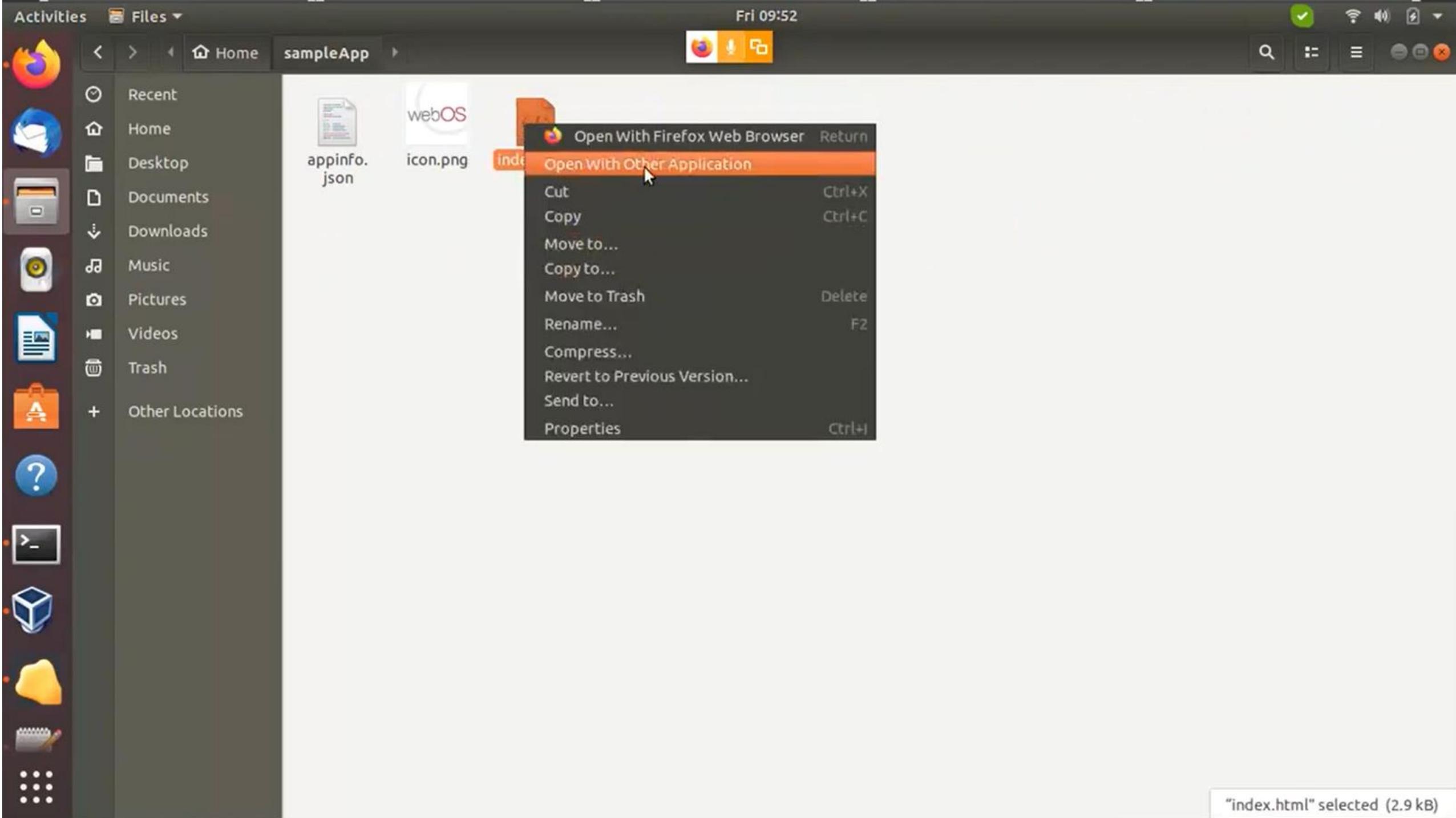


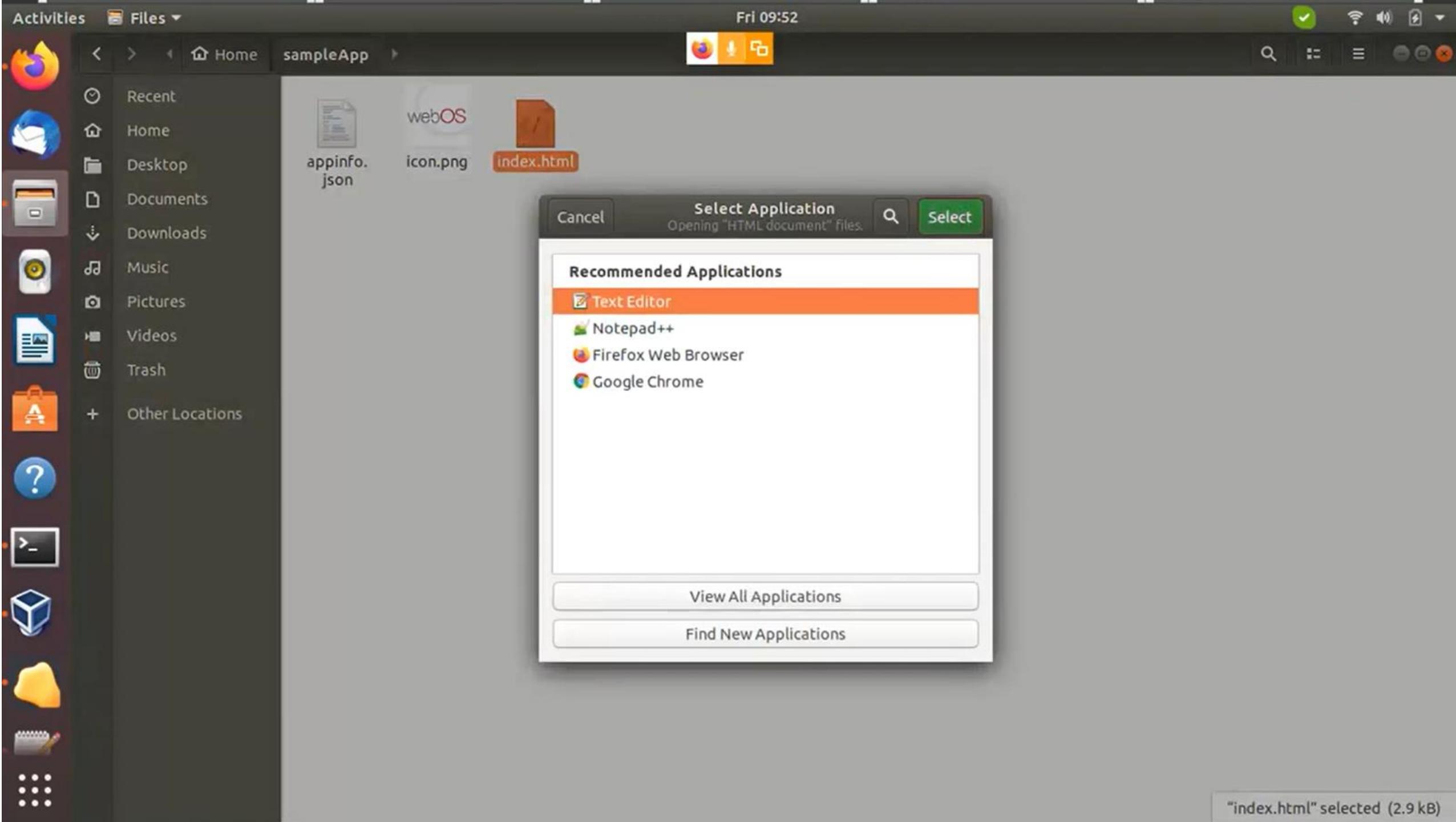
Save



```
dalia@dalia-HP-ProBook-450-G3: ~
1. In: File Edit View Search Terminal Help
https://dalia@dalial-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalial-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalial-HP-ProBook-450-G3:~$ source ~/.profile
dalia@dalial-HP-ProBook-450-G3:~$ ares-generate -l
2. v: webapp Web App - (default) web app for webOS
     hosted_webapp Web App - hosted web app for webOS
     webappinfo Web App Info - appinfo.json for web app
     js_service JS Service - js service for webOS
# add if [ jsserviceinfo JS Service Info - services.json, package.json for JS service
if [ ex: icon Icon - app icon files [80x80]
fi qmlapp QML App - QML app for webOS
qmlappinfo QML App Info - appinfo.json for QML app
3. s: dalia@dalial-HP-ProBook-450-G3:~$ ares-generate sampleApp
4. a: ? app id com.example.sampleapp
      ? title newapp
      ? version 1.0.0
5. a: Generating webapp in /home/dalia/sampleApp
     Success
6. a: dalia@dalial-HP-ProBook-450-G3:~$ █
7. a:
8. a:
9. a: ares-install --device target com.example.sampleapp_1.0.0_all.ipk
10. a: ares-install --device target --list
11. a: ares-launch --device target com.example.sampleapp
12. a: ares-launch --device target --running
13. ares-launch --device target --close com.example.sampleapp
```







Activities Text Editor Fri 09:53

Open Save

ares-cli commands *index.html

```
//webOSSystem.PmLogString(0, "GETTIME_SUCCESS", {"APP_NAME": "example web app", "UTC": "+arg.UTC");
}
else {
    console.error("[APP_NAME: example web app] GETTIME_FAILED errorText : " + arg.errorText);
    //webOSSystem.PmLogString(3, "GETTIME_FAILED", {"APP_NAME": "example web app"}, "errorText : " + arg.errorText);
}
}

function hello_callback(msg){
    var arg = JSON.parse(msg);
    if (arg.returnValue) {
        document.getElementById("txt_msg").innerHTML = arg.Response;
        console.log("[APP_NAME: example web app] CALLHELLO_SUCCESS response : " + arg.Response);
        //webOSSystem.PmLogString(6, "CALLHELLO_SUCCESS", {"APP_NAME": "example web app"}, "response : " + arg.Response);
    }
    else {
        console.error("[APP_NAME: example web app] CALLHELLO_FAILED errorText : " + arg.errorText);
        //webOSSystem.PmLogString(3, "CALLHELLO_FAILED", {"APP_NAME": "example web app"}, "errorText : " + arg.errorText);
    }
}

bridge.onservicecallback = getTime_callback;
bridge.call(getTimeApi, getTimeParams);
document.getElementById("txt_msg").onclick = function() {
    bridge.onservicecallback = hello_callback;
    bridge.call(helloApi, helloParams);
};

</script>
</head>
<body>
    <div>
        <h1 id="txt_msg">Welcom to LG webOS training!!</h1>
    </div>
</body>
</html>
```

HTML Tab Width: 8 Ln 79, Col 53 INS

Activities Terminal

Fri 09:54

dalia@ eBook-450-G3: ~

File Edit View Search Terminal Help

```
dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ source ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ ares-generate -l
webapp      Web App          - (default) web app for webOS
hosted_webapp Web App        - hosted web app for webOS
webappinfo   Web App Info    - appinfo.json for web app
js_service   JS Service       - js service for webOS
jsserviceinfo JS Service Info - services.json, package.json for JS service
icon         Icon            - app icon files [80x80]
qmlapp       QML App         - QML app for webOS
qmlappinfo  QML App Info    - appinfo.json for QML app
```

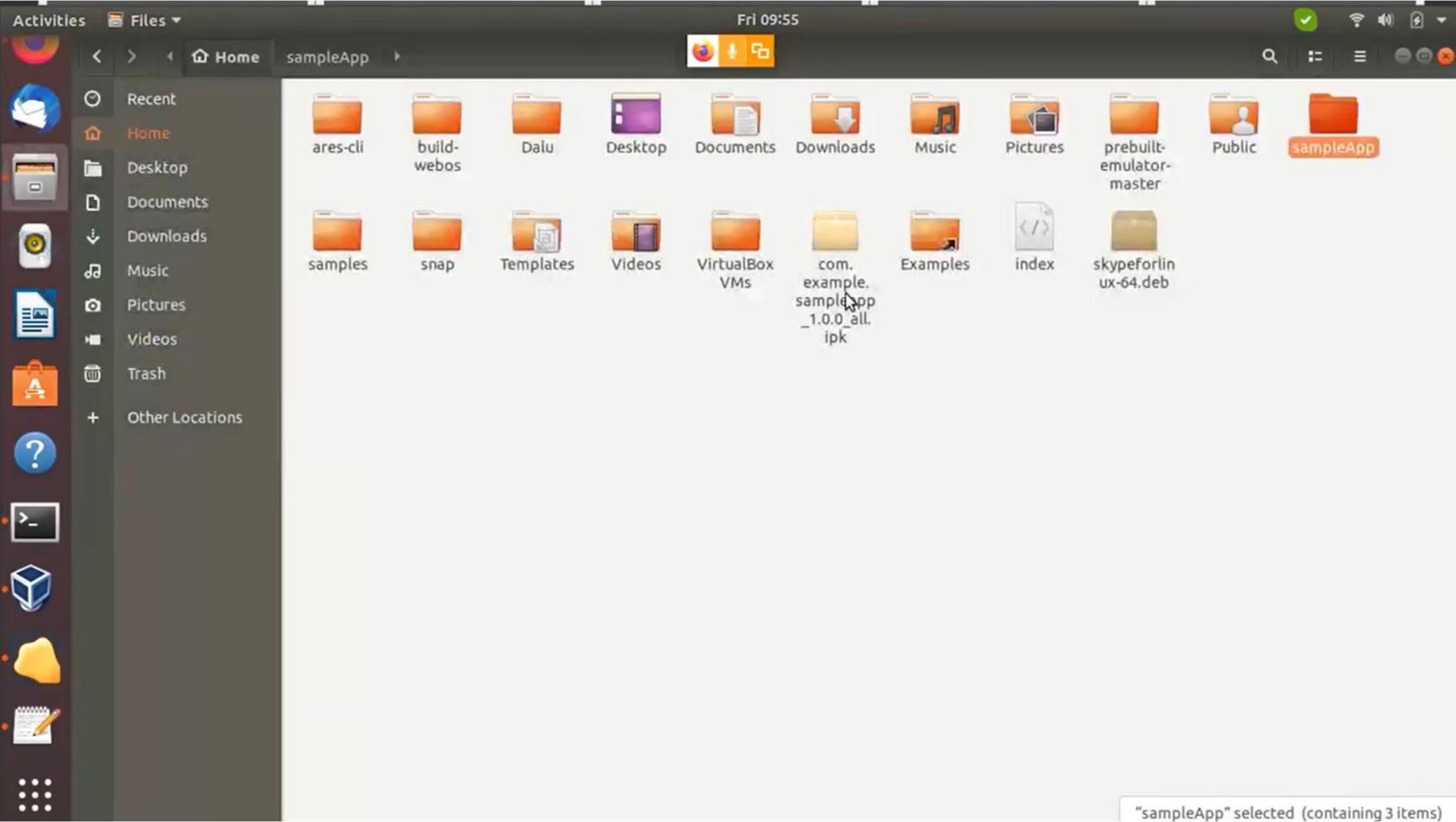
```
dalia@dalia-HP-ProBook-450-G3:~$ ares-generate sampleApp
```

```
? app id com.example.sampleapp
? title newapp
? version 1.0.0
```

```
Generating webapp in /home/dalia/sampleApp
```

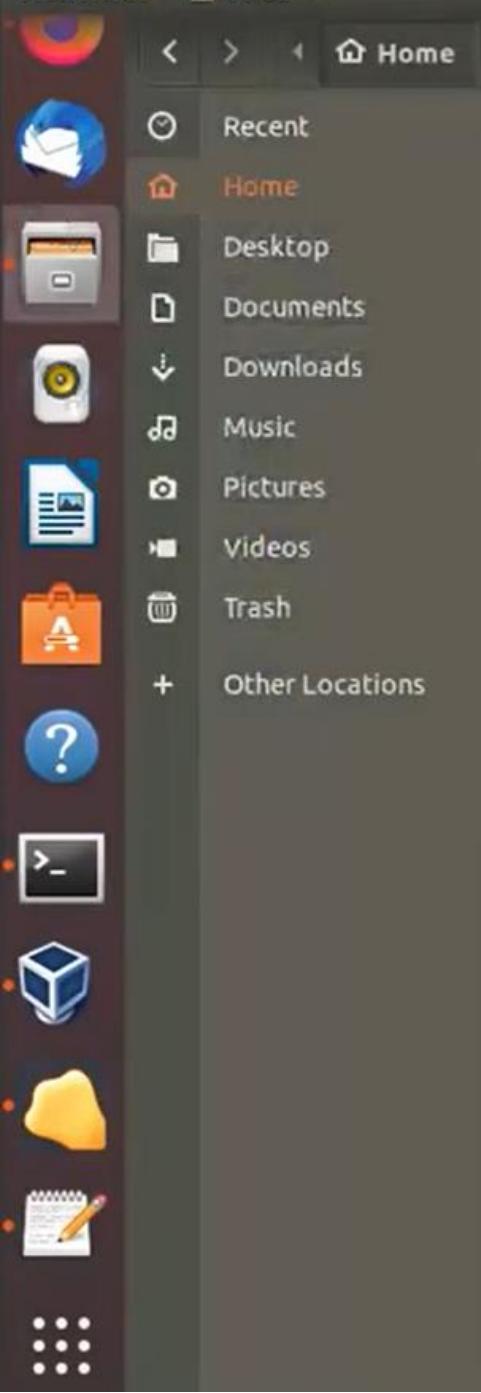
```
Success
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-package sampleApp
```



Activities Files

Fri 09:55



"sampleApp" selected (containing 3 items)

File Edit View Search Terminal Help

```
dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ vi ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ source ~/.profile
dalia@dalia-HP-ProBook-450-G3:~$ ares-generate -l
webapp      Web App          - (default) web app for webOS
hosted_webapp Web App        - hosted web app for webOS
webappinfo   Web App Info    - appinfo.json for web app
js_service   JS Service       - js service for webOS
jsserviceinfo JS Service Info - services.json, package.json for JS service
icon         Icon            - app icon files [80x80]
qmlapp       QML App         - QML app for webOS
qmlappinfo  QML App Info    - appinfo.json for QML app
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-generate sampleApp
```

```
? app id com.example.sampleapp
? title newapp
? version 1.0.0
```

```
Generating webapp in /home/dalia/sampleApp
```

```
Success
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-package sampleApp
```

```
Create com.example.sampleapp_1.0.0_all.ipk to /home/dalia
```

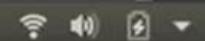
```
Success
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-setup-device --list
```

Activities Terminal

Fri 10:00

dalia@oBook-450-G3: ~



File Edit View Search Terminal Help

```
qmlapp      QML App      - QML app for webOS  
qmlappinfo QML App Info - appinfo.json for QML app
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-generate sampleApp
```

```
? app id com.example.sampleapp  
? title newapp  
? version 1.0.0
```

```
Generating webapp in /home/dalia/sampleApp
```

```
Success
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-package sampleApp
```

```
Create com.example.sampleapp_1.0.0_all.ipk to /home/dalia
```

```
Success
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-setup-device --list
```

name	deviceinfo	connection	profile
emulator (default)	developer@127.0.0.1:6622	ssh	ose

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-setup-device --listfull
```

```
[  
  {  
    "profile": "ose",  
    "name": "emulator",  
    "default": true,  
    "deviceinfo": {  
      "ip": "127.0.0.1",  
      "port": "6622",  
      "user": "developer"  
    },  
    "connection": [  
      "ssh"  
    ],  
    "details": {  
      "privatekey": "webos_emul",  
      "description": "LG webOS OSE Emulator"  
    }  
  }  
]
```

```
dalia@dalia-HP-ProBook-450-G3:~$
```

File Edit View Search Terminal Help

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-generate sampleApp
```

```
? app id com.example.sampleapp
```

```
? title newapp
```

```
? version 1.0.0
```

```
Generating webapp in /home/dalia/sampleApp
```

```
Success
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-package sampleApp
```

```
Create com.example.sampleapp_1.0.0_all.ipk to /home/dalia
```

```
Success
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-setup-device --list
```

name	deviceinfo	connection	profile
emulator (default)	developer@127.0.0.1:6622	ssh	ose

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-setup-device --listfull
```

```
[  
  {  
    "profile": "ose",  
    "name": "emulator",  
    "default": true,  
    "deviceinfo": {  
      "ip": "127.0.0.1",  
      "port": "6622",  
      "user": "developer"  
    },  
    "connection": [  
      "ssh"  
    ],  
    "details": {  
      "privatekey": "webos_emul",  
      "description": "LG webOS OSE Emulator"  
    }  
  }  
]
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-install --device emulator com.example.sampleapp_1.0.0_all.ipk
```

```
Installing package com.example.sampleapp_1.0.0_all.ipk
```

```
Success !
```

```
dalia@dalia-HP-ProBook-450-G3:~$
```

File Edit View Search Terminal Help

```
? title newapp
? version 1.0.0
Generating webapp in /home/dalia/sampleApp
Success
dalia@dalia-HP-ProBook-450-G3:~$ ares-package sampleApp
Create com.example.sampleapp_1.0.0_all.ipk to /home/dalia
Success
dalia@dalia-HP-ProBook-450-G3:~$ ares-setup-device --list
name          deviceinfo          connection profile
-----
emulator (default) developer@127.0.0.1:6622 ssh      ose
dalia@dalia-HP-ProBook-450-G3:~$ ares-setup-device --listfull
[
  {
    "profile": "ose",
    "name": "emulator",
    "default": true,
    "deviceinfo": {
      "ip": "127.0.0.1",
      "port": "6622",
      "user": "developer"
    },
    "connection": [
      "ssh"
    ],
    "details": {
      "privatekey": "webos_emul",
      "description": "LG webOS OSE Emulator"
    }
  }
]
dalia@dalia-HP-ProBook-450-G3:~$ ares-install --device emulator com.example.sampleapp_1.0.0_all.ipk
Installing package com.example.sampleapp_1.0.0_all.ipk
Success
dalia@dalia-HP-ProBook-450-G3:~$ ares-install --device emulator --list
com.example.sampleapp
dalia@dalia-HP-ProBook-450-G3:~$
```

Activities Terminal

Fri 10:05

dalia@oBook-450-G3: ~

File Edit View Search Terminal Help

Generating webapp in /home/dalia/sampleApp

Success

dalia@dalia-HP-ProBook-450-G3:~\$ ares-package sampleApp

Create com.example.sampleapp_1.0.0_all.ipk to /home/dalia

Success

dalia@dalia-HP-ProBook-450-G3:~\$ ares-setup-device --list

name	deviceinfo	connection	profile
emulator (default)	developer@127.0.0.1:6622	ssh	ose

dalia@dalia-HP-ProBook-450-G3:~\$ ares-setup-device --listfull

```
[  
  {  
    "profile": "ose",  
    "name": "emulator",  
    "default": true,  
    "deviceinfo": {  
      "ip": "127.0.0.1",  
      "port": "6622",  
      "user": "developer"  
    },  
    "connection": [  
      "ssh"  
    ],  
    "details": {  
      "privatekey": "webos_emul",  
      "description": "LG webOS OSE Emulator"  
    }  
  }  
]
```

dalia@dalia-HP-ProBook-450-G3:~\$ ares-install --device emulator com.example.sampleapp_1.0.0_all.ipk

Installing package com.example.sampleapp_1.0.0_all.ipk

Success

dalia@dalia-HP-ProBook-450-G3:~\$ ares-install --device emulator --list

com.example.sampleapp

dalia@dalia-HP-ProBook-450-G3:~\$ ares-launch --device emulator com.example.sampleapp

Launched application com.example.sampleapp on display 0

dalia@dalia-HP-ProBook-450-G3:~\$ █

Activities

VirtualBox Machine

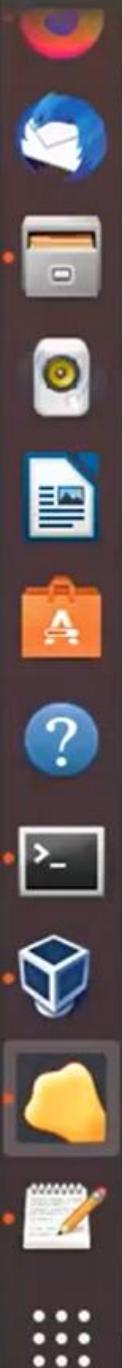
Fri 10:05



webos-image Oracle VM VirtualBox

File Machine View Input Devices Help

Welcome to LG webOS training!!

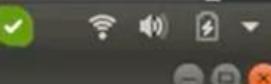


Right Ctrl

Activities Terminal

Fri 10:09

dalia@ oBook-450-G3: ~



File Edit View Search Terminal Help

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-package sampleApp
```

```
Create com.example.sampleapp_1.0.0_all.ipk to /home/dalia
```

```
Success
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-setup-device --list
```

name	deviceinfo	connection	profile
emulator (default)	developer@127.0.0.1:6622	ssh	ose

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-setup-device --listfull
```

```
[  
  {  
    "profile": "ose",  
    "name": "emulator",  
    "default": true,  
    "deviceinfo": {  
      "ip": "127.0.0.1",  
      "port": "6622",  
      "user": "developer"  
    },  
    "connection": [  
      "ssh"  
    ],  
    "details": {  
      "privatekey": "webos_emul",  
      "description": "LG webOS OSE Emulator"  
    }  
  }  
]
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-install --device emulator com.example.sampleapp_1.0.0_all.ipk
```

```
Installing package com.example.sampleapp_1.0.0_all.ipk
```

```
Success
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-install --device emulator --list
```

```
com.example.sampleapp
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-launch --device emulator com.example.sampleapp
```

```
Launched application com.example.sampleapp on display 0
```

```
dalia@dalia-HP-ProBook-450-G3:~$ ares-launch --device emulator --running
```

```
com.example.sampleapp - display 0
```

```
dalia@dalia-HP-ProBook-450-G3:~$
```

File Edit View Search Terminal Help

Success
dalia@dalia-HP-ProBook-450-G3:~\$ ares-setup-device --list
name deviceinfo connection profile

emulator (default) developer@127.0.0.1:6622 ssh ose

dalia@dalia-HP-ProBook-450-G3:~\$ ares-setup-device --listfull

```
[  
  {  
    "profile": "ose",  
    "name": "emulator",  
    "default": true,  
    "deviceinfo": {  
      "ip": "127.0.0.1",  
      "port": "6622",  
      "user": "developer"  
    },  
    "connection": [  
      "ssh"  
    ],  
    "details": {  
      "privatekey": "webos_emul",  
      "description": "LG webOS OSE Emulator"  
    }  
  }  
]
```

dalia@dalia-HP-ProBook-450-G3:~\$ ares-install --device emulator com.example.sampleapp_1.0.0_all.ipk
Installing package com.example.sampleapp_1.0.0_all.ipk

Success

dalia@dalia-HP-ProBook-450-G3:~\$ ares-install --device emulator --list
com.example.sampleapp

dalia@dalia-HP-ProBook-450-G3:~\$ ares-launch --device emulator com.example.sampleapp
Launched application com.example.sampleapp on display 0

dalia@dalia-HP-ProBook-450-G3:~\$ ares-launch --device emulator --running
com.example.sampleapp - display 0

dalia@dalia-HP-ProBook-450-G3:~\$ ares-launch --device emulator --close com.example.sampleapp
Closed application com.example.sampleapp on display 0

dalia@dalia-HP-ProBook-450-G3:~\$

Activities

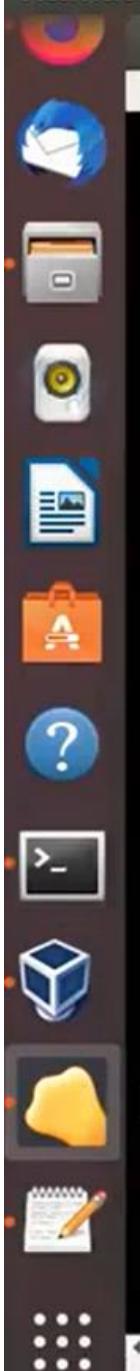
VirtualBox Machine

Fri 10:09



webos-image Oracle VM VirtualBox

File Machine View Input Devices Help



Right Ctrl

DAY5-2



Nyx

(Hardware Abstraction Layer)



LG webOS

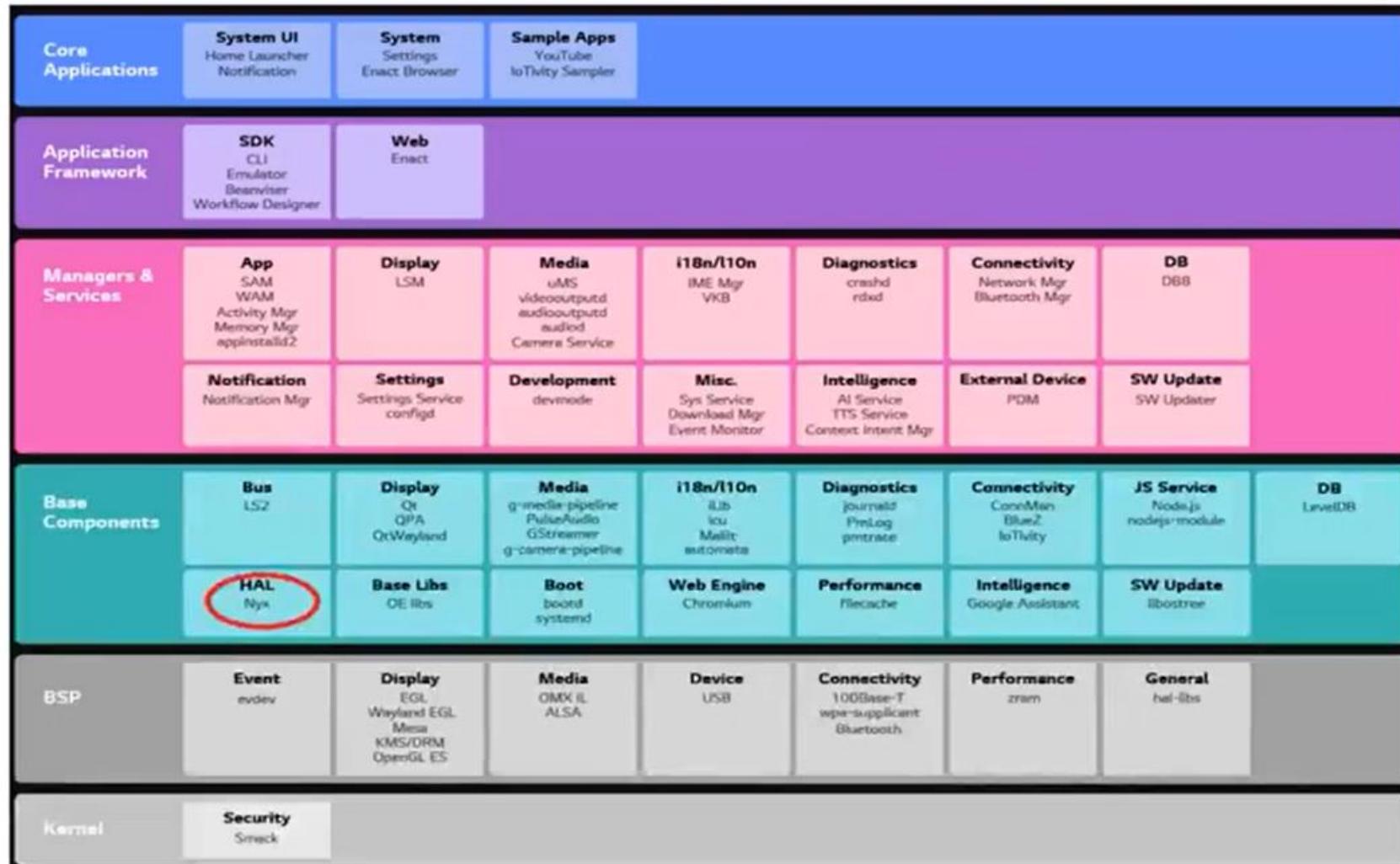
Agenda

- Hardware Abstraction Layer
- Nyx Overview
- Nyx Modules
- Nyx Interface

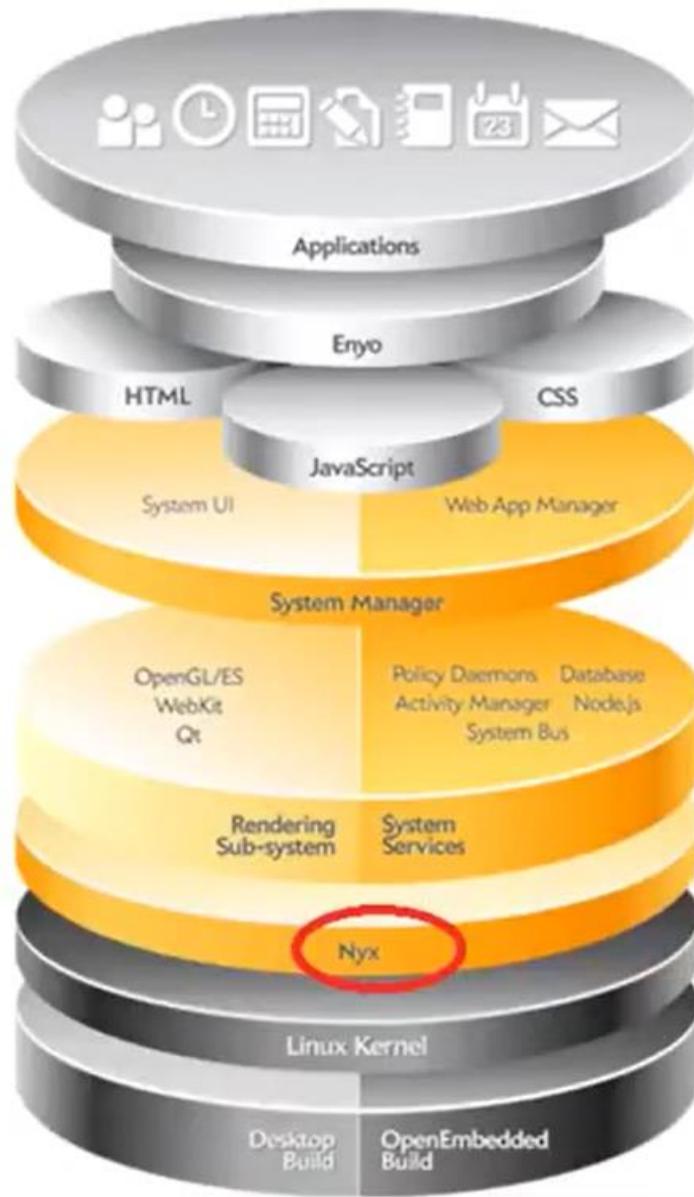
Nyx Overview

- WebOS is intended to work with any standard Linux kernel, provided that the platform porting layer provides **platform abstraction**.
- In webOS, porting means creating a **new device module** in Nyx according to the hardware configuration.
- Nyx is a **HW abstraction** project named after the night fairies in Roman mythology and is responsible for providing these **porting layers** to webOS.
- Nyx consists of a **Uniform Client API** library for providing abstraction to webOS and **device modules** for controlling each device.

WebOS - Architecture Overview (Nyx)



WebOS – Software Stack(Nyx)



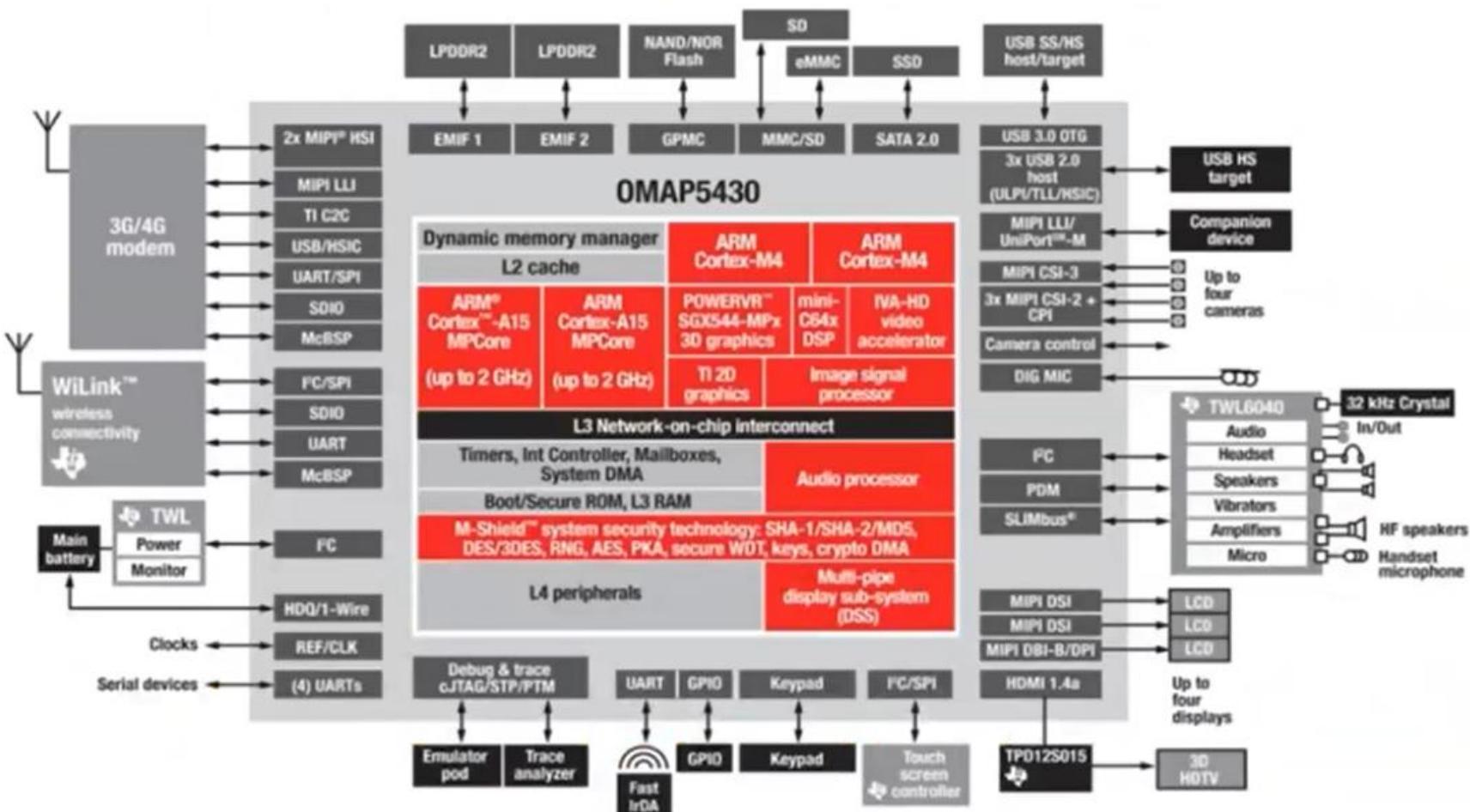
Hardware Abstraction Layer - General

Definition - Hardware abstraction

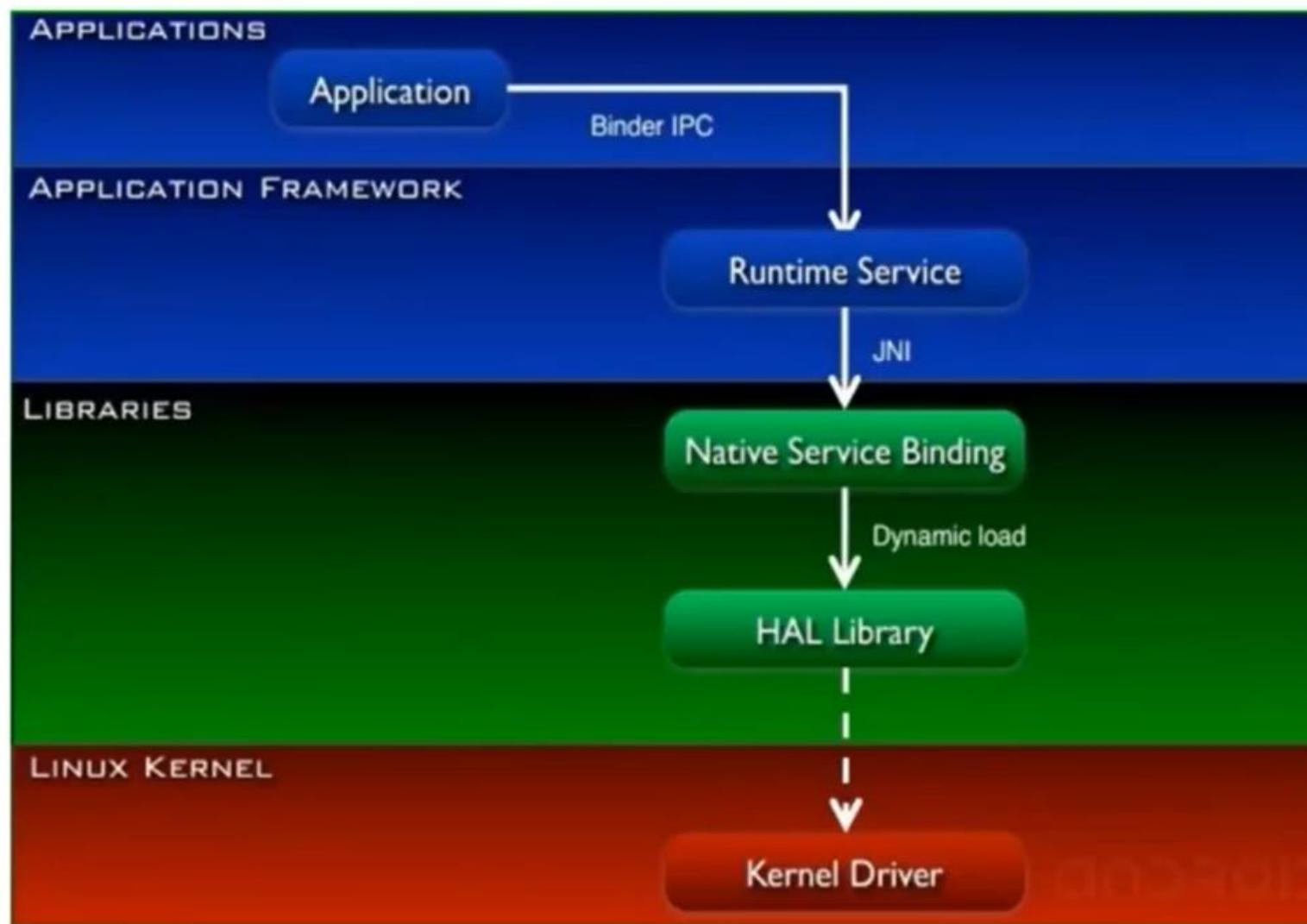
- Hardware abstractions are **sets of routines** in software that provide programs with access to hardware resources through programming interfaces.
(A HAL is a hardware abstraction layer that defines a set of routines, protocols and tools for interacting with the hardware)
- A HAL is focused on creating abstract, **high level functions** that can be used to make the hardware do something without having to have a detailed knowledge of how the hardware is doing it.
- *A HAL can also be a great way to allow engineers who aren't experts in the lower lying hardware to still write useful application code.*
- In computers, a hardware abstraction layer (HAL) is a layer of programming that allows a **computer OS to interact** with a hardware device at a general or abstract level rather than at a detailed hardware level.
- HAL can be called from either the **OS's kernel** or from a **device driver**.
- The HAL, or Hardware Abstraction Layer, provides the application developer with a **set of standard functions** that can be used to access **hardware functions** without a detailed understanding of how the hardware works.
- *HALs are essentially API's designed to interact with hardware. A properly designed HAL provides developers with many benefits, such as code that is portable, reusable, lower cost, abstracted, and with fewer bugs*

Hardware Layer Example

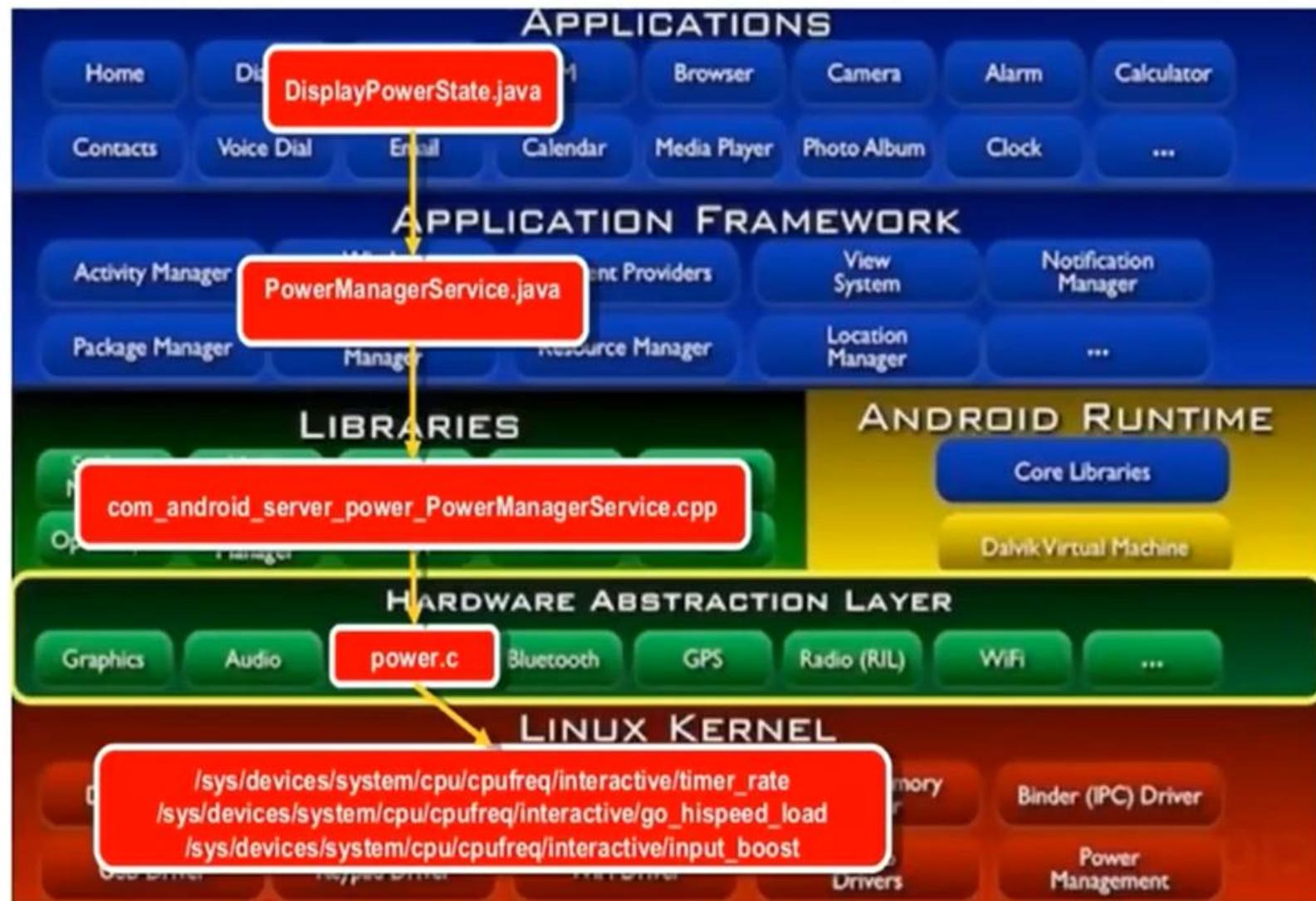
TI OMAP5430 SoC



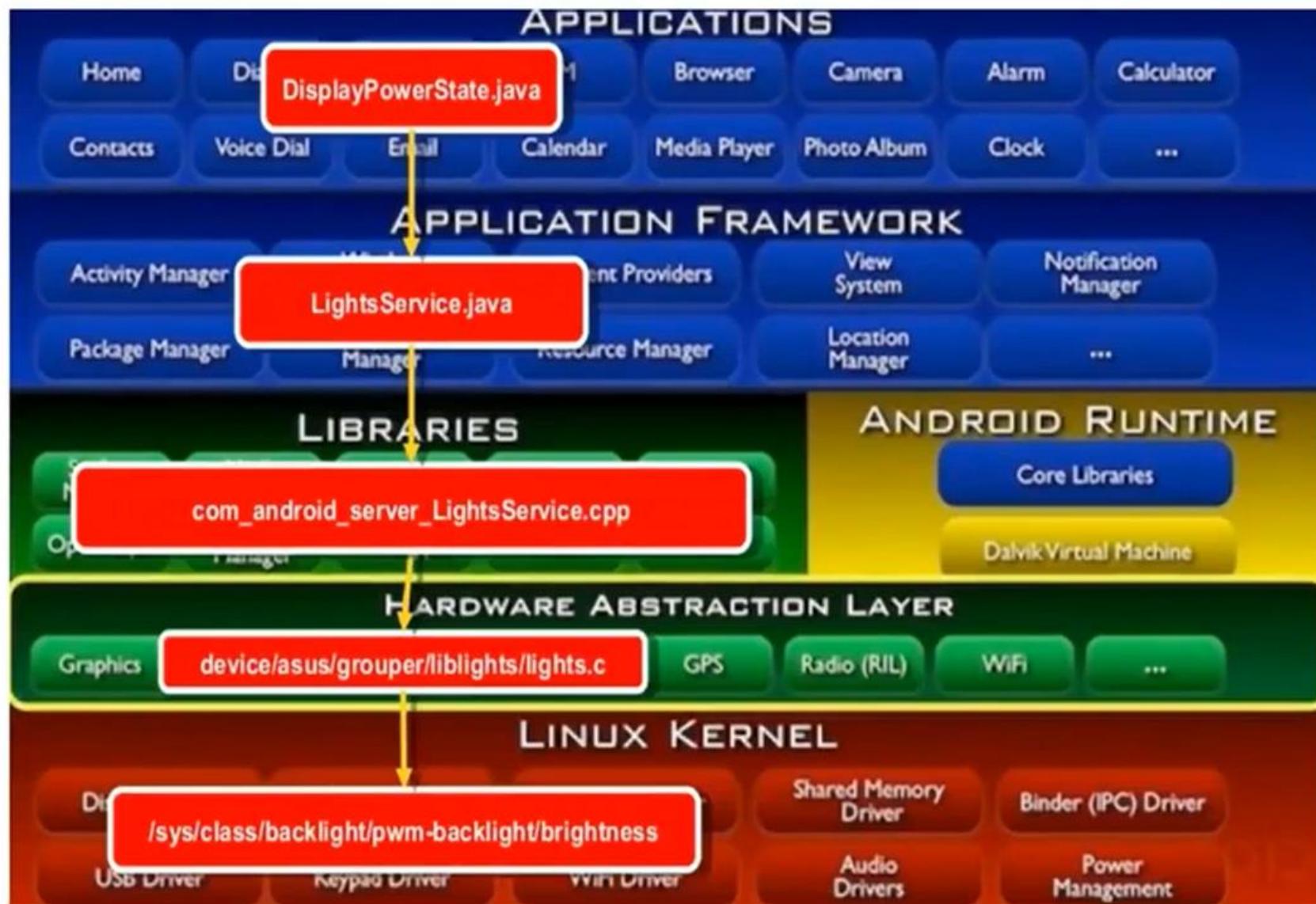
Android – Framework and HAL



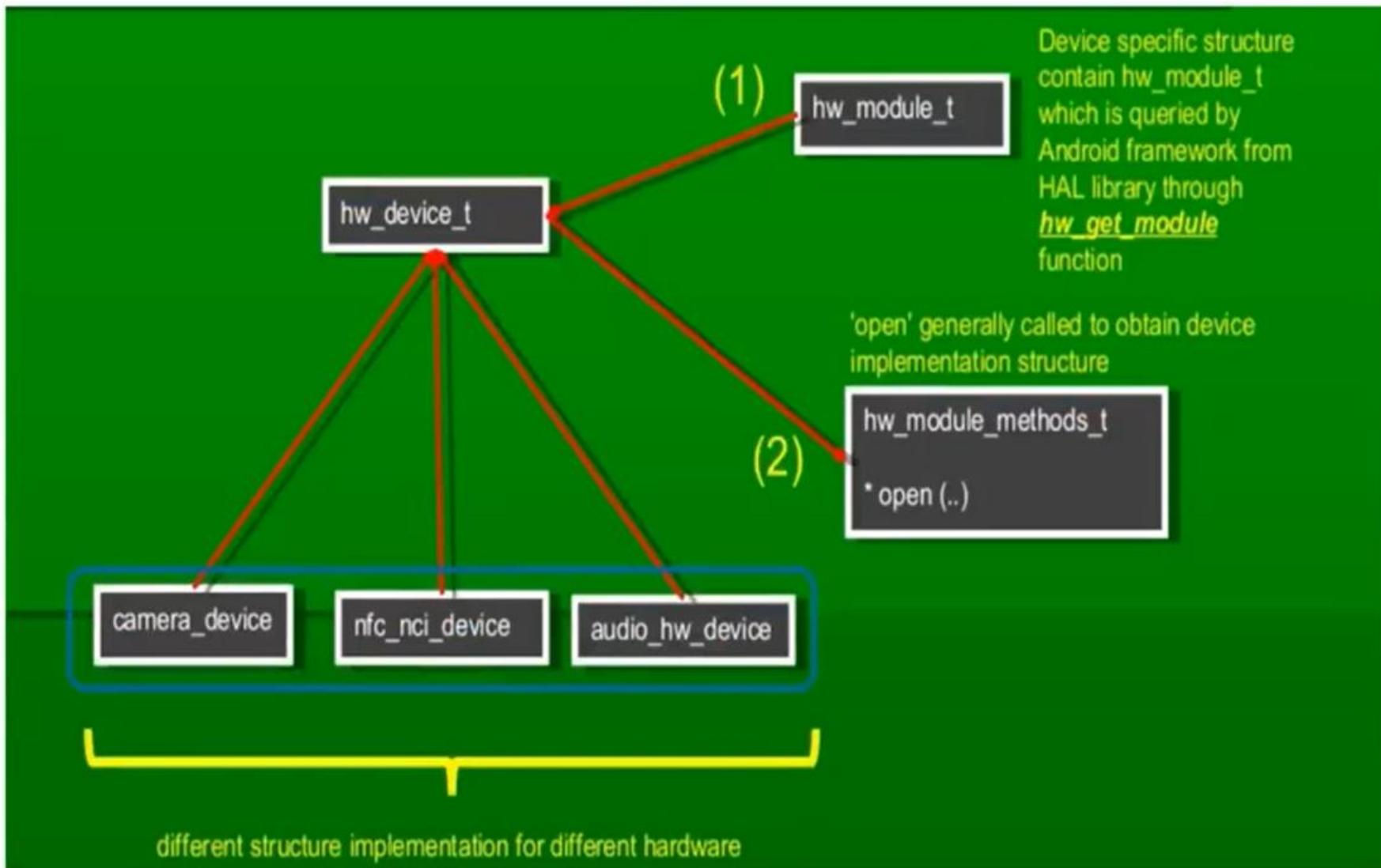
Example – Power HAL



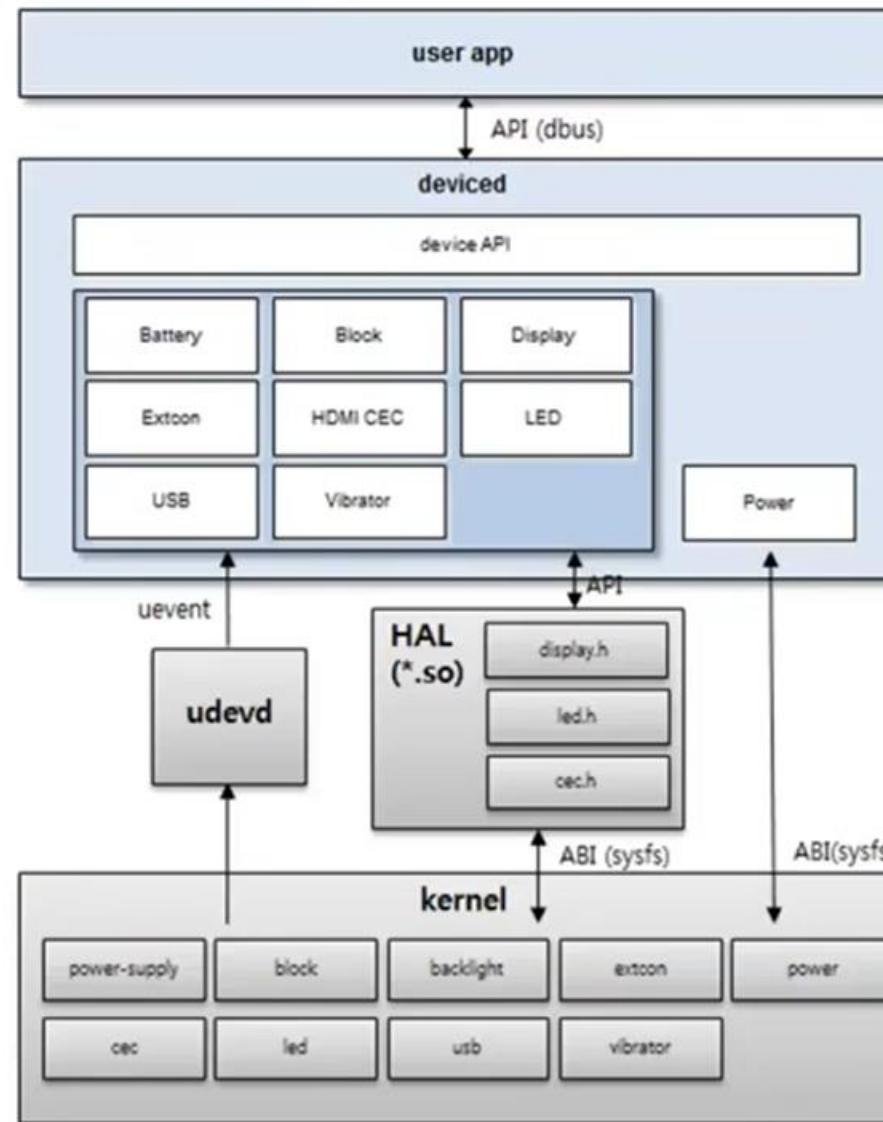
Example – LCD Backlight



Android - HAL Structure



Tizen Hardware Abstraction Layer (HAL)



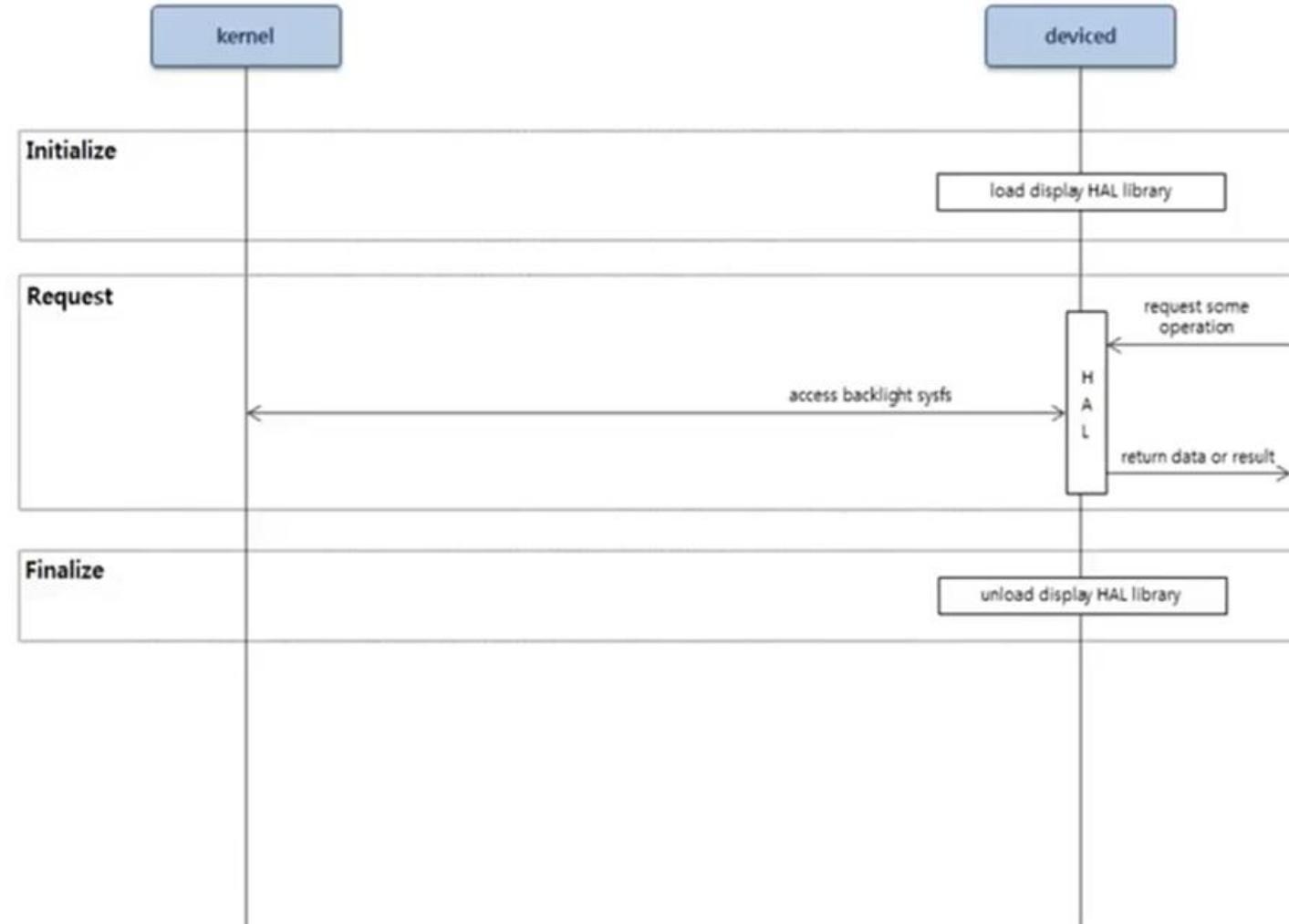
Tizen – Display HAL

Display HAL

	Function	Description	Data
	<code>int get_brightness(int *brightness);</code> <code>int set_brightness(int brightness);</code>	Get/Set current brightness	0~100
	<code>int get_state(enum display_state *state);</code> <code>int set_state(enum display_state state);</code>	Get/Set current display state	DISPLAY_ON, DISPLAY_STANDBY, DISPLAY_SUSPEND, DISPLAY_OFF
property	<code>int get_image_effect(enum display_image_effect *effect);</code> <code>int set_image_effect(enum display_image_effect effect);</code>	Get/Set image effect	DISPLAY_IMAGE_EFFECT_STANDARD, DISPLAY_IMAGE_EFFECT_NEGATIVE, DISPLAY_IMAGE_EFFECT_GRAYSCALE, DISPLAY_IMAGE_EFFECT_PICTURE, DISPLAY_IMAGE_EFFECT_VIDEO, DISPLAY_IMAGE_EFFECT_MOVIE, DISPLAY_IMAGE_EFFECT_BROWSER, DISPLAY_IMAGE_EFFECT_WARM, DISPLAY_IMAGE_EFFECT_COLD, DISPLAY_IMAGE_EFFECT_NATURAL,
	<code>int get_panel_mode(enum display_panel_mode *mode);</code> <code>int set_panel_mode(enum display_panel_mode mode);</code>	Get/Set panel mode	DISPLAY_PANEL_MODE_STANDARD, DISPLAY_PANEL_MODE_OUTDOOR, DISPLAY_PANEL_MODE_CONTENTS, DISPLAY_PANEL_MODE_LOWPOWER

Tizen – Display HAL

Interaction view

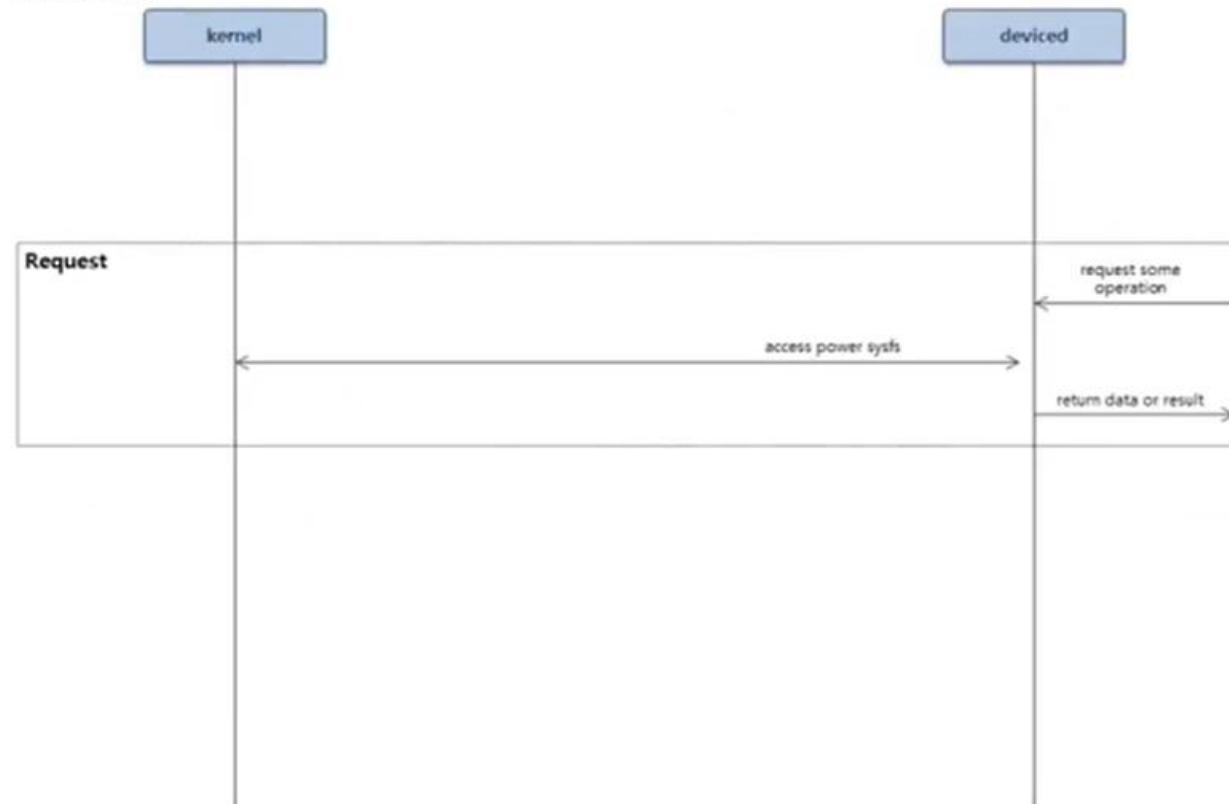


Tizen – Power HAL

Get data

	Path	Type	Description	Data
sysfs	/sys/power/state	string	Manage power state	"mem"
	/sys/power/wakeup_count	int	Report the number of wakeup events related to the device	

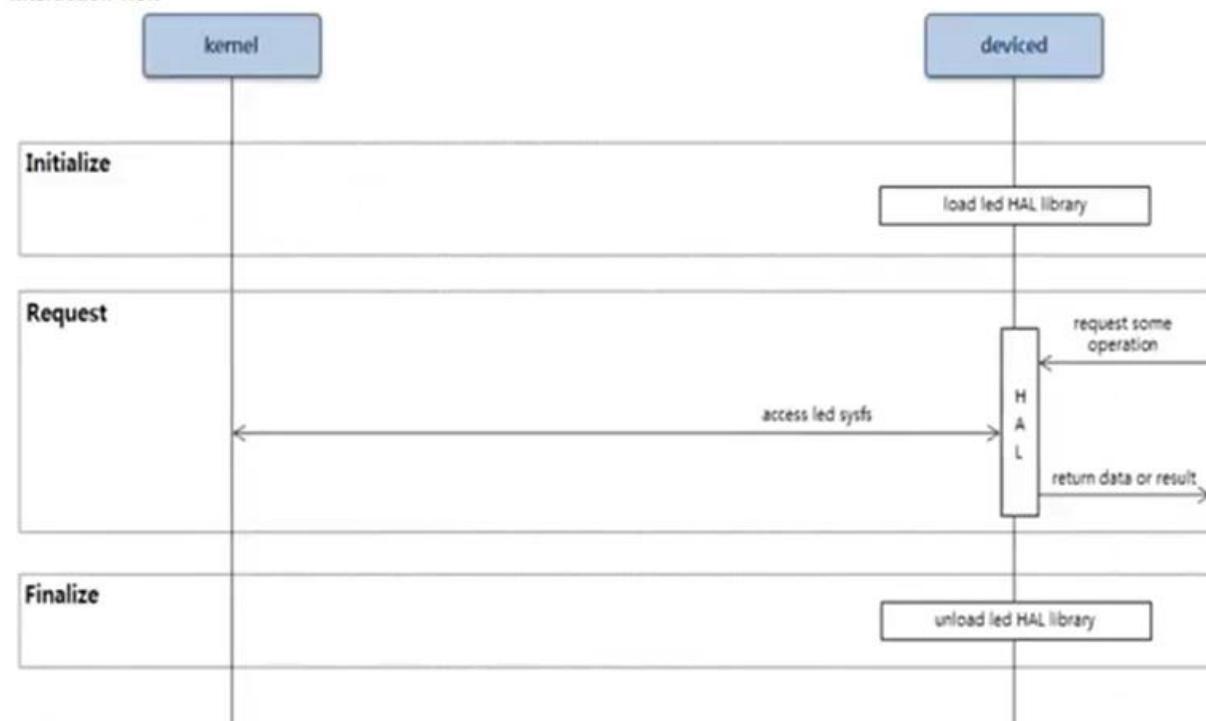
Interaction view



Tizen – LED HAL

	Function	Description	Data
struct led_state	enum led_type type	Led type	LED_TYPE_MANUAL, LED_TYPE_BLINK
	unsigned int color	Color	First byte : opaque (0x00~0xFF), The other 3bytes: RGB (0x00~0xFF)
	int duty_on	Turn on time in milliseconds	No limited
	int duty_off	Turn off time in milliseconds	No limited
	property int set_state(struct led_state *state);	Set led state	

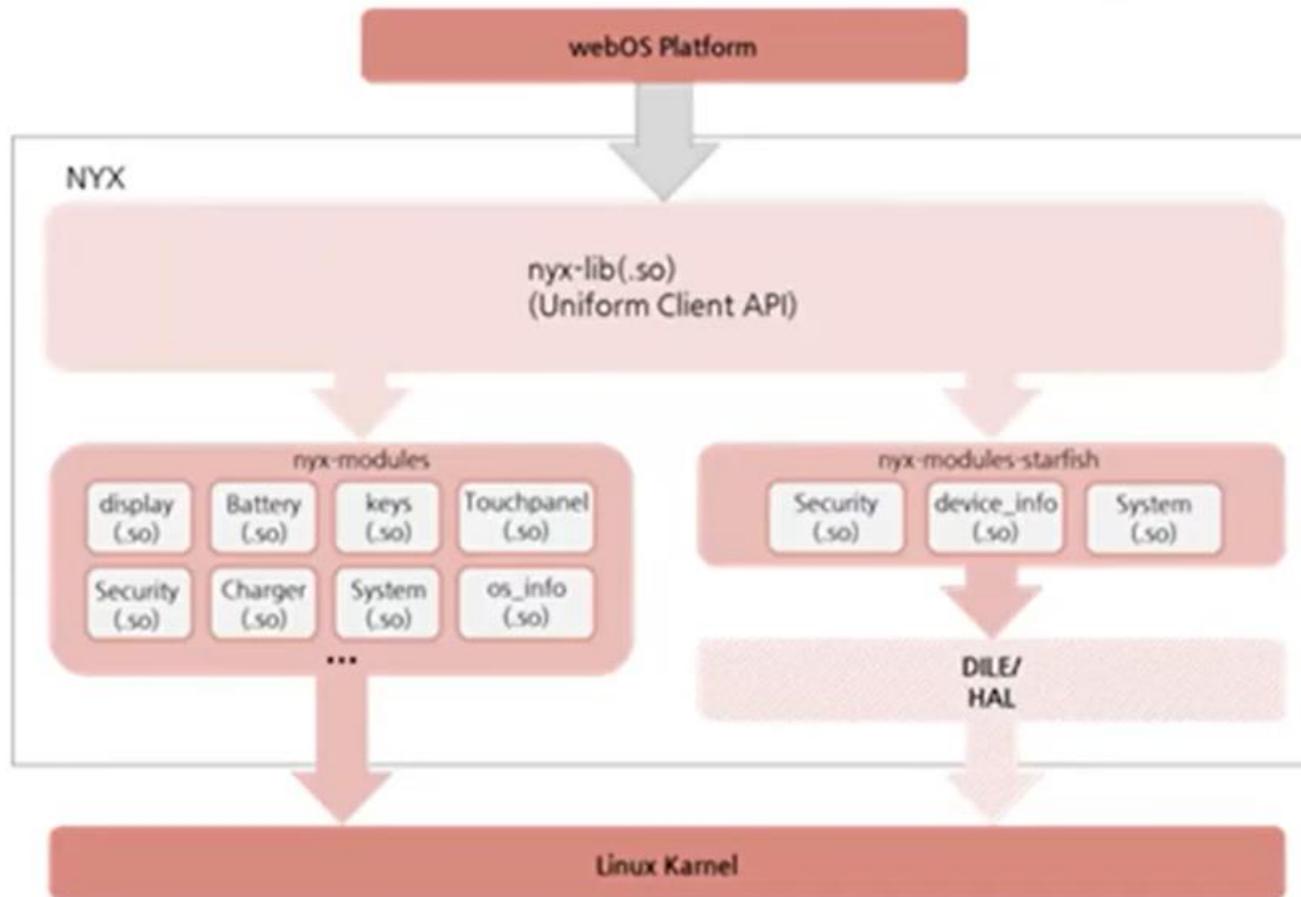
Interaction view



Tips for Designing a HAL

- **Identify core features**
 - A HAL needs to be a consistent and standard set of functions that can be used across multiple hardware platforms.
- **Avoid an all-encompassing HAL**
 - HAL designers should avoid trying to create an all-encompassing or singular HAL to rule every microcontroller device and peripheral
- **Use Doxygen to outline the HAL**
 - Doxygen uses code comments to generate HTML, RTF, and PDF documents, which means the developer already has source comments on what the different function are supposed to do
- **Get a second set of eyes**
 - Getting a second set of eyes on the HAL is a wonderful way to get a fresh perspective.
- **Don't be afraid to iterate**
 - Designing a perfect HAL is unrealistic and the goal should be to develop one that is good enough to start using
- **Keep the view at 30,000 feet**
 - Keep the interface simple and the level of detail of how the hardware works at the 30,000 feet view
- **Use appropriate naming conventions**
 - A safe bet when developing a HAL is to use an interface that is ANSI-C compliant
- **Include a parameter for initialization**
 - One of the most common mistakes encountered when designing a HAL is to have a peripheral initialization function take no parameters
- **Deploy on multiple development kits**
 - A simple and effective way to test out a HAL is to deploy it on multiple microcontrollers from different silicon vendors

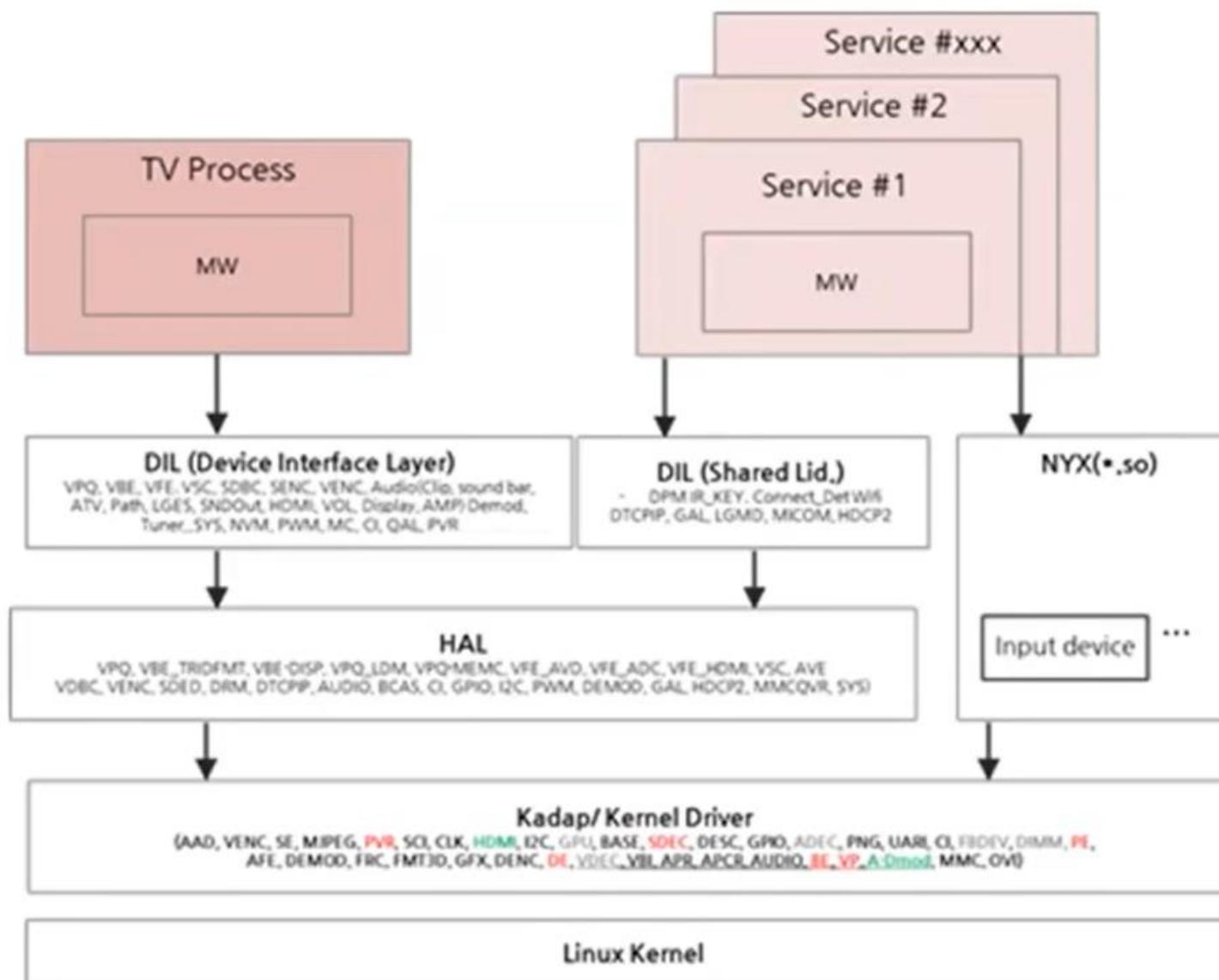
Nyx HW abstraction layer



Nyx HW abstraction layer

- Nyx's HW abstraction layer consists of Uniform Client APIs and device modules.
- **The Uniform Client API** consists of a public API that is used regardless of the device type and a device module API that provides control functions by device type.
- **A device module** is a software module that implements functions for actual control of each device.
- These modules are configured to register functions (mapping with device module API) in Nyx to create device objects and control them, and then to perform mapped functions when calling device module API.
- That is,
 - An API is called from a platform, an object is created by loading an appropriate device module,
 - Mapping of module functions to a device module API is performed
 - Perform device control.

concept of abstraction from a webOS TV



Example of Client API

The webOS platform can access hardware functionality through the Uniform Client API

```
#include <nyx/common/nyx_version.h>
#include <nyx/common/nyx_macros.h>
#include <nyx/common/nyx_error.h>
#include <nyx/common/nyx_event.h>
#include <nyx/common/nyx_device.h>

#include <nyx/common/nyx_core.h>

#include <nyx/client/nyx_bluetooth_input_detect.h>
#include <nyx/client/nyx_haptics.h>
#include <nyx/client/nyx_keys.h>
#include <nyx/client/nyx_led.h>
#include <nyx/client/nyx_led_controller.h>
#include <nyx/client/nyx_led_controller_core_configuration.h>
#include <nyx/client/nyx_touchpanel.h>
#include <nyx/client/nyx_charger.h>
#include <nyx/client/nyx_battery.h>
#include <nyx/client/nyx_firmware_update.h>
#include <nyx/client/nyx_nvram.h>
#include <nyx/client/nyx_nss_storage_mode.h>
#include <nyx/client/nyx_display.h>
#include <nyx/client/nyx_device_info.h>
#include <nyx/client/nyx_os_info.h>

#include <nyx/client/nyx_sensor_acceleration.h>
#include <nyx/client/nyx_sensor_als.h>
#include <nyx/client/nyx_sensor-angular_velocity.h>
#include <nyx/client/nyx_sensor-bearing.h>
#include <nyx/client/nyx_sensor-gravity.h>
#include <nyx/client/nyx_sensor-linear_acceleration.h>
#include <nyx/client/nyx_sensor-magnetic_field.h>
#include <nyx/client/nyx_sensor-orientation.h>
#include <nyx/client/nyx_sensor-proximity.h>
#include <nyx/client/nyx_sensor-rotation.h>
#include <nyx/client/nyx_sensor-shake.h>
#include <nyx/client/nyx_security.h>
nyx-lib/6.1.0-70-r6/git/include/public/nyx/nyx_client.h [+]
```



Device List

The types of devices that can be controlled through the Uniform Client API are predefined as shown below

```
typedef enum {
    NYX_DEVICE_ILLEGAL_DEVICE = 0,
    NYX_DEVICE_BATTERY,
    NYX_DEVICE_BLUETOOTH_INPUT_DETECT,
    NYX_DEVICE_CHARGER,
    NYX_DEVICE_DEVICE_INFO,
    NYX_DEVICE_DISPLAY,
    NYX_DEVICE_FIRMWARE_UPDATE,
    NYX_DEVICE_GENERIC,
    NYX_DEVICE_HAPTICS,
    NYX_DEVICE_KEYS,
    NYX_DEVICE_LED,
    NYX_DEVICE_LED_CONTROLLER,
    NYX_DEVICE_MEMORY,
    NYX_DEVICE_SENSOR_FIRST,      /* all psc sensors */
    NYX_DEVICE_SENSOR_ACCELERATION = NYX_DEVICE_SENSOR_FIRST,
    NYX_DEVICE_SENSOR_ALS,
    NYX_DEVICE_SENSOR_ANGULAR_VELOCITY,
    NYX_DEVICE_SENSOR_BEARING,
    NYX_DEVICE_SENSOR_GRAVITY,
    NYX_DEVICE_SENSOR_LINEAR_ACCELERATION,
    NYX_DEVICE_SENSOR_MAGNETIC_FIELD,
    NYX_DEVICE_SENSOR_ORIENTATION,
    NYX_DEVICE_SENSOR_PROXIMITY,
    NYX_DEVICE_SENSOR_ROTATION,
    NYX_DEVICE_SENSOR_SHAKE,
    NYX_DEVICE_SENSOR_LAST = NYX_DEVICE_SENSOR_SHAKE,
    NYX_DEVICE_TOUCHPANEL,
    NYX_DEVICE_SYSTEM,
    NYX_DEVICE_MEDIA_CAMERA,
    NYX_DEVICE_MASS_STORAGE_MODE,
    NYX_DEVICE_OS_INFO,
    NYX_DEVICE_SECURITY,
}
nyx_device_type_t;
nyx-lib/6.1.0-70-r6/git/include/public/nyx/common/nyx_device.h
```

Example – Adding a New Device Module

```
NYX_API_EXPORT nyx_error_t nyx_device_open(nyx_device_type_t type,
    nyx_device_id_t id, nyx_device_handle_t *handle_ptr);

NYX_API_EXPORT nyx_error_t nyx_device_close(nyx_device_handle_t handle);

NYX_API_EXPORT nyx_error_t nyx_device_set_operating_mode(
    nyx_device_handle_t handle, nyx_operating_mode_t mode);

NYX_API_EXPORT nyx_error_t nyx_device_get_operating_mode(common API
    nyx_device_handle_t handle, nyx_operating_mode_t *mode_out_ptr);

NYX_API_EXPORT nyx_error_t nyx_device_get_event_source(nyx_device_handle_t
    handle, int32_t *source_out_ptr);

NYX_API_EXPORT nyx_error_t nyx_device_get_event(nyx_device_handle_t handle,
    nyx_event_handle_t *event_out_ptr);
./nyx-lib/6.1.0-70-r6/git/include/public/nyx/common/nyx_device.h [+]
```

Example – Device Module API

The device module API provides functions for performing specific functions of a specific type of device. Below is an example of a device module API for a battery

```
NYX_API_EXPORT nyx_error_t nyx_battery_query_battery_status(
    nyx_device_handle_t handle, nyx_battery_status_t *status_out_ptr);

NYX_API_EXPORT nyx_error_t nyx_battery_register_battery_status_callback(
    nyx_device_handle_t handle, nyx_device_callback_function_t callback_func,
    void *context);

NYX_API_EXPORT nyx_error_t nyx_Device module APIe_battery(
    nyx_device_handle_t handle, bool *result);

NYX_API_EXPORT nyx_error_t nyx_battery_get_ctia_parameters(
    nyx_device_handle_t handle, nyx_battery_ctia_t *param);

NYX_API_EXPORT nyx_error_t nyx_battery_set_wakeup_percentage(
    nyx_device_handle_t handle, int32_t percentage);
```

[nyx-lib/6.1.0-70-r6/git/include/public/nyx/client/nyx_battery.h \[+\]](#)

Nyx usage example

Below is an example of how Nyx is accessed on the platform. First, the nyx_init() function is called to prepare for the Nyx logging system. Then, it calls the nyx_device_open() function with the device type (NYX_DEVICE_DEVICE_INFO) to be controlled, and receives the handle of the generated device object to the device device. Then, the device module APIs are called through this handle to control the object.

```
static bool read_modem_present()
{
    // read the modem present using Nyx
    nyx_error_t error = NYX_ERROR_GENERIC;
    nyx_device_handle_t device = NULL;
    const char *modem_present;
    bool ismodem_present=true;

    error = nyx_init();
    if (NYX_ERROR_NONE == error)
    {
        error = nyx_device_open(NYX_DEVICE_DEVICE_INFO, "Main", &device);
        if (NYX_ERROR_NONE == error && NULL != device)
        {
            error = nyx_device_info_query(device, NYX_DEVICE_INFO_MODEM_PRESENT, &modem_present);
            if (NYX_ERROR_NONE == error)
            {
                if(g_strcmp0(modem_present,"N") == 0)
                {
                    ismodem_present=false;
                }
            }
            nyx_device_close(device);
        }
        nyx_deinit();
    }
    return ismodem_present;
}
```

activitymanager/3.0.0-126-r4/git/src/ServiceApp.cpp

119,23

Example - Device Porting Method

The nyx_device structure contains the device module information (module_ptr) to perform the operation on the device object, and has the address value after loading the module. It is used to store the open function and close function pointers obtained from this module in open_ptr and close_ptr. A mapping information table (method_hash_table) for the device module function to be executed when calling the device module API is also built in. This hash table stores address values that have mapping information between the functions implemented in the device module and each device module API. The pointer to the nyx_device structure data is also used as a handle to the object in Nyx.

```
struct nyx_device
{
    nyx_device_type_t type;
    char *name;
    char *description;

    void *module_ptr;
    nyx_open_function_t open_ptr;
    nyx_close_function_t close_ptr;

    /* we need a pointer to the structure that keeps the data
     * but since we want the API to be not aware of the actual
     * implementation but we need to convey the size we will
     * give it a void* definition.
     */
    void *method_hash_table;
};

nyx-lib/6.1.0-70-r6/git/include/public/nyx/module/nyx_device_internal.h
```

Example - Device module loading and Handle Initialization

The device module exists as a shared library and has a structure in which the module is loaded according to the device type that is transmitted when the nyx_device_open () function, which is a common API, is called.

The nyx_device_open () function sets the values of the loaded module's module_ptr and open_ptr and close_ptr, which are pointers to the required functions from the module.

Initialize the contents of the parameter device which is a pointer to the nyx_device structure with these set values.

This completes the preparation that the device can be used as a handle. At this time, `_nyx_module_get_api_version_major`, `_nyx_module_get_api_version_minor`, `_nyx_module_get_api_name` and `_nyx_module_get_type`, which are required functions to be provided by the module, must be provided in the module or the open operation to the device fails while returning an error

nyx_dewie_open(NYX_DEVICE_INFO,"MAIN",&device)

- 1 module_ptr = dlopen(lid_name_str, RTLD_NOW)
- 2 open_ptr = dlsym(module_ptr, "nyx_module_open")
close_ptr = dlsym(module_ptr, "nyx_module_close")

dlsym(module_ptr, "ntx_module_get_api_version_major")
dlsym(module_ptr, "ntx_module_get_api_version_minor")
dlsym(module_ptr, "nyx_module_get_name")
dlsym(module_ptr, "nyx_module_get_type")
- 3 open_ptr(...)
- 4 device->module_ptr = module_ptr
device->type = type
device->open_ptr = open_ptr
device->close_ptr = close_ptr

Example - Device control function implementation

- Nyx's HW abstraction layer consists of Uniform Client APIs and device modules.
- The implementation of a module that loads and provides control functions for a specific device type is divided into four stages.
 1. Nyx Required Basic Function Definition
 2. Implement function by function of device module
 3. Module Open function implementation
 4. Module Close function implementation
- Each of the Module would have Module Method_id, Module Method_Function, Device_module_API.

Example –Interaction between Location service and Nyx module

Location Service

- First required NYX device need to be open by calling `nyx_device_open()`
`nyx_error_t nyx_device_open(nyx_device_type_t type, nyx_device_id_t id,
nyx_device_handle_t *handle_out_ptr)`
here,
a) `nyx_device_type_t` is the NYX device we need to open. All valid Nyx device types are present in file `nyx-lib/include/public/nyx/common/nyx_device.h`. For GPS `nyx_device_type_t` is `NYX_DEVICE_GPS`.
b) `nyx_device_id_t` is the device id
c) `nyx_device_handle_t` handle for the newly created device, this handle will be required for all the future interactions with NYX GPS module, which we opened.
- Initialization for GPS module, by calling `nyx_gps_init()`. Here we will provide the callbacks functions to interact with NYX GPS and location updates will also be provided over it
`NYX_API_EXPORT nyx_error_t nyx_gps_init(nyx_device_handle_t
handle, nyx_gps_callbacks_t *gps_cbs, nyx_gps_xtra_callbacks_t
*xtra_cbs, nyx_agps_callbacks_t *agps_cbs, nyx_gps_ni_callbacks_t
*gps_ni_cbs, nyx_agps_ril_callbacks_t *agps_ril_cbs, nyx_gps_geofence_callbacks_t
*geofence_cbs,`
- For GPS location updates `nyx_gps_start()` should be called
`NYX_API_EXPORT nyx_error_t nyx_gps_start(nyx_device_handle_t handle);`
GPS location updates will be provide to `mGPSCallbacks.location_cb` CB function

Example –Interaction between Location service and Nyx module

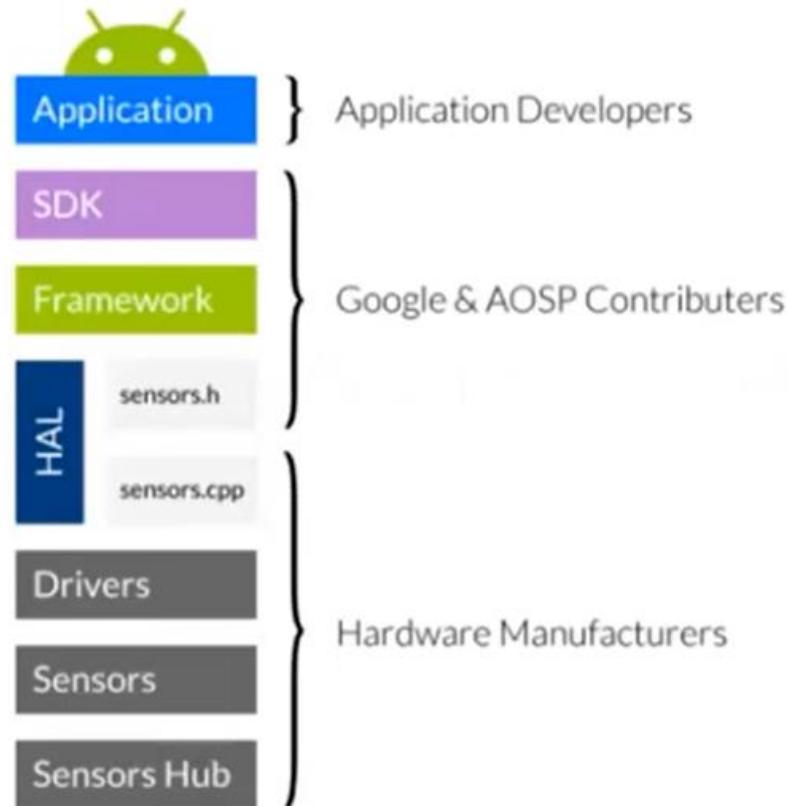
NYX-modules

A new nyx-modules need to be created for required GPS support, will generate a **nyxNYX_DEVICE_GPS.module** should be placed at path **/usr/lib/nyx/modules/**

- We must declare the module type and name, same device type need to be used in **nyx_device_open()** to get the **nyx_device_handle_t**
`NYX_DECLARE_MODULE(NYX_DEVICE_GPS, "GpsQcom");`
`nyx_device_open()` defined in `nyx_device_impl.c` in `nyx_lib` will try open to it and do `dlsym` for **nyx_module_open** and **nyx_module_close**. So **nyx_module_open** and **nyx_module_close** that should also be defined in the NYX-module.
- **nyx_module_register_method** should be used to set the method for the newly created device. Registered methods will be used by the client Location service.
`nyx_error_t nyx_module_register_method(nyx_instance_t instance, nyx_device_t *device_in_ptr, module_method_t method, const char *symbol_str);`
API's for GPS NYX are present in `nyx-lib/include/public/nyx/client/Nyx_gps.h`

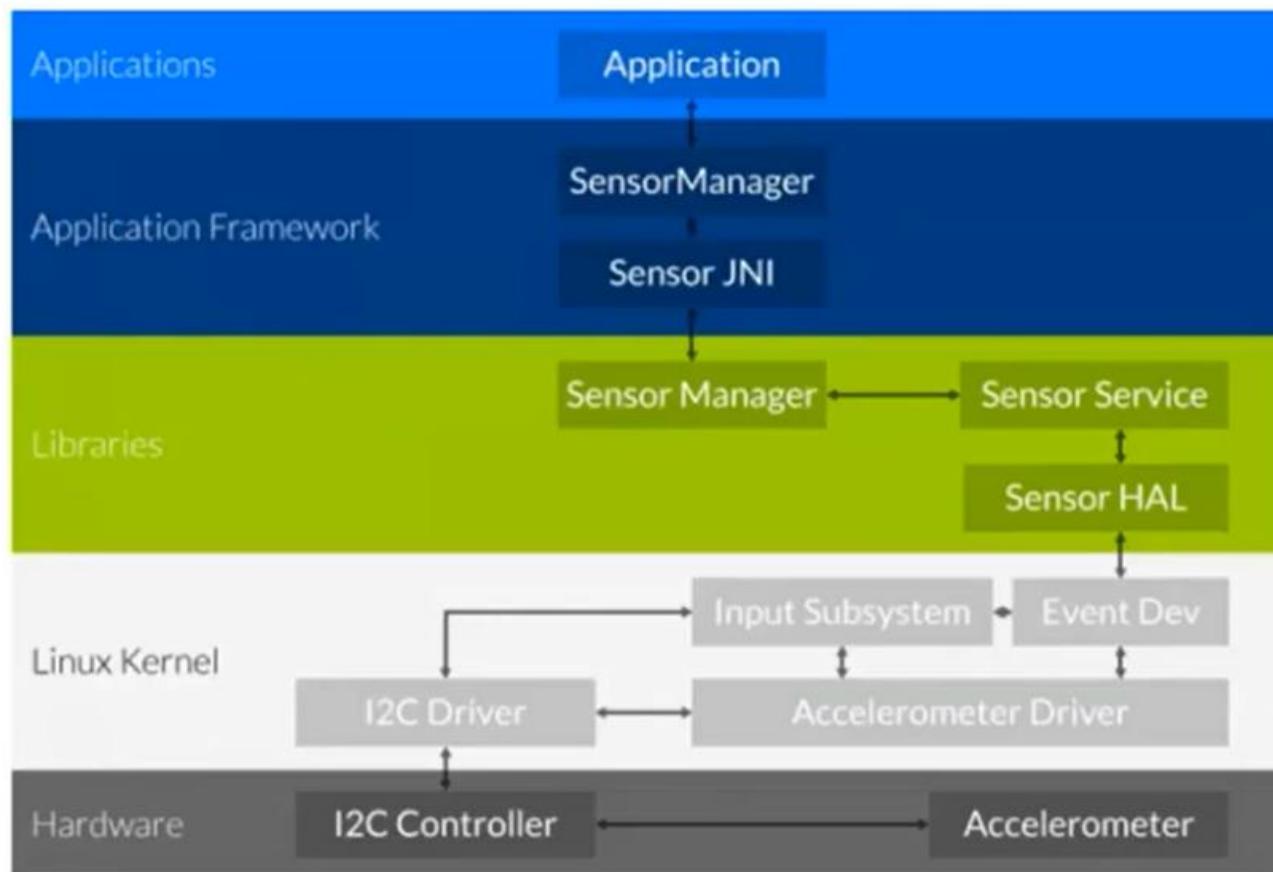
Sensord – Using Nyx module

Example - Android Sensor Stack



Source: <https://source.android.com/devices/sensors/sensor-stack.html>

The Android Sensor Stack



Source: http://processors.wiki.ti.com/index.php/Android_Sensor_PortingGuide

Example - Sensors HAL 1.0

- The Sensors HAL interface, declared in [sensors.h](#), represents the interface between the Android [framework](#) and the hardware-specific software. A HAL implementation must define each function declared in sensors.h. The main functions are:
 - `get_sensors_list` - Returns the list of all sensors.
 - `activate` - Starts or stops a sensor.
 - `batch` - Sets a sensor's parameters such as sampling frequency and maximum reporting latency.
 - `setDelay` - Used only in HAL version 1.0. Sets the sampling frequency for a given sensor.
 - `flush` - Flushes the FIFO of the specified sensor and reports a flush complete event when this is done.
 - `poll` - Returns available sensor events.
- The interface also defines several types used by those functions.
The main types are:
 - `sensors_module_t`
 - `sensors_poll_device_t`
 - `sensor_t`
 - `sensors_event_t`

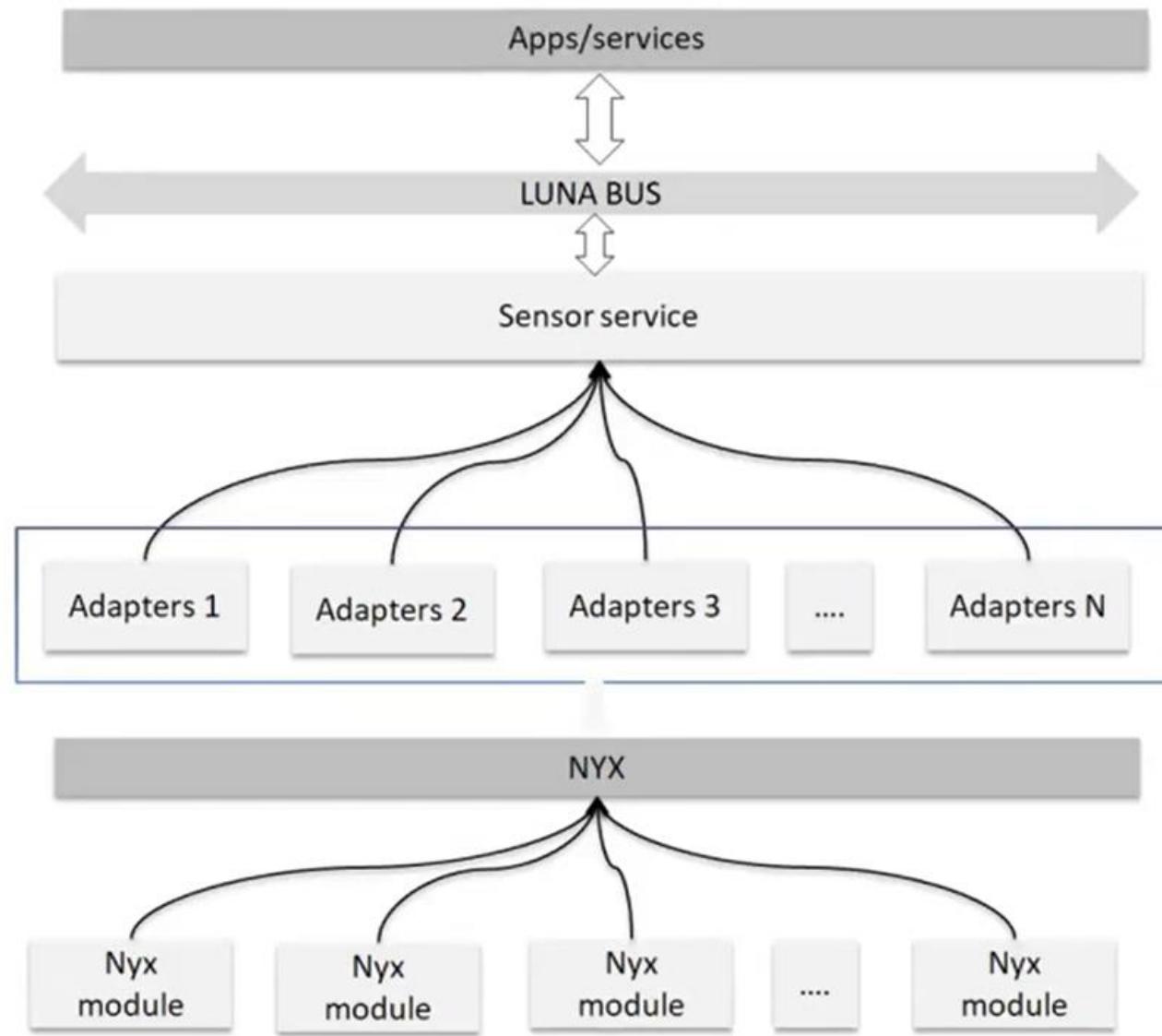
Generic Sensor framework

The design of the sensor service is meant for handling the sensors functionality through the luna-service2 bus in hardware independent manner.

The proposed sensor service provides

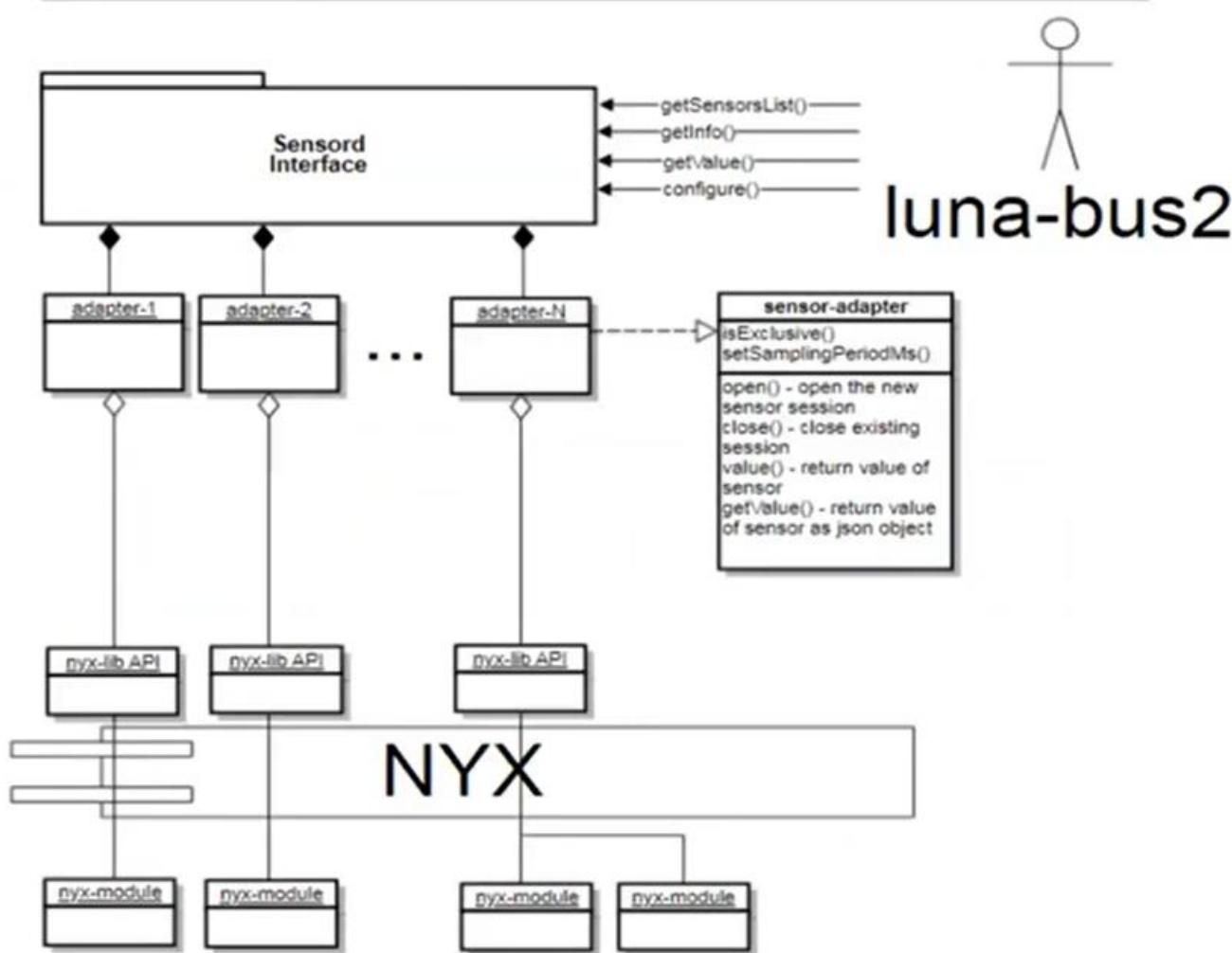
- True module architecture that enables to add new sensors easily without changing parts of sensor service.
- Strong power management model that gives sensor developers an ability to control sensor life-cycle.
- Simple and effective threading model with minimal system resources usage.
- Full asynchronous access over Luna bus with sessions support and useful functions
 - a) get supported sensors list,
 - b) get sensors status/values/info,
 - c) subscribe to sensors events,
 - d) configure sensors parameters.(Control)

Design Proposal of Architecture



Design Proposal of Architecture

Sensord Structure



WebOS - Sensord function ...

- `getSensorList`
 - `luna-send -f -n 1 luna://com.webos.service.sensor/getSensorsList'{}'`
 - {
 - "subscribed":false,
 - "names":[
 - "Accelerometer",
 - "Gravity",
 - "Gyroscope",
 - "HeartRate",
 - "MPU6050",
 - "Magnetometer",
 - "Pressure",
 - "StepCounter",
 - "Temperature"
 -],
 - "returnValue":true
 - }
 - `getValue`
 - `luna-send -f -i luna://com.webos.service.sensor/getValue '{ "name": "MPU6050", "sample-rate":1, "subscribe":true}'`
 - {
 - "subscribed":false,
 - "returnValue":true,
 - "values": [
 - {
 - "Temp (fahrenheit)": 81.829292297363,
 - "Temp (Celcius)": 27.682941436768,
 - "xgyro": 2.9541983604431,
 - "zgyro": -1.5343511104584,
 - "name": "MPU6050",
 - "xaccel": 0.085693359375,
 - "yaccel": -0.529296875,
 - "zaccel": 0.868408203125,
 - "ygyro": -1.5725190639496,
 - "time": "1573621090"
 - }]
 -]
 - }

WebOS - Sensord function

- **getInfo**

- `luna-send -f -n 1 luna://com.webos.service.sensor/getInfo '{ "name": "MPU6050"}'`
• {
• "device-type": "continuous",
• "power-state": "OFF",
• "time": "1573641079",
• "returnValue": true,
• "name": "MPU6050",
• "access-type": "shared"
• }

- **Control**

- `luna-send -n 1 -f luna://com.webos.service.sensor/control`
`'{"name":"MPU6050","cmd":"getRate"}'`
• {
• "time": "1573116927",
• "returnValue": true,
• "Rate": 10,
• "name": "MPU6050"
• }



Q&A

DAY6-1

Introduction to Bluetooth

What is Bluetooth?

Can we implement it ourselves?

What can it do?

Introduction to Bluetooth

- Bluetooth is technology for short range wireless communication
- Began as a private development effort at Ericsson in 1994
- Bluetooth SIG: The Bluetooth Special Interest Group (SIG) is a privately held, not-for-profit trade association founded in 1998 with more than 17,000 member companies today.
- SIG Membership & Key benefits: Membership is for companies, if company uses Bluetooth technology in its products.

Company gets exclusive access to:

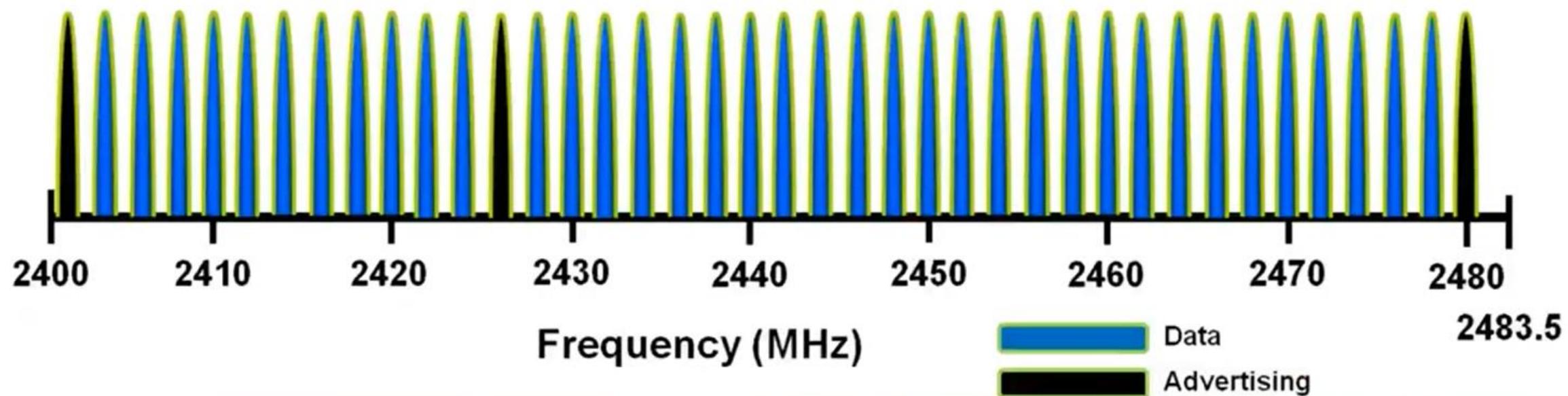
- Tools, training, and testing resources.
- Royalty-free licenses to build products that use Bluetooth Technology, word mark and logos.
- Bluetooth specifications (early access for Associate and Promoter members.)

Introduction to Bluetooth

Bluetooth radio

- Radio transceiver Frequency band 2.402 GHz - 2.480 GHz (ISM band)
- Channel spacing for Classic Bluetooth : 1 MHz apart (79 channels)
- Channel spacing for BLE: 2 MHz apart (40 channels)

Channel: 37 0 1 2 3 4 5 6 7 8 9 10 38 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 39



Evolution of Bluetooth

⋮

Bluetooth 1.0

1998.10 – 2003. 11

“Base Rate”

- 1Mbps data rate
- V1.0 - Draft
- V1.0A - published on 1999.7
- V1.0B Enhanced the Interoperability
- V1.1 - IEEE 802.15.1
- V1.2 Enhanced the compatibility

Bluetooth 2.0 + EDR

2004. 11 – 2007. 7

“Enhanced Data Rate”

- Higher ordered modulation for data payload
- 2Mbps or 3Mbps physical data rate
- V2.0
- V2.1

Bluetooth 3.0 + HS

2009. 4

“HS Mode”

- AMP
- Alternative MAC/PHY
- Implement high data rate by using 802.11 protocols.
- Facing the Challenge from Wi-Fi
- V3.0

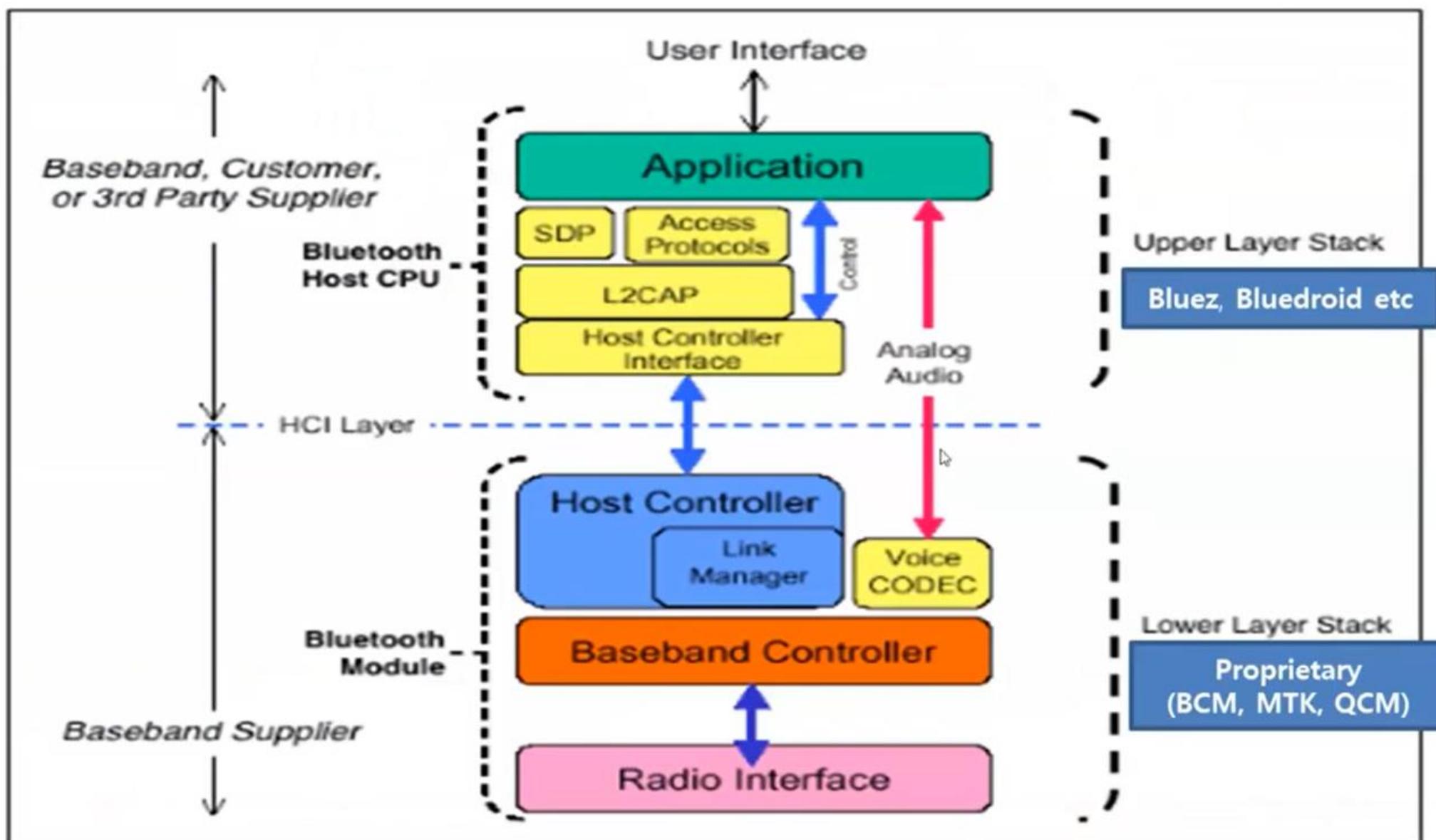
Bluetooth 4.0

2010. 6 – 2014. 12

“Low Energy”

- Facing the IoT application
- Changed the protocol greatly, almost a new technology
- V4.0
- V4.1
- V4.2

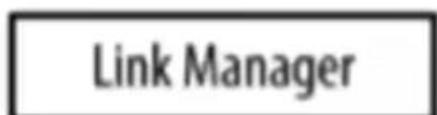
Bluetooth Architecture



Configurations between Bluetooth versions and device types



(classic or BR/EDR)



(dual mode or BR/EDR/LE)



(single mode or BLE)



Introduction to Bluetooth

Bluetooth Power Classes

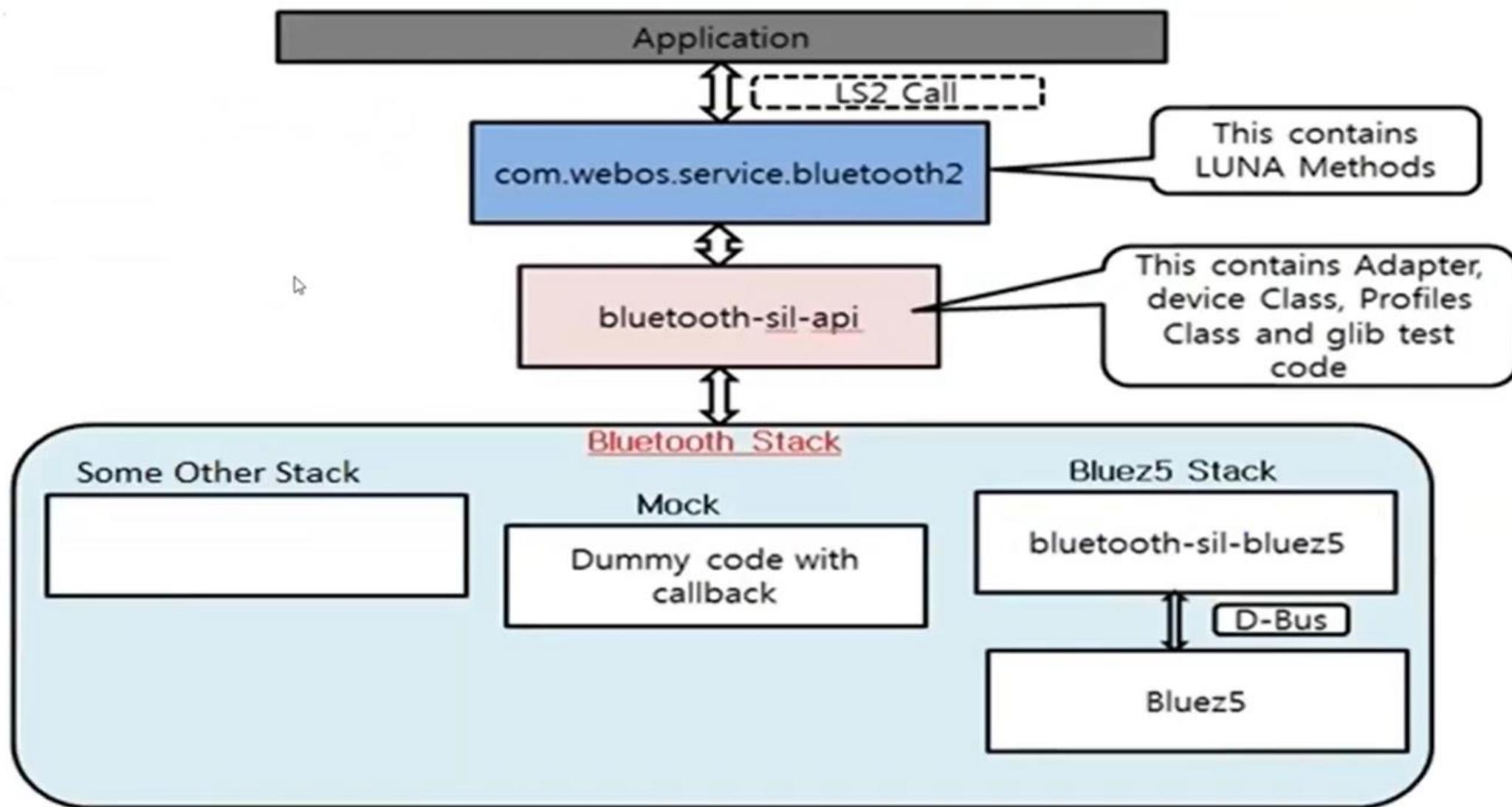
Class	Maximum Power	Operating Range
Class 1	100mW (20dBm)	100 meters
Class 2	2.5mW (4dBm)	10 meters
Class 3	1mW (0dBm)	1 meter



Bluetooth supported profiles

<https://www.bluetooth.com/specifications/profiles-overview/>

WEBOS Bluetooth Architecture



WEBOS Bluetooth Profiles supported

- GAP
- SPP
- A2DP Source
- AVRCP TG
- BLE/GATT
- OPP

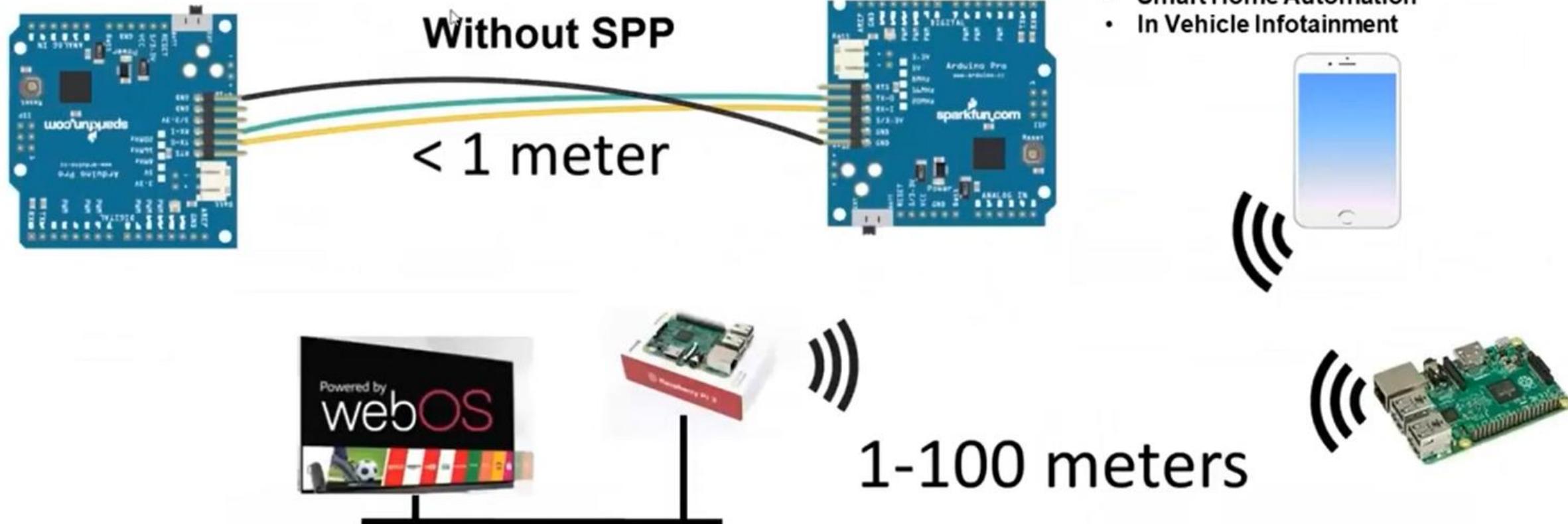
Bluetooth Profiles on WebOS

Platform team contribution

GAP, Serial Port Profile, Bluetooth Low Energy, GATT, A2DP, AVRCP

Use case: SPP

- SPP replaces serial communication interface (like RS-232 or a UART)
- SPP is great for sending bursts of data between two devices.



Where can be applied?

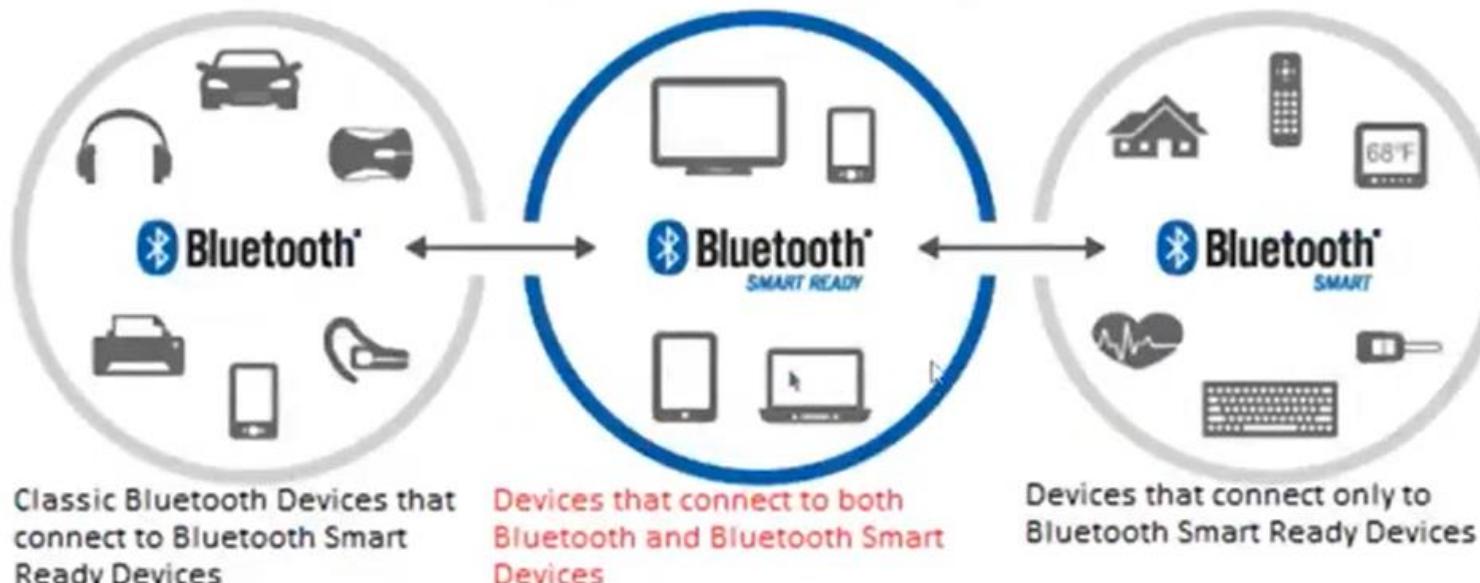
- IoT
- Health care
- Smart Home Automation
- In Vehicle Infotainment



Bluetooth Profiles on WebOS

Use case: Bluetooth Low Energy, GATT

Compared to Classic Bluetooth, Bluetooth Low Energy is intended for reduced power consumption and cost while maintaining similar communication range



Key Features

- Ultra low Power Consumption (1 ~ 20% of Standard Bluetooth power)
- Low Cost
- Small Size
- Faster Connection (no pairing required)

Where can be applied?

- IoT
- Health care
- Smart Home Automation
- Smart Energy

Generic Attribute Profile (GATT): Using the Attribute Protocol, it describes a service framework for discovering services and for reading and writing characteristic values on a peer device. It interfaces with the application through the application's profiles.

Heart Rate Measurement

UUID: 0x2A37

Properties: NOTIFY

Descriptors:

Client Characteristic Configuration

UUID: 0x2902

Value: 0x0000

Body Sensor Location

UUID: 0x2A38

Properties: READ

Value: 0x01

Heart Rate (Predefined)

UUID: 0x180D

PRIMARY SERVICE

Bluetooth Profiles on WebOS

● LGSI Platform team contribution for JCL

Advanced Audio Distribution Profile (A2DP Source Role), Audio/Video Remote Control Profile (AVRCP Target role)

● Use case: A2DP

Multimedia audio streamed from A2DP source (RPI) to A2DP sink (BT headphones or stereo system) over a Bluetooth connection



Features

- **a2dp/connect** - Connect to A2DP profile on the specified remote device
- **a2dp/disconnect** - Drop the connection to the given remote device on A2DP profile
- **a2dp/getStatus** - Return the status of A2DP connection to a remote device

Bluetooth Profiles on WebOS

● Use case: AVRCP

Plays a Target Role by accepting and processing commands from controller (eg. Stereo Headset)



* the audio stream is not handled in this profile

Features

- `avrcp/connect` - Connect to Open a AVRCP connection to a remote Bluetooth device
- `avrcp/disconnect` - Drop the connection to the given remote device on AVRCP profile
- `avrcp/getStatus` - Return the status of AVRCP connection to a remote Bluetooth device
- `avrcp/receivePassThroughCommand` - Receives PATH THROUGH command from Controller(typically considered as a remote control device) to Target (one whose characteristics are being altered)
- `avrcp/supplyMediaPlayStatus` - Supply media play status of the target to remote devices connected via AVRCP
- `avrcp/supplyMediaMetaData` - Supply media metadata of the target to remote devices connected via AVRCP
- `avrcp/awaitMediaPlayStatusRequest` - Await incoming media play status requests from remote devices. Available only for TG(Target)
- `avrcp/awaitMediaMetaDataRequest` - Await incoming media metadata requests from remote devices. Available only for TG(Target)
- `avrcp/internal/getRemoteFeatures` - Get the remote AVRCP's features

Thank You



DAY6-2

Activities Google Chrome Sat 10:23

com.webos.service.bluetooth2 Meeting is in progress

webosose.org/docs/reference/lis2-api/com-webos-service-bluetooth2/#adapter-getstatus

webOS Open Source Edition

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Reference

- audiooutput
- com.webos.service.avoutput
- com.webos.service.bluetooth2
- com.webos.service.camera2
- com.webos.service.config
- com.webos.service.configuration
- com.webos.service.connectionmanager
- com.webos.service.contextintentmgr
- com.webos.service.dab
- com.webos.service.devmode
- com.webos.service.downloadmanager
- com.webos.service.filecache
- com.webos.service.lis2

errorCode Optional Number The error code.

errorText Optional String Indicates the error text.

Error Codes Reference

Error Code	Error Text	Error Description
101,	See API Error Codes Reference.	See API Error Codes Reference.
143,		
144		

Example

```
# luna-send -i -f
luna://com.webos.service.bluetooth2/adapter/getStatus
{
    "subscribe":true
}
```

Response for a successful call:

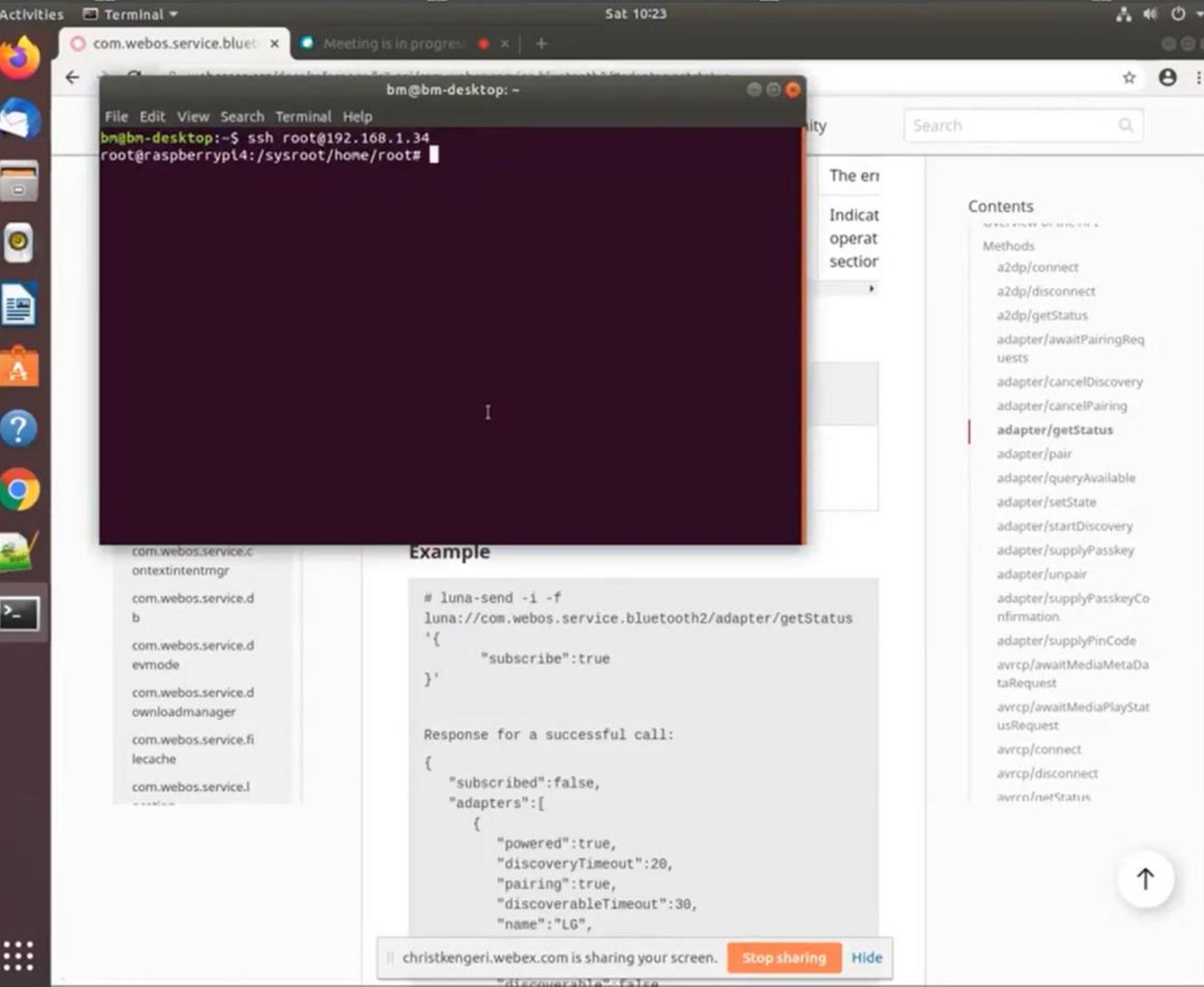
```
{
    "subscribed":false,
    "adapters":[
        {
            "powered":true,
            "discoveryTimeout":20,
            "pairing":true,
            "discoverableTimeout":30,
            "name":"LG",
            "address": "00:00:00:00:00:00"
        }
    ]
}
```

Contents

- Methods
- a2dp/connect
- a2dp/disconnect
- a2dp/getStatus
- adapter/awaitPairingRequests
- adapter/cancelDiscovery
- adapter/cancelPairing
- adapter/getStatus
- adapter/pair
- adapter/queryAvailable
- adapter/setState
- adapter/startDiscovery
- adapter/supplyPasskey
- adapter/unpair
- adapter/supplyPasskeyConfirmation
- adapter/supplyPinCode
- avrcp/awaitMediaMetaDataTableRequest
- avrcp/awaitMediaPlayStatusRequest
- avrcp/connect
- avrcp/disconnect
- avrcp/infoStatus

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<https://www.webosose.org/docs/reference/lis2-api/com-webos-service-bluetooth2/#adapter-getstatus>



Activities Terminal Sat 10:24

*new 1 - Notepad++ [Administrator]

File Edit Search View Encoding Language Settings Tools Run Plugins Window ?

bm@bm-desktop:~

```
bngbm-desktop:~$ ssh root@192.168.1.34
root@raspberrypi4:/sysroot/home/root# luna-send -t -f luna://com.webos.service.bluetooth2/adapter/getStatus '{ "subscribe":true }'
{
  "subscribed": true,
  "adapters": [
    {
      "powered": true,
      "discoveryTimeout": 0,
      "pairing": false,
      "discoverableTimeout": 180,
      "name": "raspberrypi4",
      "adapterAddress": "b8:27:eb:7b:07:3c",
      "discovering": true,
      "discoverable": false,
      "pairable": true,
      "pairableTimeout": 0
    }
  ],
  "returnValue": true
}
```

Normal text file length: 634 lines: 18 Ln: 4 Col: 1 Sel: 92 | 1 Windows (CR LF) UTF-8 INS avrcp/awaitMediaPlayStat usRequest avrcp/connect avrcp/disconnect avrcpInetStatus

ownloadmanager com.webos.service.fil cache com.webos.service.l Response for a successful call:

```
{
  "subscribed":false,
  "adapters":[
    {
      "powered":true,
      "discoveryTimeout":20,
      "pairing":true,
      "discoverableTimeout":30,
      "name":"LG",
      "discoverable":false
    }
  ]
}
```

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Activities Terminal Sat 10:25

*new 1 - Notepad++ [Administrator]

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

bm@bm-desktop: ~

```
1 "discoveryTimeout": 0,
2 "pairing": false,
3 "discoverableTimeout": 180,
4 "name": "raspberrypi4",
5 "adapterAddress": "b8:27:eb:7b:07:3c",
6 "discovering": true,
7 "discoverable": false,
8 "pairable": true,
9 "pairableTimeout": 0
10 }
11 ],
12 "returnValue": true
13 }
14 ^C
15
16 root@raspberrypi4:/sysroot/home/root# una-send -f -n 1 luna://com.webos.service.
17 bluetooth2/adapter/setState '{"powered":false}'
18 -sh: una-send: not found
19 root@raspberrypi4:/sysroot/home/root# luna-send -f -n 1 luna://com.webos.service
20 .bluetooth2/adapter/setState '{"powered":false}'
21 {
22     "adapterAddress": "b8:27:eb:7b:07:3c",
23     "returnValue": true
24 }
25 root@raspberrypi4:/sysroot/home/root#
```

Normal text file length: 634 lines: 18 Ln: 7 Col: 2 Sel: 88 | 1 Windows (CR LF) UTF-8 INS avrcp/awaitMediaPlayStat
usRequest
avrcp/connect
avrcp/disconnect
avrcp/netStatus

ownloadmanager com.webos.service.fi lecache com.webos.service.l Response for a successful call:
{
 "subscribed":false,
 "adapters": [
 {
 "powered":true,
 "discoveryTimeout":20,
 "pairing":true,
 "discoverableTimeout":30,
 "name":"LG",
 "discoverable":false
 }
]
}

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Activities Terminal Sat 10:26 *new 1 - Notepad++ [Administrator]

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

bm@bm-desktop: ~

new File Edit View Search Terminal Help

```
1 "adapters": [
2   {
3     "powered": false,
4     "discoveryTimeout": 0,
5     "pairing": false,
6     "discoverableTimeout": 180,
7     "name": "raspberrypi4",
8     "adapterAddress": "b8:27:eb:7b:07:3c",
9     "discovering": false,
10    "discoverable": false,
11    "pairable": true,
12    "pairableTimeout": 0
13  }
14 ],
15 "returnValue": true
16 }
17 ^
18 root@raspberrypi4:/sysroot/home/root# luna-send -f -n 1 luna://com.webos.service
19 .bluetooth2/adapter/setState '{"powered":true}'
20 {
21   "adapterAddress": "b8:27:eb:7b:07:3c",
22   "returnValue": true
23 }
24 root@raspberrypi4:/sysroot/home/root#
```

Normal text file length : 634 lines : 18 ln : 7 Col : 2 Sel : 88 | 1 Windows (CR LF) UTF-8 INS avrcp/awaitMediaPlayStat
usRequest avrcp/connect avrcp/disconnect avrcp/netStatus

ownloadmanager com.webos.service.fi Response for a successful call:
lecache com.webos.service.l {
"subscribed":false,
"adapters": [
{
"powered":true,
"discoveryTimeout":20,
"pairing":true,
"discoverableTimeout":30,
"name":"LG",
"discoverable":false

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Activities Terminal Sat 10:26

*new 1 - Notepad++ [Administrator]

File Edit Search View Encoding Language Settings Tools Run Plugins Window ?

bm@bm-desktop: ~

new 2 File Edit View Search Terminal Help

```
1      "name": "raspberrypi4",
2      "adapterAddress": "b8:27:eb:7b:07:3c",
3      "discovering": false,
4      "discoverable": false,
5      "pairable": true,
6      "pairableTimeout": 0
7
8    ],
9    "returnValue": true
10 }
11 ^C
12 root@raspberrypi4:/sysroot/home/root# luna-send -f -n 1 luna://com.webos.service
13 .bluetooth2/adapter/setState '{"powered":true}'
14 {
15   "adapterAddress": "b8:27:eb:7b:07:3c",
16   "returnValue": true
17 }
18 root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service
19 .bluetooth2/adapter/startDiscovery '{}'
20 {
21   "adapterAddress": "b8:27:eb:7b:07:3c",
22   "returnValue": true
23 }
24 root@raspberrypi4:/sysroot/home/root#
```

Normal text file length : 634 lines : 18 Ln : 10 Col : 83 Sel : 82 | 1 Windows (CR LF) UTF-8 INS avrcp/awaitMediaPlayStat
usRequest avrcp/connect avrcp/disconnect avrcp/netStatus

ownloadmanager com.webos.service.fil cache com.webos.service.l Response for a successful call:

```
{
  "subscribed":false,
  "adapters":[
    {
      "powered":true,
      "discoveryTimeout":20,
      "pairing":true,
      "discoverableTimeout":30,
      "name":"LG",
      "discoverable":false
    }
  ]
}
```

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Activities Terminal Sat 10:26 *new 1 - Notepad++ [Administrator]

File Edit View Search Terminal Help

```
bm@bm-desktop: ~
1      "adapterAddress": "b8:27:eb:7b:07:3c",
2      "discovering": false,
3      "discoverable": false,
4      "pairable": true,
5      "pairableTimeout": 0
6    }
7  ],
8  "returnValue": true
9 }
10 ^C
11 root@raspberrypi4:/sysroot/home/root# luna-send -f -n 1 luna://com.webos.service
12 .bluetooth2/adapter/setState '{"powered":true}'
13 {
14   "adapterAddress": "b8:27:eb:7b:07:3c",
15   "returnValue": true
16 }
17 root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service
18 .bluetooth2/adapter/startDiscovery '{}'
19 {
20   "adapterAddress": "b8:27:eb:7b:07:3c",
21   "returnValue": true
22 }
23 root@raspberrypi4:/sysroot/home/root# luna-send -i -f luna://com.webos.service.b
24 luetooth2/device/getStatus '{}'
```

I

Normal text file length: 634 lines: 18 ln: 13 Col: 1 Sel: 73 | 1 Windows (CR LF) UTF-8 avrcp/awaitMediaPlayStat
ownloadmanager usRequest
com.webos.service.fi lecache avrcp/connect
com.webos.service.l Response for a successful call:
{
 "subscribed":false,
 "adapters": [
 {
 "powered":true,
 "discoveryTimeout":20,
 "pairing":true,
 "discoverableTimeout":30,
 "name":"LG",
 "discoverable":false

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Activities Terminal Sat 10:27 *new 1 - Notepad++ [Administrator]

File Edit Search View Encoding Language Settings Tools Run Plugins Window ?

bm@bm-desktop: ~

new1 File Edit View Search Terminal Help

```
1      "scanRecord": [
2      ],
3      "pairing": false,
4      "rssi": -52,
5      "name": "boAt Rockerz",
6      "address": "eb:06:ef:0f:fb:a9",
7      "paired": false,
8      "typeOfDevice": "bredr",
9      "manufacturerData": [
10     ],
11      "adapterAddress": "",
12      "classOfDevice": 2360324,
13      "blocked": false
14    }
15  ]
16 }
17 ^C
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service
.bluetooth2/adapter/cancelDiscovery '{}'
{
  "adapterAddress": "b8:27:eb:7b:07:3c",
  "returnValue": true
}
root@raspberrypi4:/sysroot/home/root#
```

Normal text file length : 634 lines : 18 ln : 16 Col : 1 Sel : 63 | 1 Windows (CR LF) UTF-8 INS avrcp/awaitMediaPlayStat usRequest avrcp/connect avrcp/disconnect avrcp/inetStatus

ownloadmanager com.webos.service.fi lecache com.webos.service.l

Response for a successful call:

```
{
  "subscribed":false,
  "adapters":[
    {
      "powered":true,
      "discoveryTimeout":20,
      "pairing":true,
      "discoverableTimeout":30,
      "name":"LG",
      "discoverable":false
    }
  ]
}
```

christkengeri.webex.com is sharing your screen. Stop sharing Hide

Activities Google Chrome Sat 10:28

com.webos.service.bluetooth2 Meeting is in progress webosose.org/docs/reference/lsl2-api/com-webos-service-bluetooth2/#adapter-pair

webOS Open Source Edition

About Docs Blog Community Search

Reference

- audiooutput
- com.webos.service.avoutput
- com.webos.service.bluetooth2**
- com.webos.service.camera2
- com.webos.service.config
- com.webos.service.configuration
- com.webos.service.connectionmanager
- com.webos.service.contextintentmgr
- com.webos.service.db
- com.webos.service.devemode
- com.webos.service.downloadmanager
- com.webos.service.filecache
- com.webos.service.l

118 Pairing already in progress Only one remote device can be pairing with the bluetooth adapter at any given time. This error indicates that the adapter is already pairing with a remote Bluetooth device, either with incoming or outgoing. Hence another pair cannot be initiated.

Example

```
# luna-send -i -f
luna://com.webos.service.bluetooth2/adapter/pair '{
    "address": "34:4d:f7:f9:52:f7",
    "subscribe": true
}'
```

Subscription return : If remote device requests pairing

```
{
    "returnValue": true,
    "subscribed": true,
    "passkey": 952197,
    "address": "34:4d:f7:f9:52:f7",
    "request": "confirmPasskey"
}
```

Response for a failed call: If device is pairing already

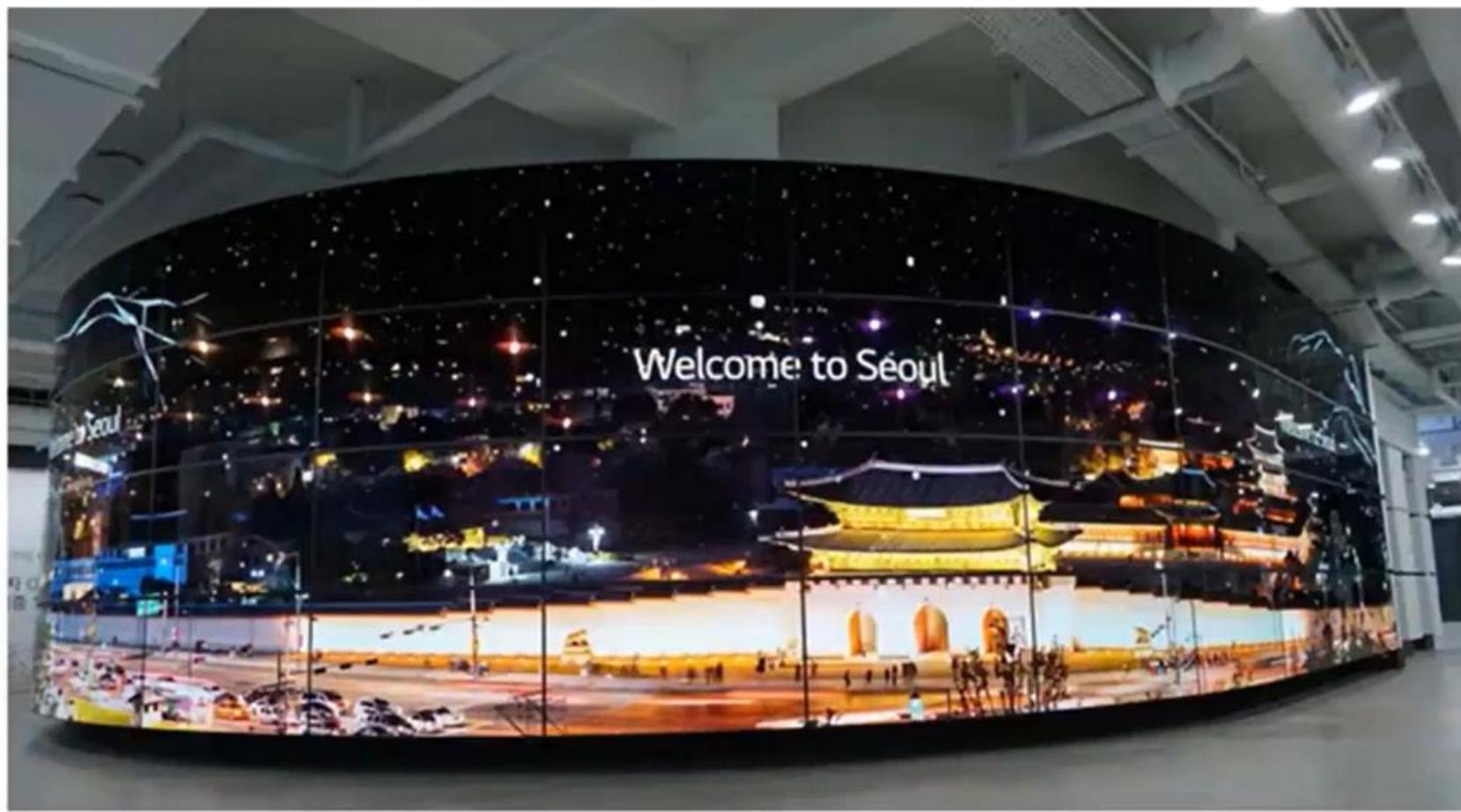
```
{
    "errorCode": 118,
    "returnValue": false,
    "errorText": "Pairing already in progress"
}
```

Contents

- Methods
- a2dp/connect
- a2dp/disconnect
- a2dp/getStatus
- adapter/awaitPairingRequests
- adapter/cancelDiscovery
- adapter/cancelPairing
- adapter/getStatus
- adapter/pair**
- adapter/queryAvailable
- adapter/setState
- adapter/startDiscovery
- adapter/supplyPasskey
- adapter/unpair
- adapter/supplyPasskeyConfirmation
- adapter/supplyPinCode
- avrcp/awaitMediaMetaDataRequest
- avrcp/awaitMediaPlayStatusRequest
- avrcp/connect
- avrcp/disconnect
- avrcp/netStatus

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LG webOS



Multimedia on webOS

Dr. Daniel D, Assistant Professor
Christ(Deemed to be University)

Web App

HTML



<< Structure >>

CSS



<< Style >>

**JAVA
SCRIPT**



<< Behavior >>

Roles of each element

HTML

- Hyper Text Markup Language
- Standard markup language for Web Pages
- Describes structure for a web Page

CSS

- Cascading style sheets
- language that describes style of an HTML document
- Style including design, layout

JavaScript

- Programming language of HTML and Web



HTML

<!DOCTYPE html> -> defines this is an HTML5 doc

<html> -> root element of an HTML page

<head> -> meta info about HTML page

<title>Page Title</title> -> title of the HTML page

</head>

<body> -> documents body and container of contents

<h1>This is a Heading</h1> -> large heading

<p>This is a paragraph.</p> -> paragraph

This is a link

</body>

</html>

CSS

```
<!DOCTYPE html>
<html>
<head>
<style>
body{
    background-color:lightblue;
}

h1{
    color: white;
    text-align:center;
}

p{
    font-family:verdana;
    font-size: 20px;
}
</style>
</head>
<body>

<h1>My First CSS Example</h1>
<p>This is a paragraph.</p>

</body>
</html>
```



JavaScript

```
<!DOCTYPE html>
<html>
<body>

<p id="demo">Click the button to change the layout of this paragraph</p>

<button onclick="myFunction()">Click Me!</button>

<script> -> code inserted between script tags
function myFunction() { -> function executed when invoked
    var x = document.getElementById("demo");
    x.style.fontSize = "25px";
    x.style.color = "red";
}
</script>

</body>
</html>
```

Ex : https://www.w3schools.com/js/tryit.asp?filename=tryjs_intro_lightbulb

HTML 5

- Prior to HTML5, video content could only be embedded into a web page using a plug-in such as, flash.
- Audio and Video playback natively in the browser, without requiring a plug-in.
- The <audio> and <video> tags make it simple to add media to your website.
 - Just include the <audio> or <video> element
 - use the src attribute to identify the media source
 - and include the controls attribute.

```
<video src="http://media.w3.org/2010/05/bunny/trailer.mp4" controls>  
</video>
```

Video Attributes

- controls
- loop
- autoplay
- width
- Height
- source
- tracks

```
<video src="test-1.mp4"  
       controls  
       width=640 height=480 >  
</video>
```

Sample App

```
<!DOCTYPE html>
<html>
<body>

<button onclick="playVid()" type="button">Play Video</button>
<button onclick="pauseVid()" type="button">Pause Video</button><br>
<button onclick="changeVid()" type="button">Change Video</button><br>

<video id="myVideo" width="640" height="480">
  <source id="mp4_src" src="mov_bbb.mp4" type="video/mp4">
  <source id="ogg_src" src="mov_bbb.ogg" type="video/ogg">
    Your browser does not support HTML5 video.
</video>

<script>
var vid = document.getElementById("myVideo");

function playVid() {
  vid.play();
}

function pauseVid() {
  vid.pause();
}

function changeVid() {
  document.getElementById("mp4_src").src = "movie.mp4";
  document.getElementById("ogg_src").src = "movie.ogg";
  document.getElementById("myVideo").load();
}
</script>
<p>Video courtesy of <a href="https://www.bigbuckbunny.org/" target="_blank">Big Buck Bunny</a>. </p>
</body>
</html>
```



How it looks like ?



Video courtesy of [Big Buck Bunny](#).

LG webOS





application.json index.html css_FestHTML video.html Bunny.html

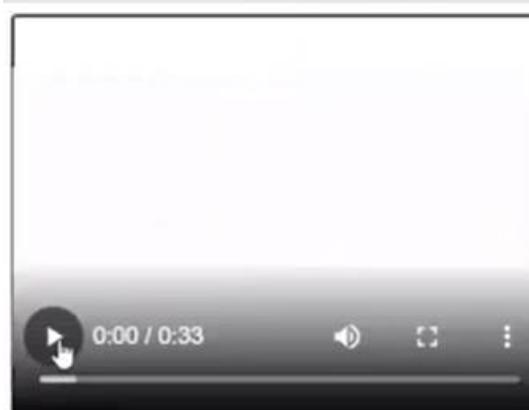
```
1 <!doctype html>
2 <html>
3 <title>Simple Video Page
4 </title>
5 <head></head>
6 <body>
7 <video width="320" height="240" controls>
8   <source src="http://media.w3.org/2010/05/bunny/trailer.mp4" type="video/mp4">
9
10 Your browser does not support the video tag.
11 </video>
12 </body>
13 </html>
14
15
```

I



Type here to search





WYSIWYG

Play Video | Pause Video
Change Video



Video courtesy of [Big Buck Bunny](#).

Chrome Browser

Play Video | Pause Video
Change Video



Video courtesy of [Big Buck Bunny](#).

webOS

LG webOS



Let's Try – (Today's Assignment)

Video Player to play the url:

<http://media.w3.org/2010/05/bunny/trailer.mp4>

<https://media.w3.org/2010/05/sintel/trailer.mp4>

any video from local disk

```
<!doctype html>
<html>
  <head>
    <title>Simple Movie Player</title>
  </head>
  <body>

  </body>
</html>
```



```
1 <!DOCTYPE html>
2 <html>
3 <body>
4
5   <button onclick="playVid()" type="button">Play Video</button>
6   <button onclick="pauseVid()" type="button">Pause Video</button><br>
7   <button onclick="changeVid()" type="button">Change Video</button><br>
8
9   <video id="myVideo" width="640" height="480">
10    <source id="mp4_src" src="http://media.w3.org/2010/05/bunny/trailer.mp4" type="video/mp4">
11    <source id="mp4_src" src="https://media.w3.org/2010/05/sintel/trailer.mp4" type="video/mp4">
12    Your browser does not support HTML5 video.
13  </video>
14
15 <script>
16   var vid = document.getElementById("myVideo");
17
18   function playVid() {
19     vid.play();
20   }
21
22   function pauseVid() {
23     vid.pause();
24   }
25
26   function changeVid() {
27     document.getElementById("mp4_src").src = "http://media.w3.org/2010/05/bunny/trailer.mp4";
28     document.getElementById("mp4_src").src = "https://media.w3.org/2010/05/sintel/trailer.mp4";
29     document.getElementById("myVideo").load();
30   }
31 </script>
32 <p>Video courtesy of <a href="https://www.bigbuckbunny.org/" target="_blank">Big Buck Bunny</a>.</p>
33 </body>
34 </html>
```

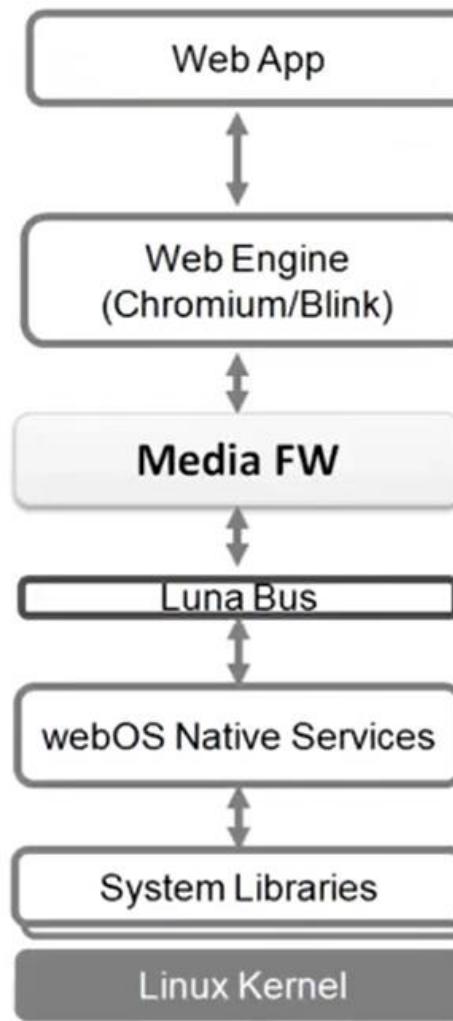
Play Video Pause Video

Change Video

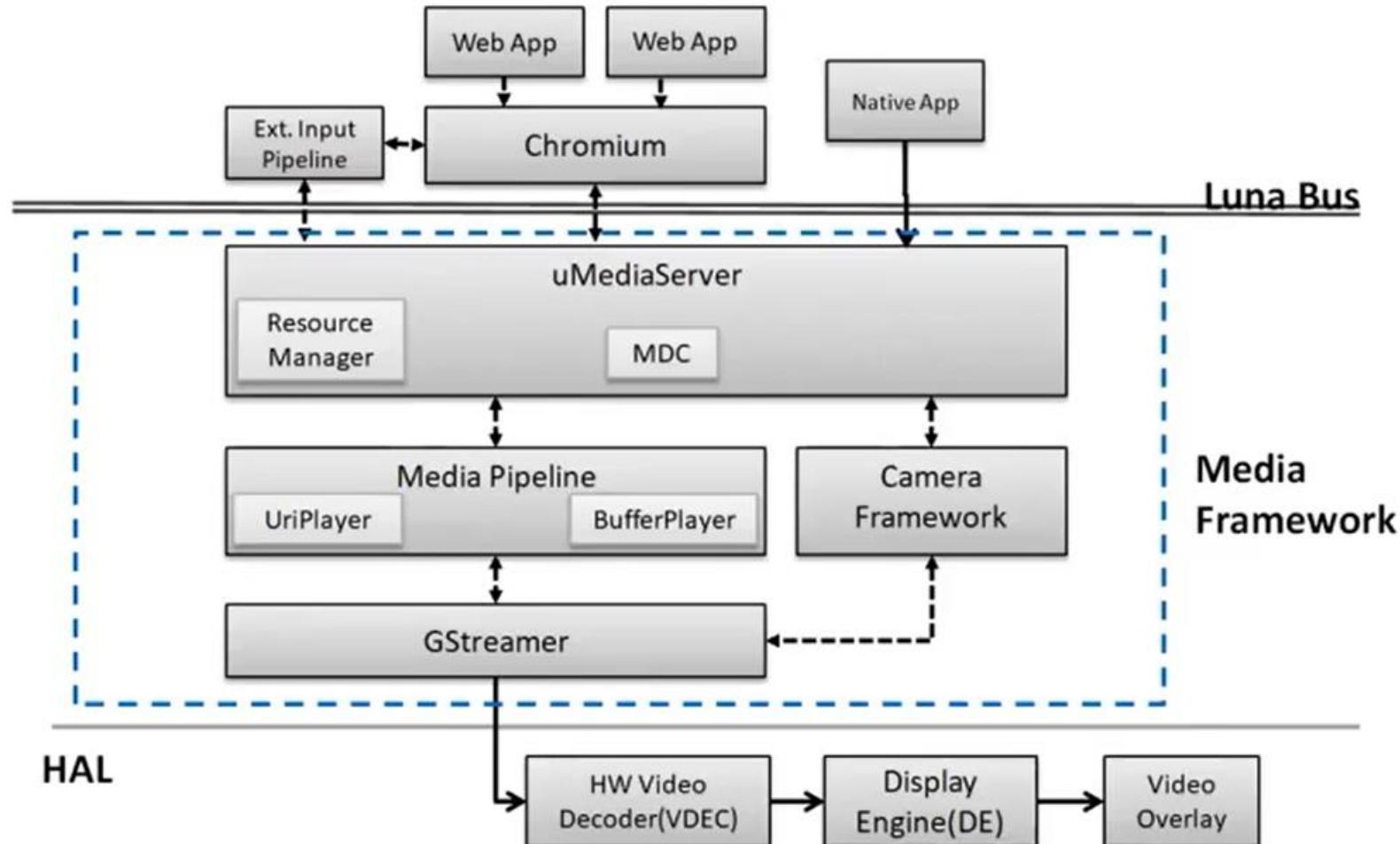


Video courtesy of [Big Buck Bunny](#).

Basic webOS media flow



webOS Media Framework



*MDC – Media Display Controller

LG webOS



gstreamer.freedesktop.org/documentation/tutorials/basic/dynamic-pipelines.html?gi-language=c

API References Application manual Tutorials Language ▾

Basic tutorial 3: Dynamic pipelines

Basic tutorial 4: Time management

Basic tutorial 5: GUI toolkit integration

Basic tutorial 6: Media formats and Pad Capabilities

Basic tutorial 7: Multithreading and Pad Availability

Basic tutorial 8: Short-cutting the pipeline

Basic tutorial 9: Media information gathering

Basic tutorial 10: GStreamer tools

Basic tutorial 11: Debugging tools

Basic tutorial 12: Streaming

Basic tutorial 13: Playback speed

Basic tutorial 14: Handy elements

Basic tutorial 16: Platform-specific elements

Search Q

In this example we are opening a file which is multiplexed (or *muxed*), this is, audio and video are stored together inside a *container* file. The elements responsible for opening such containers are called *demuxers*, and some examples of container formats are Matroska (MKV), Quick Time (QT, MOV), Ogg, or Advanced Systems Format (ASF, WMV, WMA).

If a container embeds multiple streams (one video and two audio tracks, for example), the demuxer will separate them and expose them through different output ports. In this way, different branches can be created in the pipeline, dealing with different types of data.

The ports through which GStreamer elements communicate with each other are called pads (`GstPad`). There exists sink pads, through which data enters an element, and source pads, through which data exits an element. It follows naturally that source elements only contain source pads, sink elements only contain sink pads, and filter elements contain both.

source element

filter

sink element

Goal

Introduction

Dynamic Hello World

Walkthrough

Exercise

Conclusion

Figure 1. GStreamer elements with their pads.

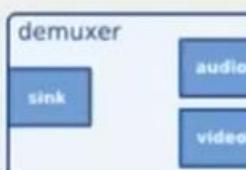
A demuxer contains one sink pad, through which the muxed data arrives, and multiple source pads, one for each stream found in the container.

Type here to search

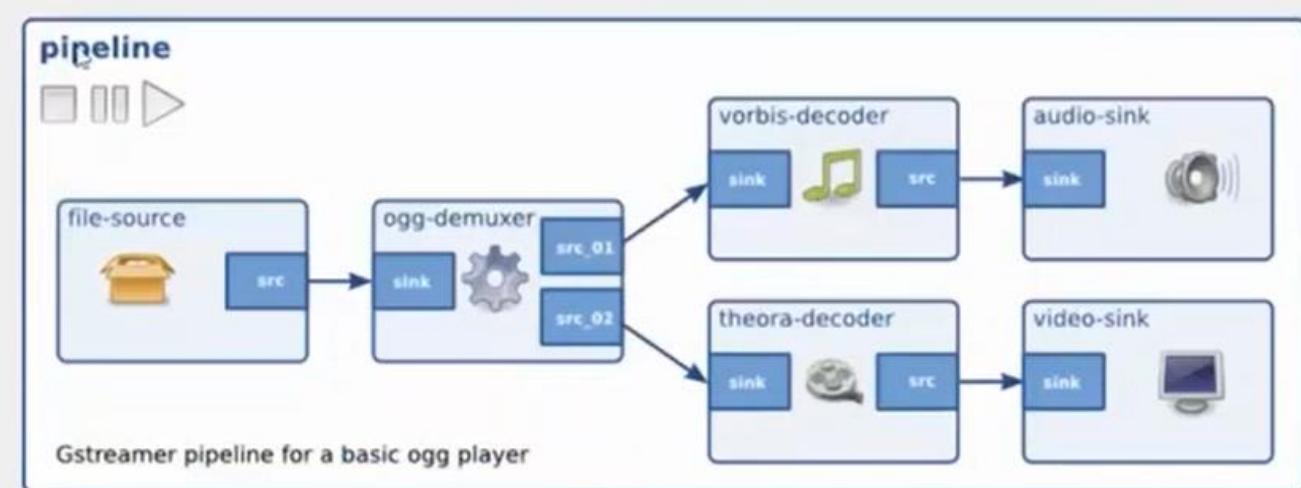
11:33 AM 01-Aug-20

Basic tutorial 3: Dynamic pipelines[Basic tutorial 4: Time management](#)[Basic tutorial 5: GUI toolkit integration](#)[Basic tutorial 6: Media formats and Pad Capabilities](#)[Basic tutorial 7: Multithreading and Pad Availability](#)[Basic tutorial 8: Short-cutting the pipeline](#)[Basic tutorial 9: Media information gathering](#)[Basic tutorial 10: GStreamer tools](#)[Basic tutorial 11: Debugging tools](#)[Basic tutorial 12: Streaming](#)[Basic tutorial 13: Playback speed](#)[Basic tutorial 14: Handy elements](#)[Basic tutorial 16: Platform-specific elements](#)

FOUND IN THE CONTAINER.

[Edit on GitLab](#)**Figure 2.** A demuxer with two source pads.

For completeness, here you have a simplified pipeline containing a demuxer and two branches, one for audio and one for video. This is **NOT** the pipeline that will be built in this example:

**Figure 3.** Example pipeline with two branches.

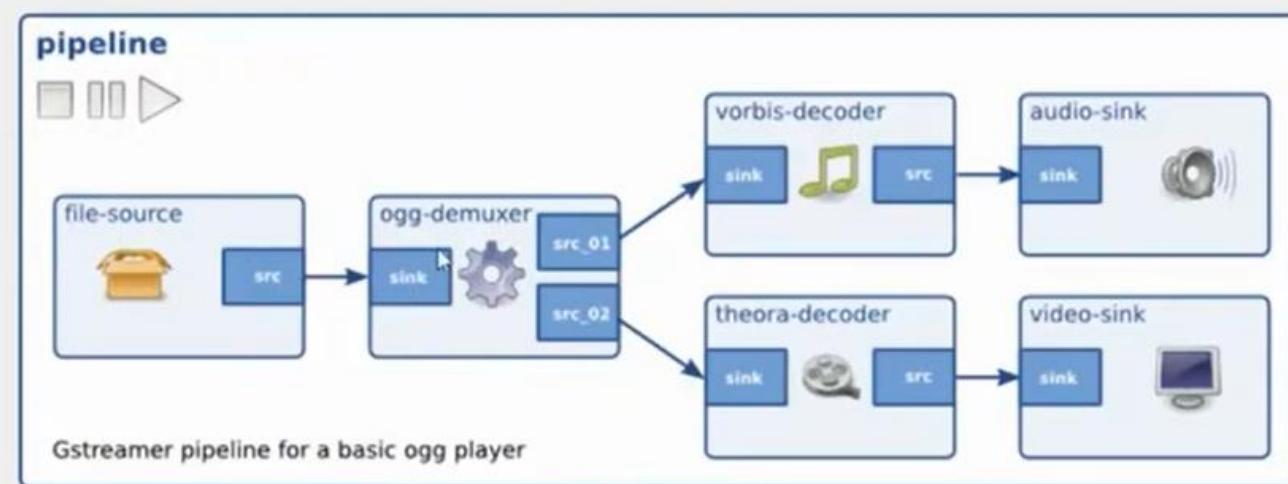
The main complexity when dealing with demuxers is that they cannot produce any information until they have received some data and have had a chance to look at the container to see what is inside. This is, demuxers start with no source pads to which other elements can link, and thus the pipeline must necessarily terminate at them.

The solution is to build the pipeline from the source down to the demuxer, and set it to run (play). When the demuxer has received enough information to know about the number and kind of streams in the container, it will start creating source pads. This is the right time for us to finish building the pipeline and attach it to the newly added demuxer pads.

Goal**Introduction**[Dynamic Hello World](#)[Walkthrough](#)[Exercise](#)[Conclusion](#)

Basic tutorial 3: Dynamic pipelines[Edit on GitLab](#)[Basic tutorial 4: Time management](#)[Goal](#)[Basic tutorial 5: GUI toolkit integration](#)[Introduction](#)[Basic tutorial 6: Media formats and Pad Capabilities](#)[Dynamic Hello World](#)[Basic tutorial 7: Multithreading and Pad Availability](#)[Walkthrough](#)[Basic tutorial 8: Short-cutting the pipeline](#)[Exercise](#)[Basic tutorial 9: Media information gathering](#)[Conclusion](#)[Basic tutorial 10: GStreamer tools](#)**Figure 2.** A demuxer with two source pads.

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The solution is to build the pipeline from the source down to the demuxer, and set it to run (play). When the demuxer has received enough information to know about the number and kind of streams in the container, it will start creating source pads. This is the right time for us to finish building the pipeline and attach it to the newly added demuxer pads.

For simplicity, in this example, we will only link to the audio pad and ignore the video.

[Search](#)[Goal](#)[Introduction](#)[Dynamic Hello World](#)[Walkthrough](#)[Exercise](#)[Conclusion](#)

Dynamic Hello World

webOS media service (com.webos.media)

- **com.webos.media**

A webos service that provides **high-level methods** to

- control the playback of media content.
- to manage the underlined system resources for media playback
- Provided by uMediaServer

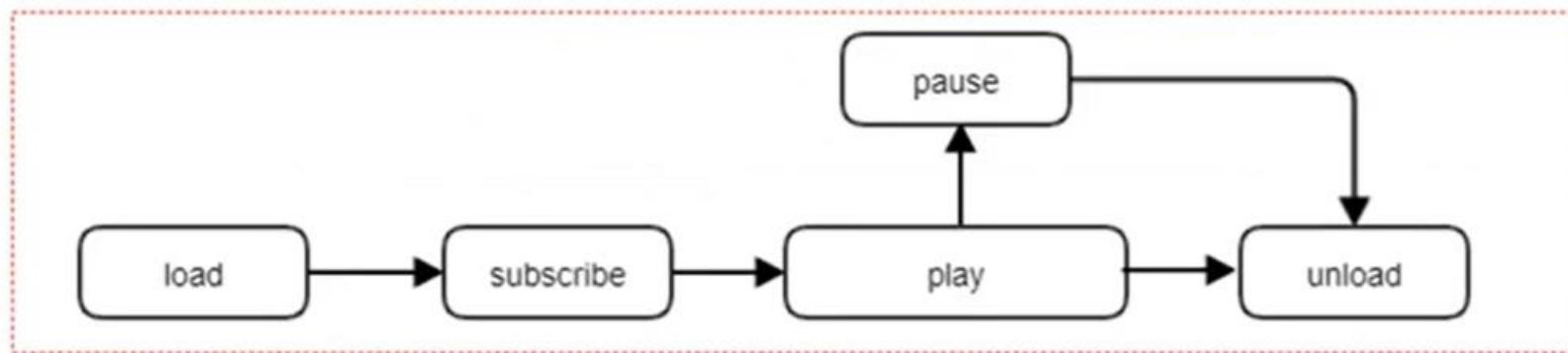
- **Basic API:**

- load()
- subscribe()
- play()
- pause()
- unload() etc.

- <https://www.webosose.org/docs/reference/lis2-api/com-webos-media/>



media API flow



Sample API call

```
luna-send -n 1 -f luna://com.webos.media/load
'{
  "uri": "https://media.w3.org/2010/05/sintel/trailer.mp4",
  "type": "media",
  "payload": {
    "option": {
      "appId": "com.webos.app.mytestapp",
      "display-path": 0
    }
  }
}'
```

Response:

```
{
  "errorCode":0,
  "returnValue":true,
  "errorText":"No Error",
  "mediaId":"_Pvzj2FRn42sL99"
}
```



Reference

LS2 API Reference ^

- [LS2 API Index](#)
- [com.webos.appInstallService](#)
- [com.webos.bootManager](#)
- [com.webos.media](#)
- [com.webos.notification](#)
- [com.webos.pmlogd](#)
- [com.webos.rxd](#)
- [com.webos.service.activitymanager](#)
- [com.webos.service.ai.voice](#)
- [com.webos.service.alarm](#)
- [com.webos.service.applicationmanager](#)
- [com.webos.service.audio](#)
- [com.webos.service.audiooutput](#)
- [com.webos.service.avoutput](#)
- [com.webos.service.bluetooth2](#)
- [com.webos.service.camera2](#)
- [com.webos.service.config](#)

the media interfaces native to a particular application framework (e.g. Web, QT, SDL/NDL) should be used.

Overview of the API

See [Summary](#).

Methods

load

Description

Loads a new pipeline for the specified URI. The media server returns a unique id to the client which is used for subsequent operations on the pipeline.

Parameters

Name	Required	Type	Description
uri	Required	String	Indicates the uri of the media object. Example: <code>http://mymovie.mp4</code> , <code>file://mymovie.mp4</code>
type	Required	String	Indicates the type of pipeline to load.

Note:

Contents

API Summary

Overview of the API

Methods

load

unload

notifyForeground

notifyBackground

subscribe

attach

play

pause

seek

registerPipeline

unregisterPipeline

acquire

tryAcquire

release

notifyActivity

trackAppProcesses

unsubscribe

getActivePipelines

setVolume

getForegroundAppInfo

setPlayRate



Reference**LS2 API Reference**

LS2 API Index

com.webos.appInstallService

com.webos.bootManager

com.webos.media

com.webos.notification

com.webos.pmlogd

com.webos.rxd

com.webos.service.activitymanager

com.webos.service.ai.voice

com.webos.service.alarm

com.webos.service.applicationmanager

com.webos.service.audio

com.webos.service.audiooutput

com.webos.service.avoutput

com.webos.service.bluetooth

2

com.webos.service.camera2

com.webos.service.config

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Search



mediaId	Optional	String	Indicates the unique identifier of the loaded media/camera pipeline which is used for subsequent operations.
---------	----------	--------	--

Example

```
# luna-send -n 1 -f luna://com.webos.media/load '{
    "uri": "https://media.w3.org/2010/05/sintel/trailer.mp4",
    "type": "media",
    "payload": {
        "option": {
            "appId": "com.webos.app.enactbrowser",
            "windowId": "_Window_Id_2"
        }
    }
}'
```

Response:

```
{
    "errorCode": 0,
    "returnValue": true,
    "errorText": "No Error",
    "mediaId": "_Pvzj2FRn42sL99"
}
```

```
# luna-send -n 1 luna://com.webos.media/load '{
    "uri": "camera://com.webos.service.camera2/7010",
    "payload": {
        "option": {
            "cameraId": "7010"
        }
    }
}'
```

Contents[API Summary](#)[Overview of the API](#)**Methods**[load](#)[unload](#)[notifyForeground](#)[notifyBackground](#)[subscribe](#)[attach](#)[play](#)[pause](#)[seek](#)[registerPipeline](#)[unregisterPipeline](#)[acquire](#)[tryAcquire](#)[release](#)[notifyActivity](#)[trackAppProcesses](#)[unsubscribe](#)[getActivePipelines](#)[setVolume](#)[getForegroundAppInfo](#)[setPlayRate](#)

Media Source Extension (MSE)

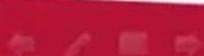
- Provides functionality enabling plugin-free web-based streaming media.
- Using MSE, media streams can be created via JavaScript, and played using `<audio>` and `<video>` elements.
- finer control over how much and how often content is fetched
- some control over memory usage details, such as when buffers are evicted.
- DASH and HLS protocols

Find the difference ?



DASH

- DASH - Dynamic Adaptive Streaming over HTTP
 - DASH is a protocol for specifying how adaptive content should be fetched. It is effectively a layer built on top of MSE for building adaptive bitrate streaming clients.
 - On Demand Video services.
 - Live video – not so efficient in terms of latency.



HLS

- HTTP Live Streaming (HLS)
 - to send audio and video over HTTP from an ordinary web server
 - HLS is designed for reliability and dynamically adapts to network conditions by optimizing playback for the available speed of wired and wireless connections.
- Features:
 - Live broadcasts and prerecorded content (video on demand, or *VOD*)
 - Multiple alternate streams at different bit rates
 - Intelligent switching of streams w.r.to network bandwidth changes
 - Media encryption and user authentication

DAY9-1

Internet of Things

Agenda

- What is Internet of Things (IoT) ?
- How IoT works ?
- Major Components of IoT.
- Applications of IoT
- Open Source IoT stacks.
- IoT using webOS.
- Why Gateway?
- Future Scope

What Exactly is IoT ?

- The Internet of Things (IoT) is the network of physical objects or "things" embedded with
 - Electronics,
 - Software,
 - Sensors & Actuators,
 - Network Connectivity
- Enables these objects to collect and exchange data. IoT allows objects to be sensed and controlled remotely across existing network infrastructure.
- Interconnection of Things or Objects or Machines, e.g., sensors, actuators, mobile phones, electronic devices, home appliances, any existing items.

IoT Platform Requirements

Top 5 platform requirements

- 1] security
- 2] reliability
- 3] scalability
- 4] flexibility
- 5] simplicity

How IoT works?

- Data is collected through an IoT device, including temperature, pressure, position, motion, and other measures.
- The data is transmitted via WiFi/cellular/RFID/Bluetooth technologies.
- The data is sent to applications running in the cloud or traditional architecture
- Analysis is performed by software using rules or algorithms.
- Instructions are then executed by machines (Internet Bot), including connection with customers or the workforce via apps, text, or email.



Sensors

Collecting data



Connectivity

Sending data to cloud



Data Processing

Making data useful

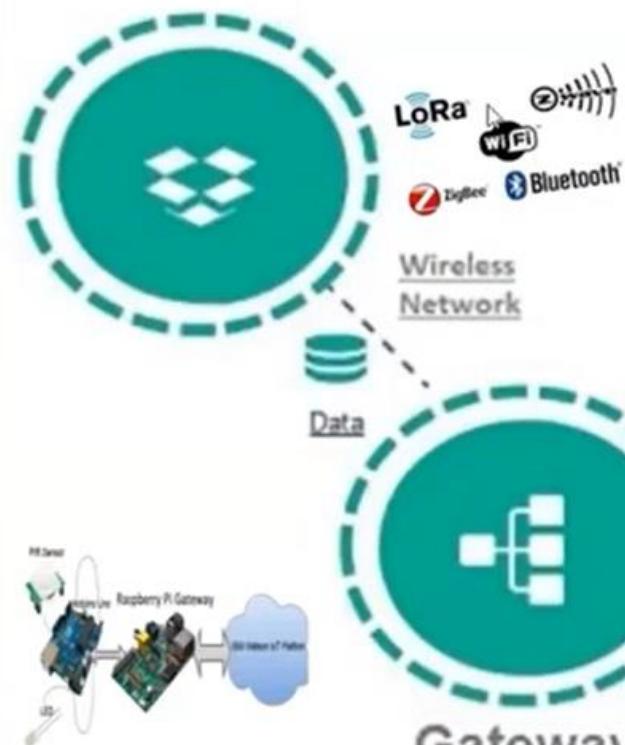


User Interface

Delivering information to user

Major Components of IoT

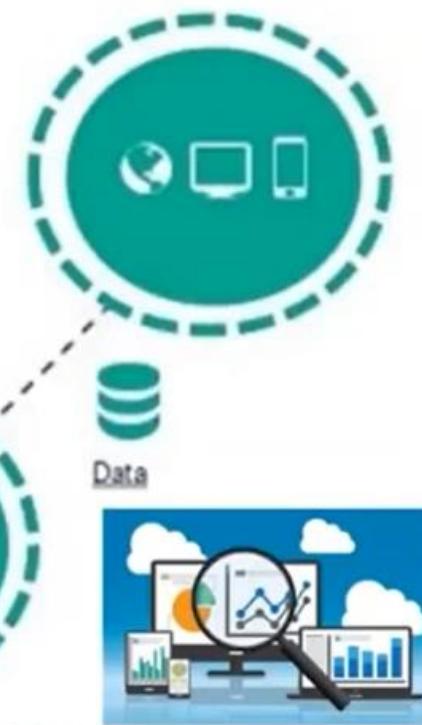
Thing
or Device



Cloud



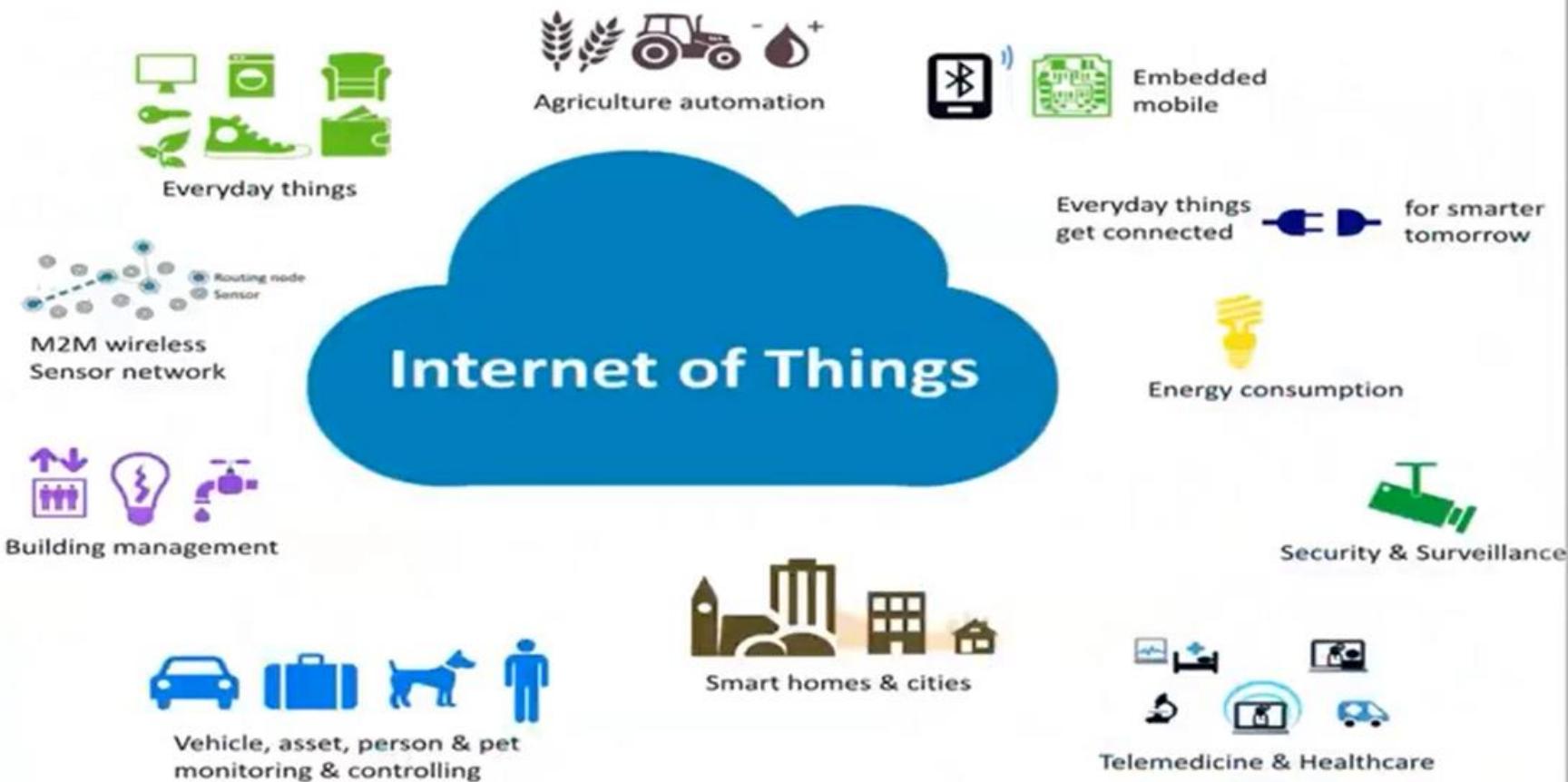
User Interface



Gateway



Applications of IoT



IoT Smart Home

- **Smart Home Appliances:** Refrigerators with LCD screen telling what's inside, food that's about to expire, ingredients you need to buy and with all the information available on a Smartphone app. Washing machines allowing you to monitor the laundry remotely, and. Kitchen ranges with interface to a Smartphone app allowing remotely adjustable temperature control and monitoring the oven's self-cleaning feature.

IoT Smart Cities

Transportation: Smart Roads and Intelligent High-ways with warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams,

Smart Parking: Real-time monitoring of parking spaces availability in the city making residents able to identify and reserve the closest available spaces,

IoT Smart Health

Patients Surveillance: Monitoring of conditions of patients inside hospitals and in old people's home, Medical Fridges: Control of conditions inside freezers storing vaccines, medicines and organic elements,

Fall Detection: Assistance for elderly or disabled people living independent

Dental: Bluetooth connected toothbrush with Smartphone app analyzes the brushing uses and gives information on the brushing habits on the Smartphone for private information or for showing statistics to the dentist.

Open Source IoT stacks



IoTivity

Smart home interoperability



PREDIX



OPEN IoT



Node-RED

openthread
released by Nest

Application



Transport

THREAD

Networking Stack

Network

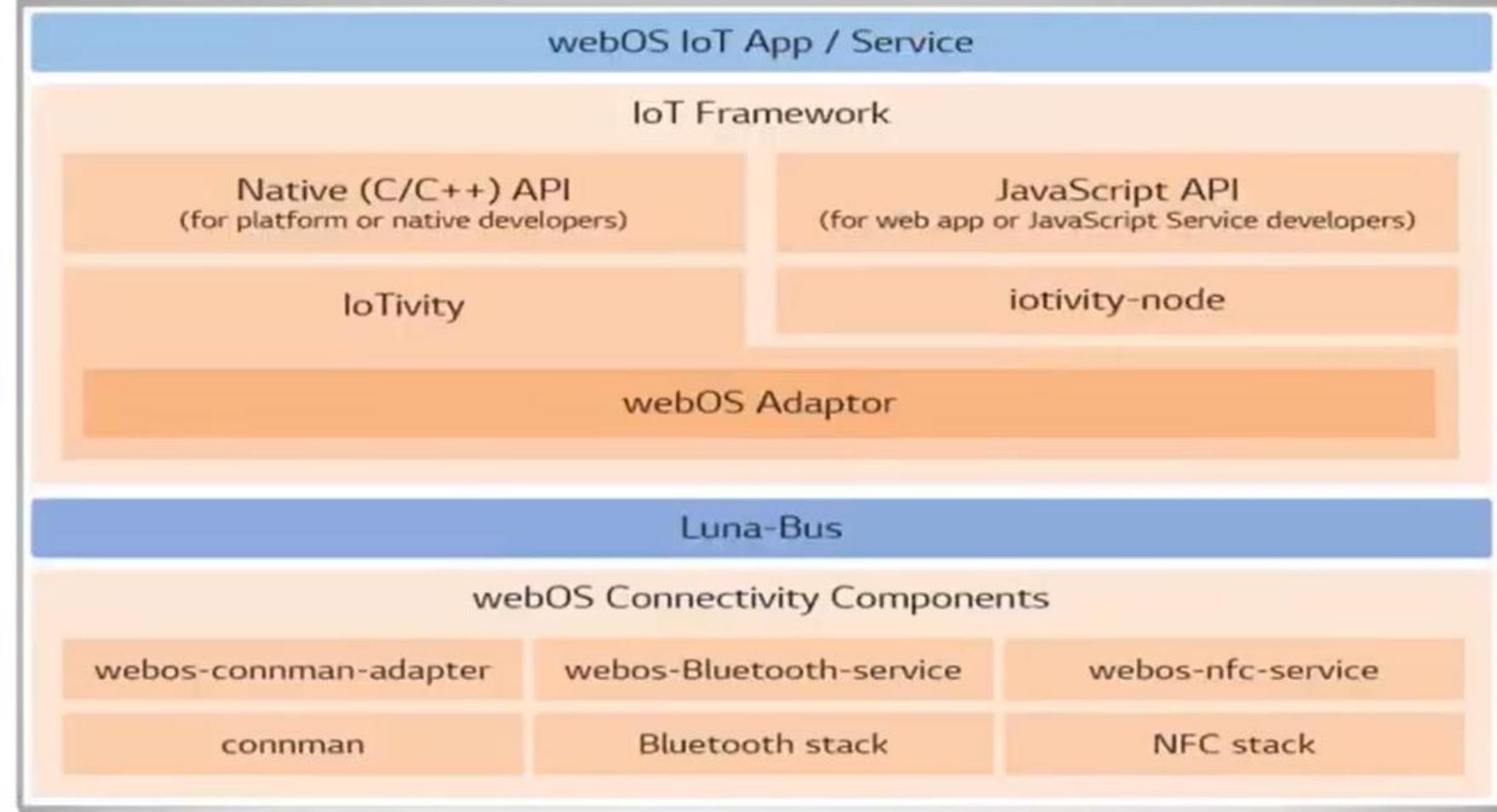
MAC

IEEE 802.15.4

PHY

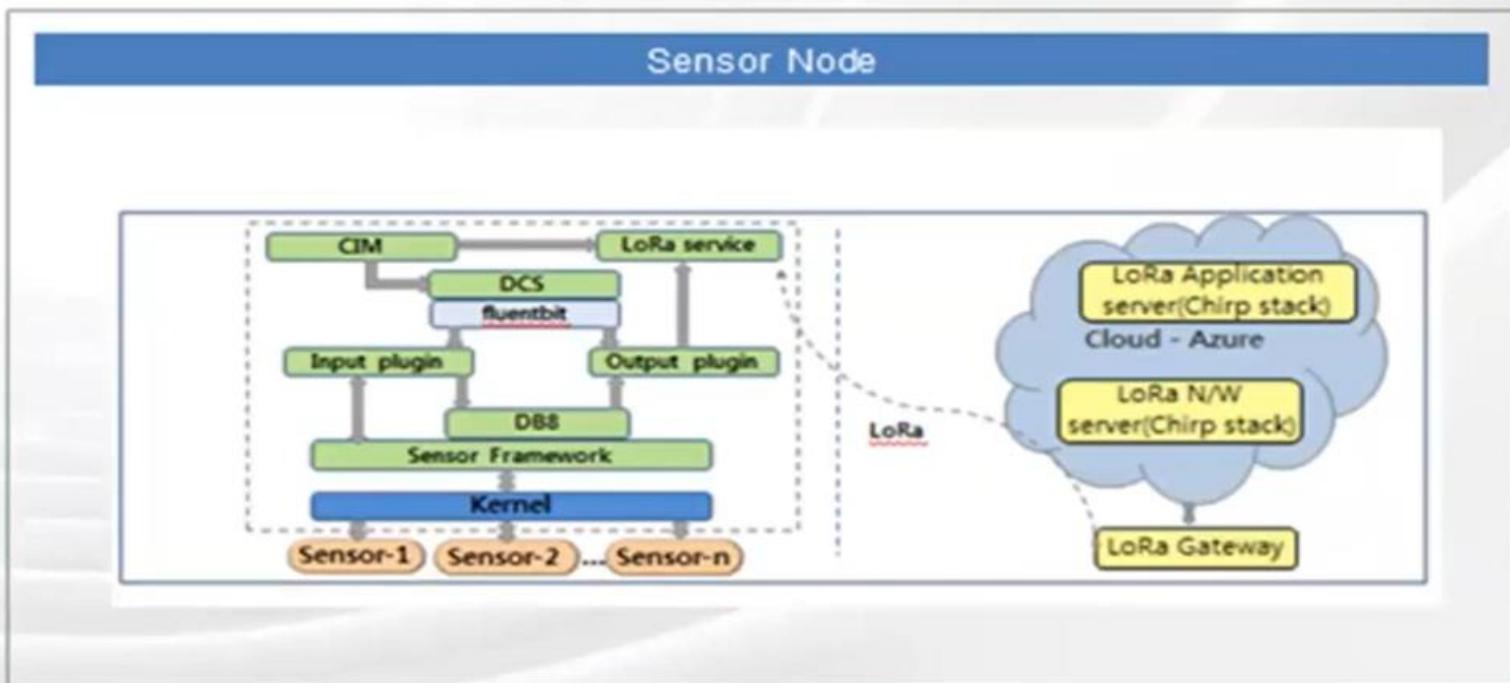
MAC/PHY

IoT using webOS

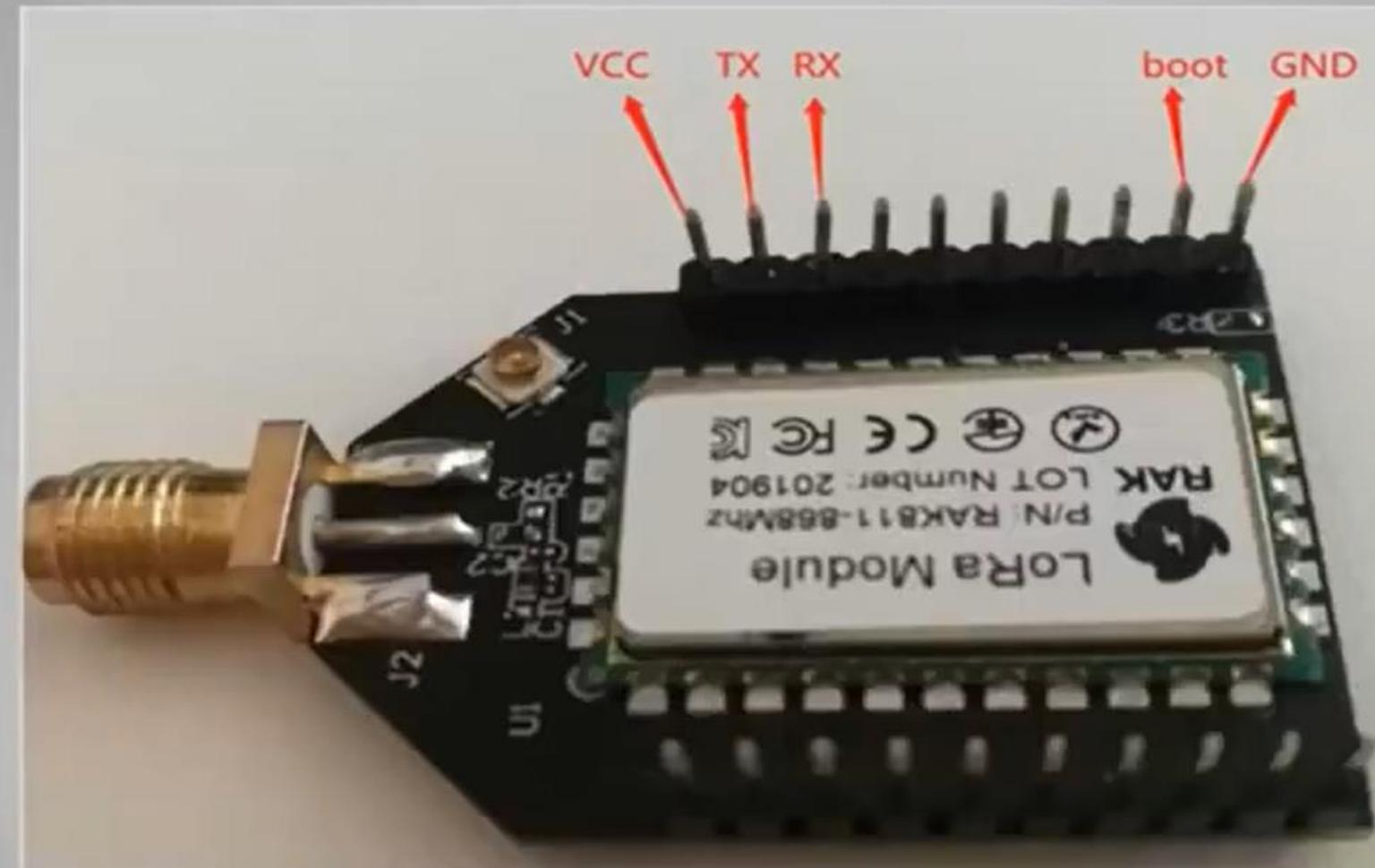


Present Architecture

Case study



LoRa Setup



Device Registration

ChirpStack Application Server

<http://52.172.55.77:8080/#/organizations/1/applications>

Set Device EUI

- luna-send -n 1 -f luna://com.webos.service.loramodule/lora/setdevEUI '{ "value" : "<device_eui>" }'
Ex:- **luna-send -n 1 -f luna://com.webos.service.loramodule/lora/setdevEUI
'{"value":"b7c9e27d3035cdb5"}'**

Set Application EUI

- luna-send -n 1 -f luna://com.webos.service.loramodule/lora/setappEUI '{ "value" : "<app_eui>" }'
Ex:- **luna-send -n 1 -f luna://com.webos.service.loramodule/lora/setappEUI
'{"value":"1ffbdb6126dac748b561e78d3328bd89"}'**

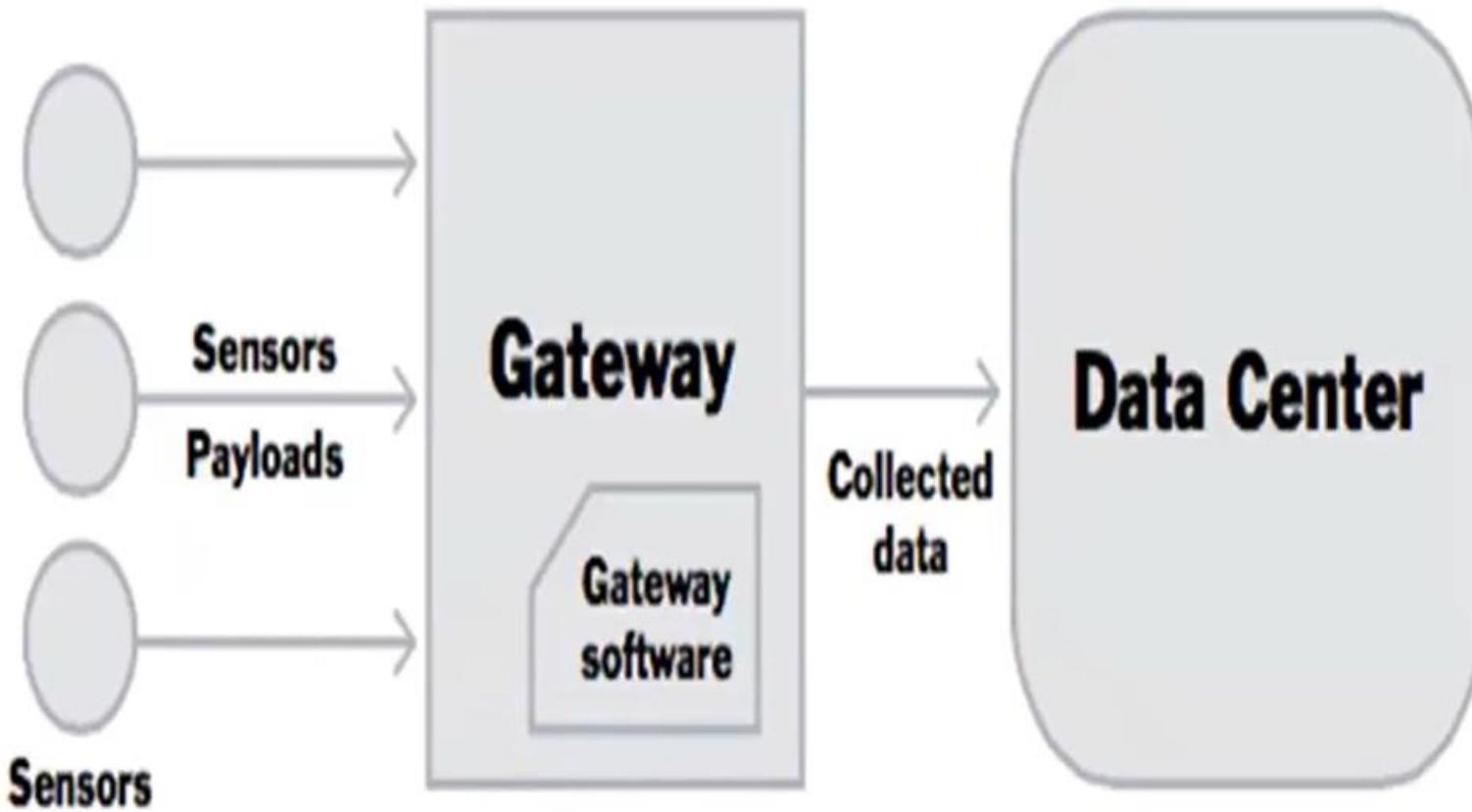
Set Application Key

- luna-send -n 1 -f luna://com.webos.service.loramodule/lora/setappkey '{ "value" : "<app_key>" }'
Ex:- **luna-send -n 1 -f luna://com.webos.service.loramodule/lora/setappkey
'{"value":"2B7E151628AED2A6ABF7158809CF4F3C"}'**

Actual Data can be seen below link

<https://lorawiz.azurewebsites.net/>

IoT Gateway & it's Need

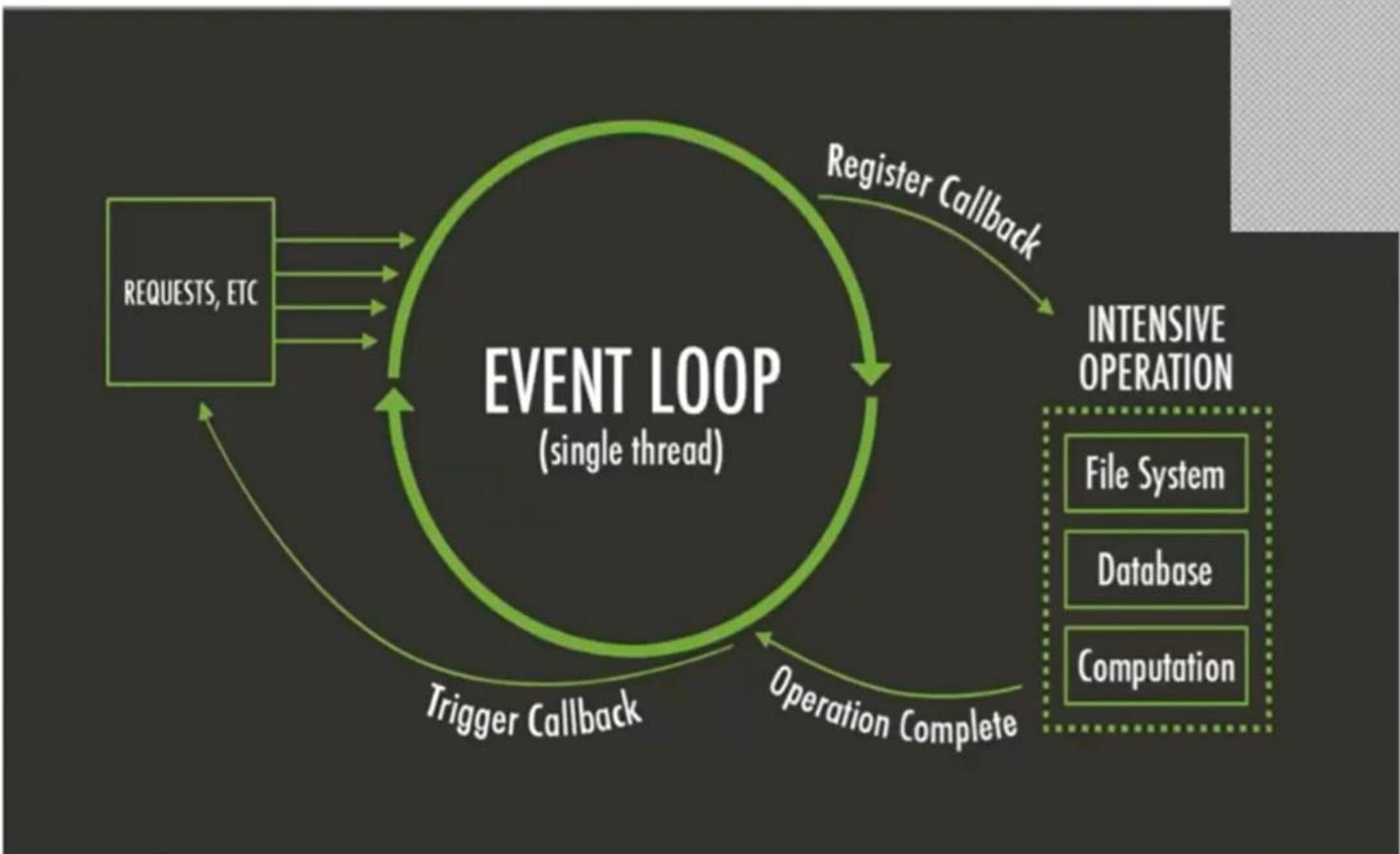


Thank You

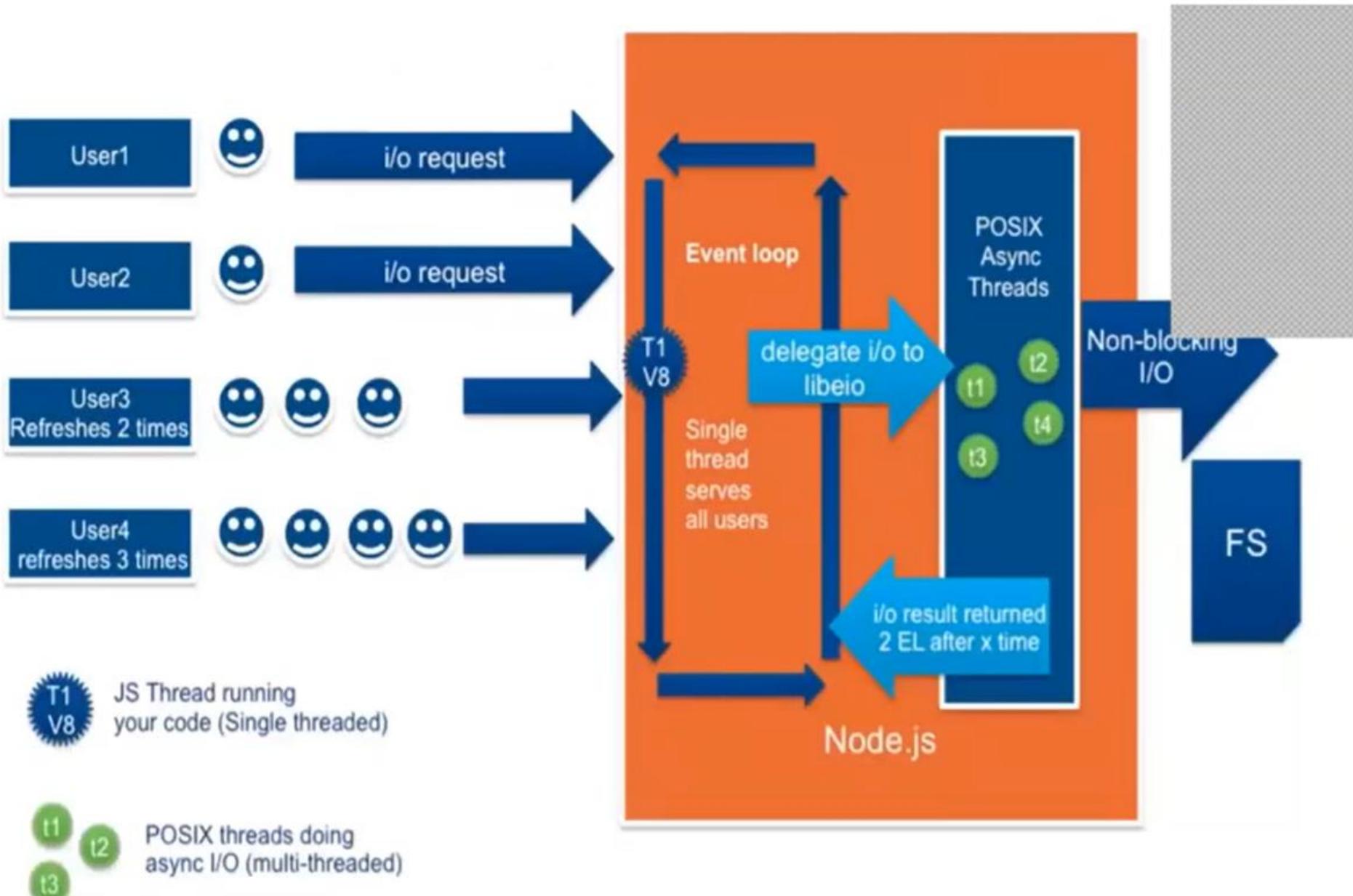
DAY9-2

Nodejs Event Loop

Node is primarily made up of JavaScript and the event loop.



Nodejs Architecture



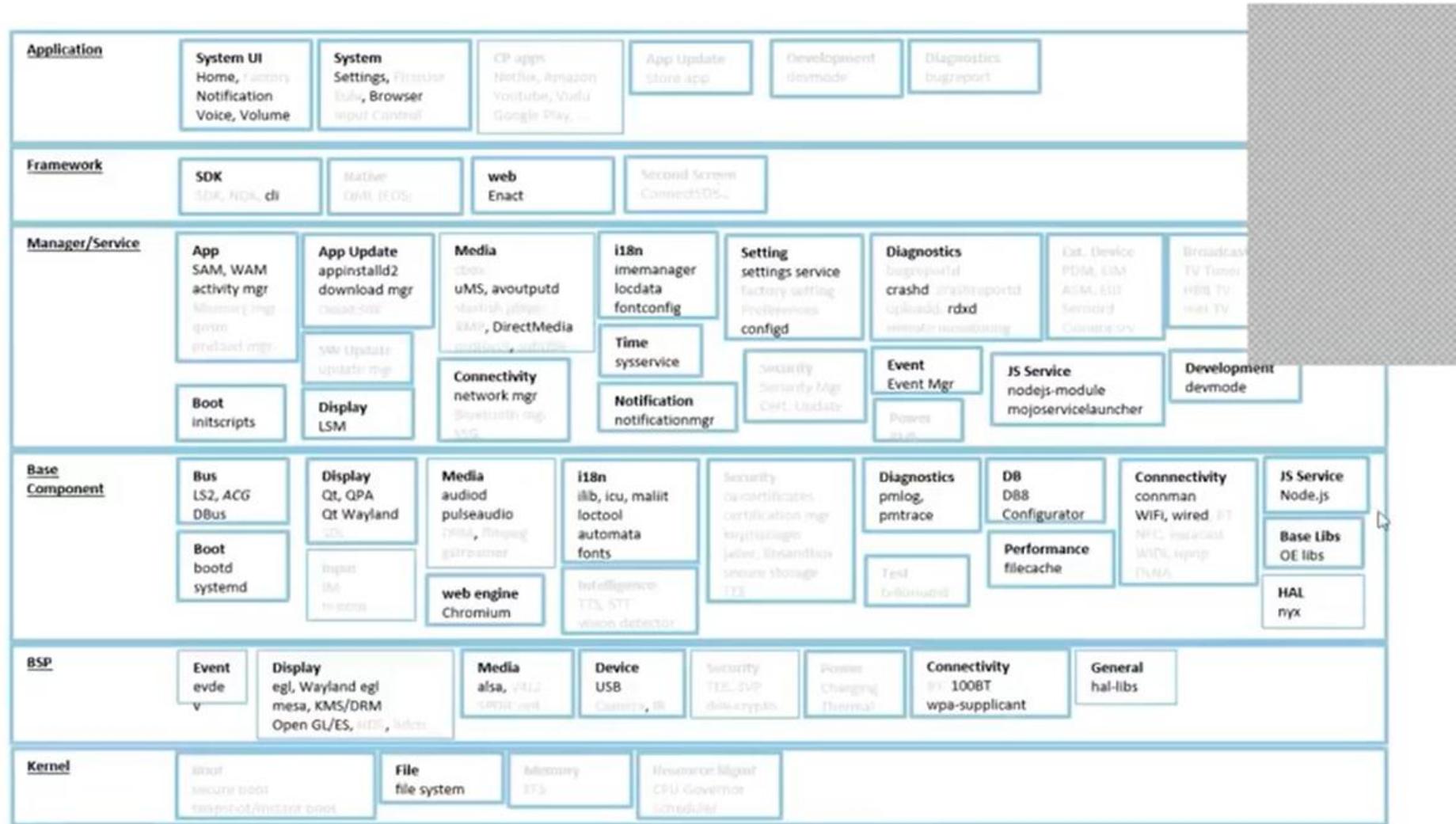
What can we build with NodeJS ?

- REST APIs and Backend Applications
- Real-Time services (Chat, Games etc)
- Blogs, CMS, Social Applications.
- Utilities and Tools
- Anything that is not CPU intensive.

Download & Install nodejs

<https://nodejs.org/en/download/>

wek ure



webOS JS Service

- External JS Service
- Built-In JS Service

Creating JS Services

Developing an external JS service requires the following steps:

[Step 1: Create a JS Service](#)

[Step 2: Implement the JS Service](#)

[Step 3: Configure the JS Service](#)

[Step 4: Package the JS Service](#)

[Step 5: Install the JS Service](#)

[Step 6: Run the JS Service](#)

Step 1: Create a JS Service

Start by creating a JS service using the available JS service template.

To create a basic JS service, execute the following command:

```
$ ares-generate -t js_service sampleService
```

In the above command:

- js_service is the name of the template that creates a basic JS service.
- sampleService is the JS service directory which is created in the current directory.

The following shows an example directory structure of JS services packaged in a web app.

```
sampleService
├── helloclient.js
└── helloworld_webos_service.js
├── package.json
└── services.json
```

Activities Terminal

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Wed 09:52

christkengeri.webex.com/webappng/sites/christkengeri/meeting/download/0393680816f54ca0960d0277f7e6131c?MTID=m1dd2b311009569c...

Chat

Chat with All

MAHESH D S COMPUTER SCIENCE ... 09:51

is it based on Rasperipi

bm@bm-desktop:~

File Edit View Search Terminal Help

```
bm@bm-desktop:~$ source ~/.profile
bm@bm-desktop:~$ ares-generate -l
webapp      Web App          - (default) web app for webOS
hosted_webapp Web App        - hosted web app for webOS
webappinfo   Web App Info    - appinfo.json for web app
js_service   JS Service       - js service for webOS
jsserviceinfo JS Service Info - services.json, package.json for JS service
icon         Icon            - app icon files [80x80]
qmlapp      QML App          - QML app for webOS
qmlappinfo  QML App Info    - appinfo.json for QML app
```

bm@bm-desktop:~

PE

PRAVEE... (Host)

AM

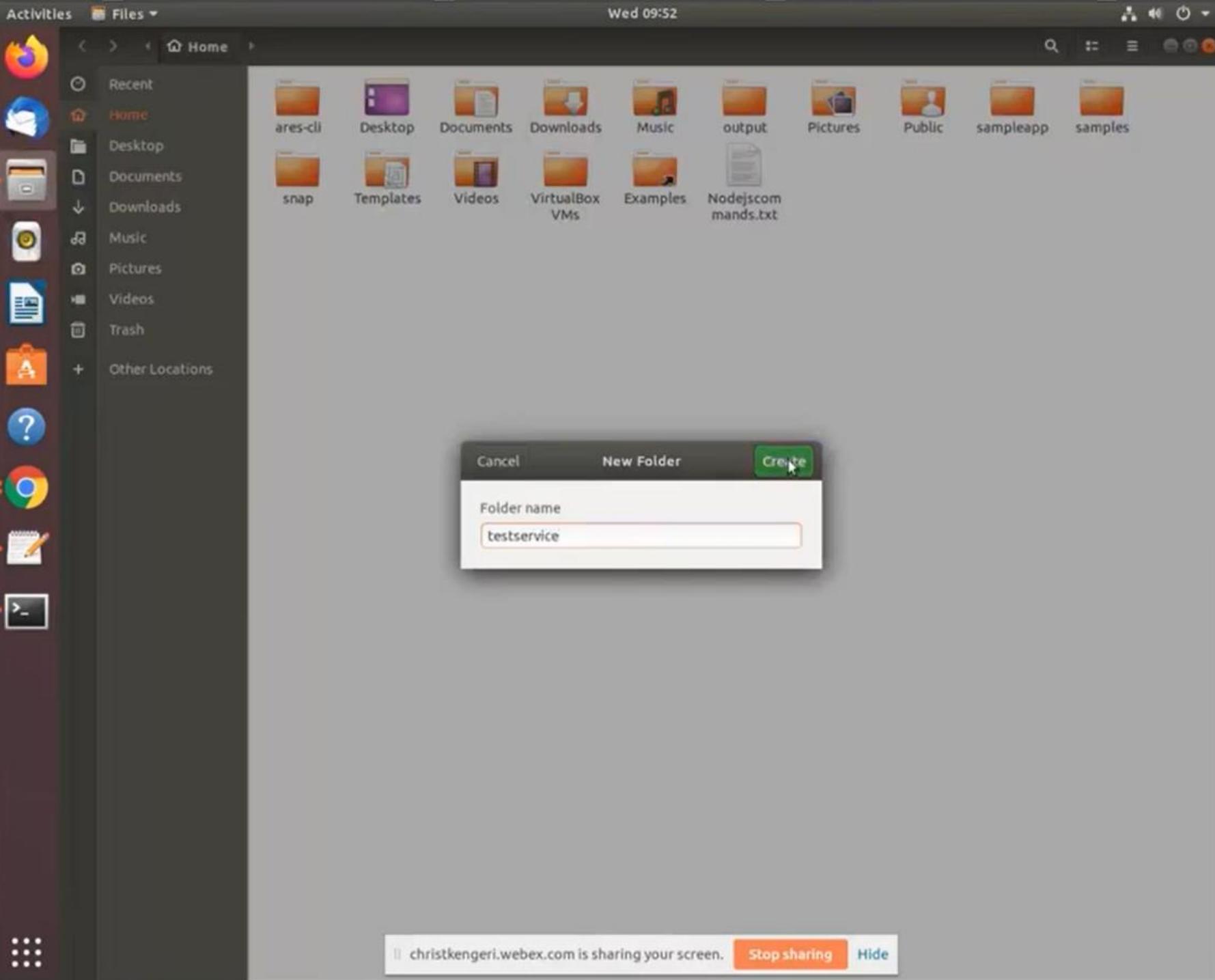
AT

Harsha

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Activities Terminal

Wed 09:53

Home

Recent

Home

Desktop

Documents

Downloads

Music

Picture

Videos

Trash

Other

Public

sampleapp

samples

File Edit View Search Terminal Help

```
bm@bm-desktop:~$ source ~/.profile
bm@bm-desktop:~$ ares-generate -l
    webapp      Web App          - (default) web app for webOS
    hosted_webapp Web App        - hosted web app for webOS
    webappinfo   Web App Info    - appinfo.json for web app
    js_service   JS Service      - js service for webOS
    jsserviceinfo JS Service Info - services.json, package.json for JS service
    icon         Icon            - app icon files [80x80]
    qmlapp      QML App          - QML app for webOS
    qmlappinfo  QML App Info    - appinfo.json for QML app
bm@bm-desktop:~$ ares-generate -t js_service -o /home/bm/testservice
? service id (com.domain.app.service)
```

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"testservice" selected (containing 0 items)

Activities Terminal Wed 09:53

< > Home >

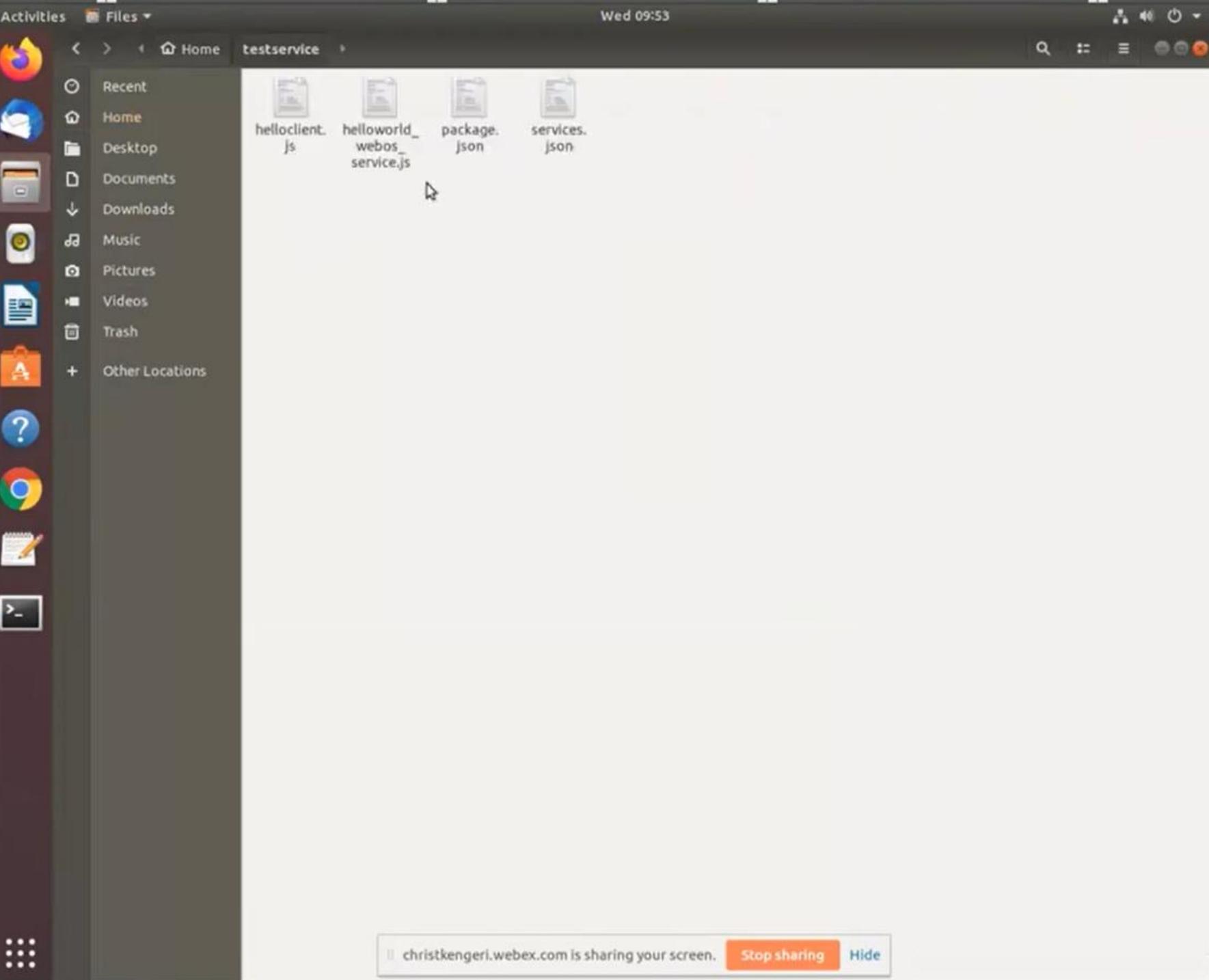
Recent Home Desktop Documents Downloads Music Pictures Videos Trash + Other

Public sampleapp samples

File Edit View Search Terminal Help

```
bm@bm-desktop:~$ source ~/.profile
bm@bm-desktop:~$ ares-generate -l
webapp      Web App          - (default) web app for webOS
hosted_webapp Web App        - hosted web app for webOS
webappinfo   Web App Info    - appinfo.json for web app
js_service   JS Service      - js service for webOS
jsserviceinfo JS Service Info - services.json, package.json for JS service
icon         Icon            - app icon files [80x80]
qmlapp      QML App          - QML app for webOS
qmlappinfo  QML App Info    - appinfo.json for QML app
bm@bm-desktop:~$ ares-generate -t js_service -o /home/bm/testservice
? service id com.domain.app.service
Generating js_service in /home/bm/testservice
Success
bm@bm-desktop:~$
```

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Activities Visual Studio Code ▾

Wed 09:55

package.json - testservice - Visual Studio Code

File Edit Selection View Go Run Terminal Help

EXPLORER

> OPEN EDITORS

TESTSERVICE

helloclient.js

helloworld_webos_service.js

(package.json

(services.json

(package.json X

(package.json > name

```
1  {
2    "name": "com.domain.app.service",
3    "version": "1.0.0",
4    "description": "Helloworld service",
5    "main": "helloworld_webos_service.js",
6    "scripts": {
7      "test": "echo \\\"Error: no test specified\\\" && exit 1"
8    },
9    "author": "",
10   "license": "BSD"
11 }
```

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0 0 0 (31 selected) Spaces: 2 UTF-8 LF JSON

Activities Visual Studio Code ▾

File Edit Selection View Go Run Terminal Help

EXPLORER OPEN EDITORS SAMPLESERVICE helloclient.js helloworld_webos_service.js package.json services.json

Wed 10:00 helloworld_webos_service.js - sampleservice - Visual Studio Code

```
168 });
169
170 service.register("pong", function(message) {
171     context.log(pmloglib.LOG_INFO, "SERVICE_METHOD_CALLED", {}, "" + pkgInfo);
172     console.log("Pong!");
173     console.log(message.payload);
174     message.respond({message: "Pong"});
175 });
176
177 service.register("/do/re/me", function(message) {
178     context.log(pmloglib.LOG_INFO, "SERVICE_METHOD_CALLED", {}, "" + pkgInfo);
179     message.respond({verses:[
180         {doe: "a deer, a female deer"},
181         {ray: "a drop of golden sun"},
182         {me: "a name I call myself"}
183     ]});
184 });
185
186 // list files
187
188 service.register("listfiles", function (message){
189     var path = ROOT+message.payload.path;
190     fs.readdir(path, function (err,files){
191         if (err){
192             message.respond({
193                 returnValue:false,
194                 errorCode: 'listFiles ERROR',
195                 errorText: err
196             });
197         }
198         else {
199             message.respond({
200                 returnValue: true,
201                 files: files
202             });
203         }
204     });
205 });
206 });
207
```

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Activities Terminal

Wed 10:04

< > Home output sampleapp

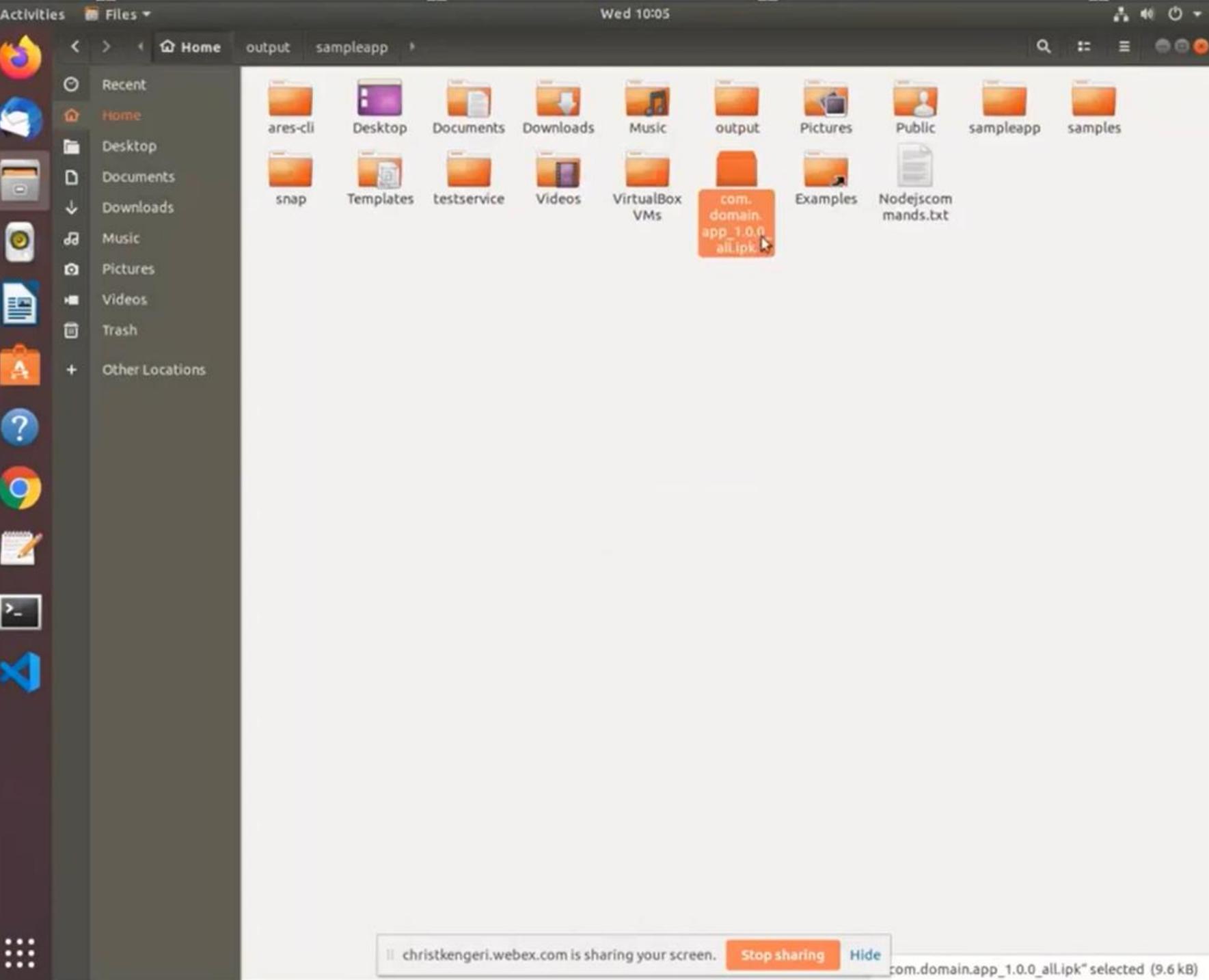
Recent Home Desktop Documents Downloads Music Pictures Videos Trash Other Locations

sampleapp sampleservice

```
bm@bm-desktop:~$ source ~/.profile
bm@bm-desktop:~$ ares-generate -l
webapp      Web App          - (default) web app for webOS
hosted_webapp Web App        - hosted web app for webOS
webappinfo   Web App Info    - appinfo.json for web app
js_service   JS Service      - js service for webOS
jsserviceinfo JS Service Info - services.json, package.json for JS service
icon         Icon            - app icon files [80x80]
qmlapp       QML App         - QML app for webOS
qmlappinfo   QML App Info    - appinfo.json for QML app

bm@bm-desktop:~$ ares-generate -t js_service -o /home/bm/testservice
? service id com.domain.app.service
Generating js_service in /home/bm/testservice
Success
bm@bm-desktop:~$ ares-package /home/bm/output/sampleapp /home/bm/output/sampleservice
Create com.domain.app_1.0.0_all.ipk to /home/bm
Success
bm@bm-desktop:~$
```

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Activities Terminal

Wed 10:05

Home output sampleapp

Recent Home Desktop Documents Downloads Music Pictures Public sampleapp samples

Desktop Documents Downloads Music Pictures Public sampleapp samples

Music Pictures Public sampleapp samples

Documents Downloads Music Pictures Public sampleapp samples

Downloads Music Pictures Public sampleapp samples

Music Pictures Public sampleapp samples

Public sampleapp samples

sampleapp samples

bm@bm-desktop:~

```
webapp      Web App          - (default) web app for webOS
hosted_webapp Web App        - hosted web app for webOS
webappinfo   Web App Info    - appinfo.json for web app
js_service   JS Service      - js service for webOS
jserviceinfo JS Service Info - services.json, package.json for JS service
icon         Icon            - app icon files [80x80]
qmlapp      QML App         - QML app for webOS
qmlappinfo  QML App Info    - appinfo.json for QML app

bm@bm-desktop:~$ ares-generate -t js_service -o /home/bm/testservice
? service id com.domain.app.service
Generating js_service in /home/bm/testservice
Success
bm@bm-desktop:~$ ares-package /home/bm/output/sampleapp /home/bm/output/sampleapp
Create com.domain.app_1.0.0_all.ipk to /home/bm
Success
bm@bm-desktop:~$ ares-setup-device -l
name           deviceInfo       connection profile
-----
raspberrypi4 (default) root@192.168.1.34:22 ssh      ose
emulator       developer@127.0.0.1:6622 ssh      ose

bm@bm-desktop:~$
```

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com.domain.app_1.0.0_all.ipk selected (9.6 kB)

Activities Terminal

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Wed 10:22

File Edit View Search Terminal Help

```
bm@bm-desktop:~$ ssh root@192.168.1.34
ssh: connect to host 192.168.1.34 port 22: No route to host
bm@bm-desktop:~$ ssh root@192.168.1.34
ssh: connect to host 192.168.1.34 port 22: No route to host
bm@bm-desktop:~$ ssh root@192.168.1.34
ssh: connect to host 192.168.1.34 port 22: No route to host
bm@bm-desktop:~$ ssh root@192.168.1.33
The authenticity of host '192.168.1.33 (192.168.1.33)' can't be established.
RSA key fingerprint is SHA256:5uJRKd509GwYQ2WZC2rlUMkBLEI2V99/FPPN8tlBcLk.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.33' (RSA) to the list of known hosts.
root@raspberrypi4:/sysroot/home/root#
```

123.45.67

device

device

CLI Workflow

Contents

- Key Features
- System Requirements
- Installing CLI
 - Download the Package
 - Unzip the Package
 - Set the Path
- CLI Commands
 - ares-generate
 - ares-package
 - ares-setup-device
 - ares-install
 - ares-launch
 - ares-inspect
 - ares-server
 - ares-shell
 - ares-push
 - ares-pull

bm@bm-desktop:~

File Edit View Search Terminal Help

```
bm@bm-desktop:~$ ares-setup-device --add target -l "host=192.168.1.33"
name          deviceinfo      connection profile
-----  -----
raspberrypi4 (default)  root@192.168.1.34:22  ssh      ose
target        root@192.168.1.33:22  ssh      ose
emulator      developer@127.0.0.1:6622  ssh      ose
```

bm@bm-desktop:~

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2 Set default? Yes

Activities Terminal ▾

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wed 10:23

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2 Set default? Yes

← → C 🔍 webosose.org/docs/tools/sdk/cli/cli-user-guide/#ares-setup-device

star 🌟 person ⚙️

webOS

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SDK

- SDK Download
- Command-Line Interface
- User Guide

Release Notes

Emulator

Beanviser

Workflow Designer

LS2 Commands

luna-send

Guide

ls-monitor

Guide

]

- Adding the target device as a default device (target device name: target , host address: 10.123.45.67 , port number: 22 , user: root)

```
ares-setup-device --add target -i "host=10.123.45.67
```
- Adding the target device with JSON format (target device name: target , host address: 10.123.45.67 , port number: 22 , user: root)

```
ares-setup-device --add target -i "host=10.123.45.67"
```

bm@bm-desktop:~

```
File Edit View Search Terminal Help
bm@bm-desktop:~$ ares-setup-device --add target -i "host=192.168.1.33"
name          deviceInfo           connection  profile
-----
raspberrypi4 (default)  root@192.168.1.34:22  ssh        ose
target         root@192.168.1.33:22  ssh        ose
emulator       developer@127.0.0.1:6622  ssh        ose

bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$
```

Contents

- Key Features
- System Requirements
- Installing CLI
 - Download the Package
 - Unzip the Package
 - Set the Path
- CLI Workflow
- CLI Commands
 - ares-generate
 - ares-package
 - ares-setup-device**
 - ares-install
 - ares-launch
 - ares-inspect
 - ares-server
 - ares-shell
 - ares-push
 - ares-pull

Activities Terminal ▾

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Wed 10:23

chrome webosose.org/docs/tools/sdk/cli/cli-user-guide/#ares-setup-device

star ⌂ ⌂ ⌂

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Tools

SDK ^

- SDK Download
- Command-Line Interface
- User Guide

Release Notes

Emulator ▼

Beanviser ▼

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LS2 Commands ^

Imla-send

Guide

ls-monitor

Guide

]

- Adding the target device as a default device (target device name: target , host address: 10.123.45.67 , port number: 22 , user: root)

```
ares-setup-device --add target -i "host=10.123.45.67"
```
- Adding the target device with JSON format (target device name: target , host address: 10.123.45.67 , port number: 22 , user: root)

```
ares-setup-device --add target -i "host=10.123.45.67"
```

Contents

- Key Features
- System Requirements
- Installing CLI
 - Download the Package
 - Unzip the Package
 - Set the Path
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- CLI Commands
 - ares-generate
 - ares-package
 - ares-setup-device
 - ares-install
 - ares-launch
 - ares-inspect
 - ares-server
 - ares-shell
 - ares-push
 - ares-pull

bm@bm-desktop:~

File Edit View Search Terminal Help

```
bm@bm-desktop:~$ ares-setup-device --add target -i "host=192.168.1.33"
name          deviceinfo      connection   profile
-----  -----
raspberrypi4 (default)  root@192.168.1.34:22  ssh        ose
target         root@192.168.1.33:22  ssh        ose
emulator       developer@127.0.0.1:6622  ssh        ose

bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$ ares-install -d target -l
com.domain.app
com.sample.echo
bm@bm-desktop:~$
```

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2 Set default? Yes

Error 발생

Activities Terminal ▾

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Wed 10:25

bm@bm-desktop:~

```
File Edit View Search Terminal Help
bm@bm-desktop:~$ ssh root@192.168.1.34
ssh: connect to host 192.168.1.34 port 22: No route to host
bm@bm-desktop:~$ ssh root@192.168.1.34
ssh: connect to host 192.168.1.34 port 22: No route to host
bm@bm-desktop:~$ ssh root@192.168.1.34
ssh: connect to host 192.168.1.34 port 22: No route to host
bm@bm-desktop:~$ ssh root@192.168.1.33
The authenticity of host '192.168.1.33 (192.168.1.33)' can't be established.
RSA key fingerprint is SHA256:5uJRKD509GwYQ2WZC2rlUHkBLEI2V99/FPPN8tlBcLk.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.33' (RSA) to the list of known hosts.
root@raspberrypi4:/sysroot/home/root#
```

123.45.67

device

device

I

name	deviceinfo	connection	profile
raspberrypi4 (default)	root@192.168.1.34:22	ssh	ose
target	root@192.168.1.33:22	ssh	ose
emulator	developer@127.0.0.1:6622	ssh	ose

```
bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$ ares-install -d target -l
com.domain.app
com.sample.echo
bm@bm-desktop:~$ ares-install -d target com.domain.app -r
ares-install [red] ares-install: Error: luna-send command failed (FAILED_REMOVE)
bm@bm-desktop:~$ ares-install -d target com.domain.app -r
ares-install [red] ares-install: Error: luna-send command failed (FAILED_REMOVE)
bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$
```

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2 Set default? Yes

Contents

- Key Features
- System Requirements
- Installing CLI
 - Download the Package
 - Unzip the Package
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- CLI Commands
 - ares-generate
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 - ares-setup-device
 - ares-install
 - ares-launch
 - ares-inspect
 - ares-server
 - ares-shell
 - ares-push
 - ares-pull

Activities Google Chrome ▾ Meeting is in progress x User Guide | webOS Open +

Wed 10:26

bm@bm-desktop:~

File Edit View Search Terminal Help

```
bm@bm-desktop:~$ ssh root@192.168.1.34
ssh: connect to host 192.168.1.34 port 22: No route to host
bm@bm-desktop:~$ ssh root@192.168.1.34
ssh: connect to host 192.168.1.34 port 22: No route to host
bm@bm-desktop:~$ ssh root@192.168.1.34
ssh: connect to host 192.168.1.34 port 22: No route to host
bm@bm-desktop:~$ ssh root@192.168.1.33
The authenticity of host '192.168.1.33 (192.168.1.33)' can't be established.
RSA key fingerprint is SHA256:5uJ3RkD509GwYQ2WZC2rlUMkBlEI2V99/FPPN8tlBcLk.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.33' (RSA) to the list of known hosts.
root@raspberrypi4:/sysroot/home/root# ls-monitor -i con.domain.app.service
```

name	deviceinfo	connection	profile
raspberrypi4 (default)	root@192.168.1.34:22	ssh	ose
target	root@192.168.1.33:22	ssh	ose
emulator	developer@127.0.0.1:6622	ssh	ose

```
bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$ ares-install -d target -l
com.domain.app
com.sample.echo
bm@bm-desktop:~$ ares-install -d target com.domain.app -r
ares-install [redacted] ares-install: Error: Linux send command failed (FAILED_REMOVE)
bm@bm-desktop:~$ ares-install -d target com.domain.app -r
ares-install [redacted] ares-install: Error: Linux send command failed (FAILED_REMOVE)
bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$
```

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Contents

- Key Features
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 - Download the Package
 - Unzip the Package
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 - ares-generate
 - ares-package
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 - ares-install
 - ares-launch
 - ares-inspect
 - ares-server
 - ares-shell
 - ares-push
 - ares-pull

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Wed 10:28

bm@bm-desktop:~

```
File Edit View Search Terminal Help
  .cli"]}
    "locale": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}}
    "hello": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}}
    "info": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}}
    "listfiles": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}}
    "pong": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}}
    "quit": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}}
    "heartbeat2": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}}
  "/config":
    "setGreeting": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}}
  "/do/re":
    "me": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 luna://com.domain.app.service/hello '{"hello": true}'
{"returnValue":true,"Response":"Hello, webos training interns!"}
root@raspberrypi4:/sysroot/home/root# ls-monitor
ls-monitor
  name          deviceinfo      connection profile
  -----
raspberrypi4 (default) root@192.168.1.34:22 ssh      ose
target           root@192.168.1.33:22 ssh      ose
emulator         developer@127.0.0.1:6622 ssh      ose
bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$ ares-install -d target -l
com.domain.app
com.sample.echo
bm@bm-desktop:~$ ares-install -d target com.damain.app -r
ares-install [red] ares-install: Error: luna-send command failed (FAILED_REMOVE)
bm@bm-desktop:~$ ares-install -d target com.damain.app -r
ares-install [red] ares-install: Error: luna-send command failed (FAILED_REMOVE)
bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$
```

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 - ares-server
 - ares-shell
 - ares-push
 - ares-pull

Activities Terminal

Wed 10:30

helloworld_webos_service.js - sampleservice - Visual Studio Code

```
File Edit Selection View Go Run Terminal Help
bm@bm-desktop: ~
  "pong": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]
  }
  "quit": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]
  }
  "heartbeat2": {"provides": ["com.domain.app.service.group", "all", "ares.webo
s.cli"]}
  "/config":
    "setGreeting": {"provides": ["com.domain.app.service.group", "all", "ares.web
os.cli"]}
  "/do/re":
    "me": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 luna://com.domain.app.servi
ce/hello '{"hello":'
{"returnValue":true,"Response":"Hello, webos training interns!"}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 luna://com.domain.app.servi
ce/listfiles {'path': ""}
{"returnValue":true,"files": [".ICE-unix", ".Test-unix", ".X11-unix", ".XIM-unix", ".f
ont-unix", "PmLogSetContextLevel.log", "activitymanager-ready", "backup-log-ready"
, "boot-done", "configd_1595576871_before_load.json", "core-boot-done", "datastore-i
nit-start", "developer", "init-boot-done", "ls-hubd-ready", "lsm-ready", "minimal-bo
ot-done", "rdxd", "rest-boot-done", "run-js-service-no-cgroup", "sam-respawned", "sam_
runtime", "settingsservice-ready", "settingsservice ready", "systemd-environments.l
og", "xdg"]}

root@raspberrypi4:/sysroot/home/root# 32 >
38
39   :respond({
40     iValue: true,
41     iing: greeting
42
43
44
45   :if service
46   :ter("locale", function(message) {
47     log(pmloglib.LOG_INFO, "SERVICE_METHOD_CALLED", {}, "" + pkgInfo.name + "/l
ocal callback");
48     call("luna://com.webos.service.settingsservice/getSystemSettings", {"key": "l
ocale"});
49     log(pmloglib.LOG_INFO, "SERVICE_METHOD_CALLED", {}, "com.webos.service.
settingsservice response = "You appear to have your locale set to: " + m2.payload.settings
);
50     e.log(response);
51     je.respond({message: response});
52
53
54
55
56
57   :scription requests
58
59
```

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Activities Terminal Wed 10:32

helloworld_webos_service.js - sampleservice - Visual Studio Code

```
File Edit Selection View Go Run Terminal Help
bm@bm-desktop: ~
File Edit View Search Terminal Help
    "me": {"provides": ["com.domain.app.service.group", "all", "ares.webos.cli"]}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 luna://com.domain.app.service/hello '{"hello"}'
("returnValue":true,"Response":"Hello, webos training intern!")
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 luna://com.domain.app.service/listfiles '{"path": ""}'
("returnValue":true,"files": [".ICE-unix", ".Test-unix", ".X11-unix", ".XIM-unix", ".font-unix", "PmLogSetContextLevel.log", "activitymanager-ready", "backup-log-ready", "boot-done", "configd_1595576871_before_load.json", "core-boot-done", "datastore-init-start", "developer", "init-boot-done", "ls-hubd-ready", "lsm-ready", "minimal-boot-done", "rdxd", "rest-boot-done", "run-js-service-no-cgroup", "sam-respawned", "sam-runtime", "settingsservice-ready", "settingsservice_ready", "systemd-environments.log", "xdg"])
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service.camera2/getCameraList '{}'
{
  "deviceList": [
    {
      "id": "camera1"
    }
  ],
  "returnValue": true
}
root@raspberrypi4:/sysroot/home/root#
Open the camera
13. luna-send -n 1 -f luna://com.webos.service.camera2/open '{ "id": "camera1"}'

Capture the image:
14. luna-send -n 1 -f luna://com.webos.service.camera2/startCapture '{ "handle": 9383, "params": {
  "width": 640, "height": 480, "format": "JPEG", "mode": "MODE_BURST", "nimage": 2 } }'

+ pkgInfo.name + "/l
Plain Text ▾ Tab Width: 8 ▾ Ln 25, Col 74 ▾ INS emSettings, {"key": "com.webos.service.
51 :response = "You appear to have your locale set to: " + m2.payload.settings
52 .e.log(response);
53 je.respond({message: response});
54
55
56
57 icription requests
58
christkengeri.webex.com is sharing your screen. Stop sharing Hide
18, Col 85 Spaces:4 UTF-8 LF JavaScript R Q
```

Activities Terminal Meeting is in progress User Guide | webOS Open

Wed 10:32

bm@bm-desktop:~

```
File Edit View Search Terminal Help
[{"returnValue":true,"files":[".ICE-unix",".Test-unix",".X11-unix",".XIM-unix",".font-unix","PmLogSetContextLevel.log","activitymanager-ready","backup-log-ready","boot-done","configd_1595576871_before_load.json","core-boot-done","datastore-init-start","developer","init-boot-done","ls-hubd-ready","lsm-ready","minimal-boot-done","rdxd","rest-boot-done","run-js-service-no-cgroup","sam-respawned","san-runtime","settingsservice-ready","settingsservice_ready","systemd-environments.log","xdg"]}]
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service.camera2/getCameraList '{}'
[
  "deviceList": [
    {
      "id": "camera1"
    }
  ],
  "returnValue": true
}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service.camera2/open '{ "id":"camera1"}'
[
  "returnValue": true,
  "handle": 992
}
root@raspberrypi4:/sysroot/home/root#
```

Open the camera
13. luna-send -n 1 -f luna://com.webos.service.camera2/open '{ "id":"camera1"}'

Capture the image:
14. luna-send -n 1 -f luna://com.webos.service.camera2/startCapture '{ "handle": 9383, "params": { "width": 640, "height": 480, "format": "JPEG", "mode": "MODE_BURST", "nimage": 2 } }'

Plain Text Tab Width: 8 Ln 28, Col 81 INS

```
bm@bm-desktop:~$ ares-install -d target com.domain.app -r
ares-install [REDACTED] ares-install: Error: luna-send command failed (FAILED REMOVE)
bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$
```

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2 Set default? Yes

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 - ares-inspect
 - ares-server
 - ares-shell
 - ares-push
 - ares-pull

Activities Terminal

Meeting is in progress User Guide | webOS Open +

Wed 10:33

bm@bm-desktop:~

```
File Edit View Search Terminal Help
og","xdg"]}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service
.camera2/getCameraList '{}'
{
  "deviceList": [
    {
      "id": "camera1"
    }
  ],
  "returnValue": true
}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service
.camera2/open '{ "id": "camera1"}'
{
  "returnValue": true,
  "handle": 992
}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service
.camera2/startCapture '{ "handle": 992, "params": { "width": 640, "height": 480, "format": "JPEG", "mode": "MODE_BURST", "nimage": 2 } }'
{
  "returnValue": true
}
root@raspberrypi4:/sysroot/home/root#
```

Open the camera

13. luna-send -n 1 -f luna://com.webos.service.camera2/open '{ "id": "camera1"}'

Capture the image:

14. luna-send -n 1 -f luna://com.webos.service.camera2/startCapture '{ "handle": 9383, "params": { "width": 640, "height": 480, "format": "JPEG", "mode": "MODE_BURST", "nimage": 2 } }'

Plain Text Tab Width: 8 Ln 32, Col 190 INS

```
bm@bm-desktop:~$ ares-install -d target com.domain.app -r
ares-install [redacted] ares-install: Error: luna-send command failed (FAILED_REMOVE)
bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk
Installing package com.domain.app_1.0.0_all.ipk
Success
bm@bm-desktop:~$
```

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Activities Terminal Wed 10:33

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File Edit View Search Terminal Help

```
bm@bm-desktop:~  
"deviceList": [  
    {  
        "id": "camera1"  
    },  
    {"returnValue": true}  
}  
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service  
.camera2/open '{ "id": "camera1"}'  
{  
    "returnValue": true,  
    "handle": 992  
}  
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service  
.camera2/startCapture '{ "handle": 992, "params": { "width": 640, "height":  
480, "format": "JPEG", "mode": "MODE_BURST", "nimage": 2 } }'  
{  
    "returnValue": true  
}  
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 luna://com.domain.app.servi  
ce/listfiles '{ "path": ""}'  
{ "returnValue": true, "files": [ "Picture04082020-22030270.jpeg", "run-js-service-no-  
cgroup", "systemd-environments.log", "xdg" ] }  
root@raspberrypi4:/sysroot/home/root#  
  
Open the camera  
13. luna-send -n 1 -f luna://com.webos.service.camera2/open '{ "id": "camera1"}'  
  
Capture the image:  
14. luna-send -n 1 -f luna://com.webos.service.camera2/startCapture '{ "handle": 9383, "params":  
{ "width": 640, "height": 480, "format": "JPEG", "mode": "MODE_BURST", "nimage": 2 } }'
```

Plain Text Tab Width: 8 Ln 32, Col 190 INS

```
bm@bm-desktop:~$ ares-install -d target com.domain.app -r  
ares-install rm ares-install: Error: luna-send command failed (FAILED_REMOVE)  
bm@bm-desktop:~$ ares-install --device target com.domain.app_1.0.0_all.ipk  
Installing package com.domain.app_1.0.0_all.ipk  
Success  
bm@bm-desktop:~$
```

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2 Set default? Yes

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 - ares-install
 - ares-launch
 - ares-inspect
 - ares-server
 - ares-shell
 - ares-push
 - ares-pull

Activities Google Chrome ▾ Meeting is in progress com.webos.service.camera2 #startcapture

Wed 10:34

← → C webosose.org/docs/reference/ls2-api/com-webos-service-camera2/#startcapture

star

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Reference

- voutput
- com.webos.service.bluetooth2
- com.webos.service.camera2**
- com.webos.service.config
- com.webos.service.configuration
- com.webos.service.connectionmanager
- com.webos.service.contextintentmgr
- com.webos.service.db
- com.webos.service.devemode
- com.webos.service.downloadmanager
- com.webos.service.filecache
- com.webos.service.location
- com.webos.service.

startCapture

Description

Starts capturing images using the camera. The captured images are stored as separate files at the location given by the "path" parameter.

The default file name is of the format *PictureDDMMYYYY-HHMMSS*, where *DDMMYYYY-HHMMSS* is current date and time.

Example: /tmp/Picture11022019-204128.jpeg

By default, captured images are saved in the **/tmp/** folder.

Parameters

Name	Required	Type	Description
handle	Required	Number	Indicates the handle for the device obtained using the op API.
params	Required	Object: camera_capture_format	Indicates the size and form of the image to be captured.
path	Optional	String	Indicates the location where the captured images are to be stored.

↑

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Activities Terminal Meeting is in progress com.webos.service.camera2

File Edit View Search Terminal Help

```

"returnValue": true
}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service
.camera2/open '{ "id": "camera1" }'
{
    "returnValue": true,
    "handle": 992
}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 -f luna://com.webos.service
.camera2/startCapture '{ "handle": 992, "params": { "width": 640, "height": 480, "format": "JPEG", "mode": "MODE_BURST", "nimage": 2 } }'
{
    "returnValue": true
}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 luna://com.domain.app.servi
ce/listfiles '{ "path": "" }'
{"returnValue": true, "files": ["Picture04082020-22030270.jpeg", "run-js-service-no-
cgroup", "systemd-environments.log", "xdg"]}
root@raspberrypi4:/sysroot/home/root# cd ..
root@raspberrypi4:/sysroot/home# cd ..
-sh: cd.: not found
root@raspberrypi4:/sysroot/home# cd ..
root@raspberrypi4:/sysroot# cd ..
root@raspberrypi4:/#

```

com.webos.service.d

	Name	Required	Type	Description
b				
com.webos.service.d				
evmode	handle	Required	Number	Indicates the handle for the device obtained using the open API.
ownloadmanager				
com.webos.service.fi				
lecache				
com.webos.service.i	params	Required	Object: camera_capture_format	Indicates the size and form of the image to be captured.
location				
com.webos.service.				

Path

Optional

String

Indicates the location where the captured images are stored.

Search

Contents

- API Summary
- Overview of the API
- Methods
 - getCameraList
 - open
 - startPreview
 - startCapture
 - stopCapture
 - stopPreview
 - close
 - getInfo
 - getProperties
 - setProperties
 - setFormat
 - getEventNotification
- Objects
 - camera_properties
 - deviceList
 - camera_format
 - capture_info
 - picture
 - video
 - camera_memory_source
 - details

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Activities Terminal Meeting is in progress com.webos.service.camera

Wed 10:35

```
bm@bm-desktop: ~
File Edit View Search Terminal Help
480, "format": "JPEG", "mode": "MODE_BURST", "nimage": 2 } }
{
  "returnValue": true
}
root@raspberrypi4:/sysroot/home/root# luna-send -n 1 luna://com.domain.app.service/listfiles '{"path": ""}'
{"returnValue":true,"files":["Picture04082020-22030270.jpeg","run-js-service-no-cgroup","systemd-environments.log","xdg"]}
root@raspberrypi4:/sysroot/home/root# cd ..
root@raspberrypi4:/sysroot/home# cd ..
-sh: cd..: not found
root@raspberrypi4:/sysroot/home# cd ..
root@raspberrypi4:/sysroot# cd ..
root@raspberrypi4:# cd tmp
root@raspberrypi4:/tmp# ls -l
total 344
-rw-r--r-- 1 root root 341333 Aug 4 22:03 Picture04082020-22030270.jpeg
-rw-r--r-- 1 nobody 99 5 Aug 4 22:03 run-js-service-no-cgroup
-rw-r--r-- 1 root root 1116 Aug 4 21:49 systemd-environments.log
drwxrwx--- 2 root composit 68 Jul 24 00:47 xdg
root@raspberrypi4:/tmp#
com.webos.service.d
  b
  com.webos.service.d
  evmode
  com.webos.service.d
  downloadmanager
  com.webos.service.fi
  lecache
  com.webos.service.l
  ocation
  com.webos.service.
```

	Name	Required	Type	Description
com.webos.service.d	handle	Required	Number	Indicates the handle for the device obtained using the open API.
evmode	params	Required	Object: camera_capture_format	Indicates the size and form of the image to be captured.
downloadmanager	path	Optional	String	Indicates the location where the captured images are stored.
com.webos.service.downloadmanager				

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Contents

- API Summary
- Overview of the API
- Methods
- getCameraList
- open
- startPreview
- startCapture
- stopCapture
- stopPreview
- close
- getInfo
- getProperties
- setProperties
- setFormat
- getEventNotification
- Objects
- camera_properties
- deviceList
- camera_format
- capture_info
- picture
- video
- camera_memory_source
- details

Activities Google Chrome

Meeting is in progress | com.webos.service.camera | User Guide | webOS Open

Wed 10:38

← → C <http://webosose.org/docs/tools/sdk/cli-user-guide/#ares-package>

star   

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pattern expression such as wildcard (*).

Tools

SDK

- SDK Download
- Command-Line Interface
- User Guide

Release Notes

Emulator

Beanviser

Workflow Designer

LS2 Commands

- luna-send Usage Guide
- ls-monitor Usage Guide

pattern expression such as wildcard (*).

Examples

Here are some examples of the different uses:

- Creating a package file from ./sampleApp directory and outputting it in the working directory
- ares-package sampleApp
- Creating a package file from the ./sampleApp directory and outputting it in ./output directory
- ares-package -o output sampleApp
- Creating a package file except for testCode1 sub-directory, README.md file and all text file (.txt)
- ares-package -e "testCode1" -e "README.md" -e "*.txt"
- Creating a package file with an external JS service
- ares-package sampleApp sampleServiceA sampleServiceB
- Creating a package file with multiple external JS services
- Creating a package file with an external JS service (using absolute path)

Key Features

System Requirements

Installing CLI

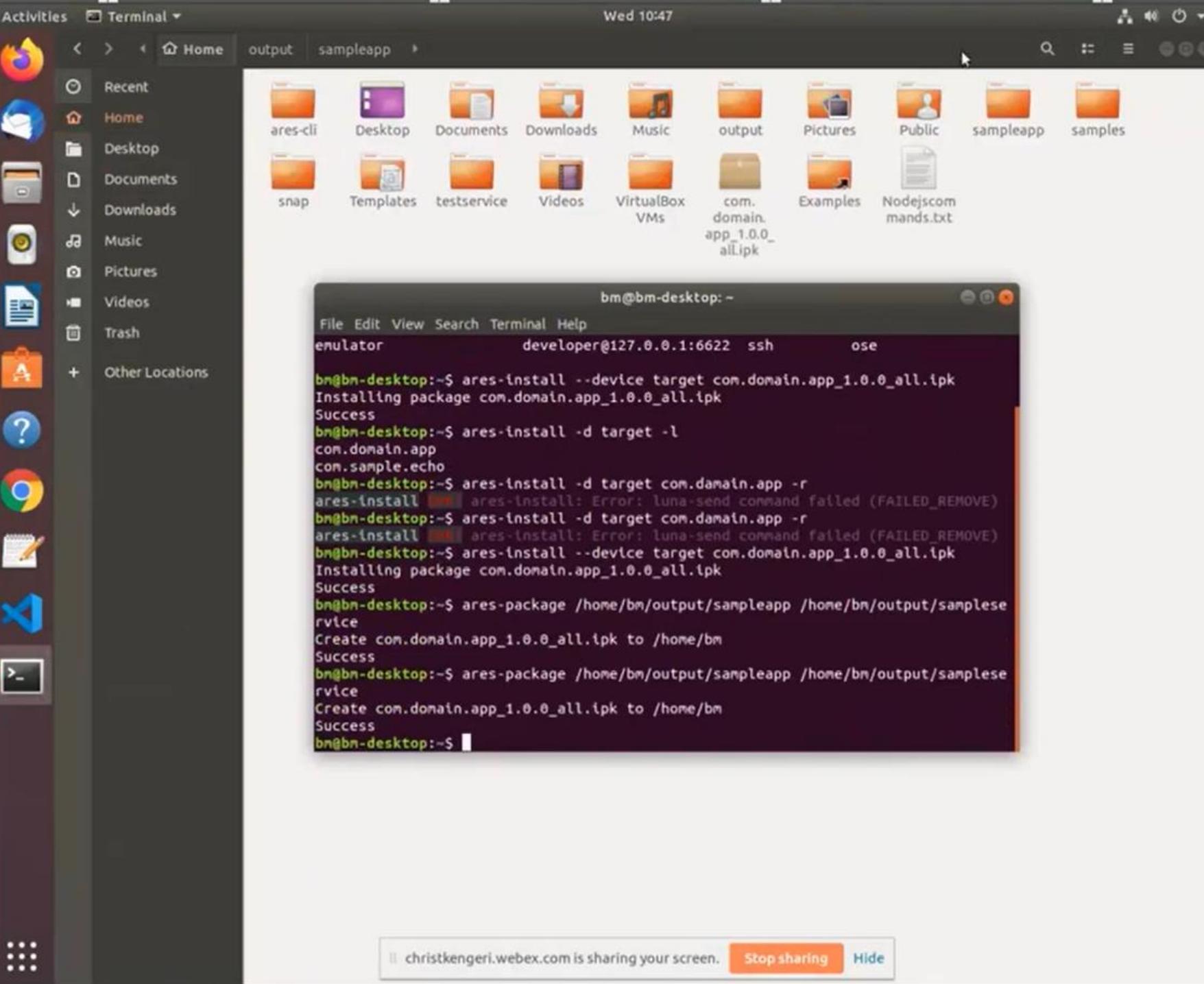
- Download the Package
- Unzip the Package
- Set the Path

CLI Workflow

CLI Commands

- ares-generate
- ares-package
- ares-setup-device
- ares-install
- ares-launch
- ares-inspect
- ares-server
- ares-shell
- ares-push
- ares-pull

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DAY10-1

webOS

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Introduction To Web Application



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Introduction to Web Application

- Similar to standard web apps that use web-based technologies like HTML, CSS, and JavaScript.
- Developers with experience in building web apps can easily start developing web apps for webOS OSE



Web App Management

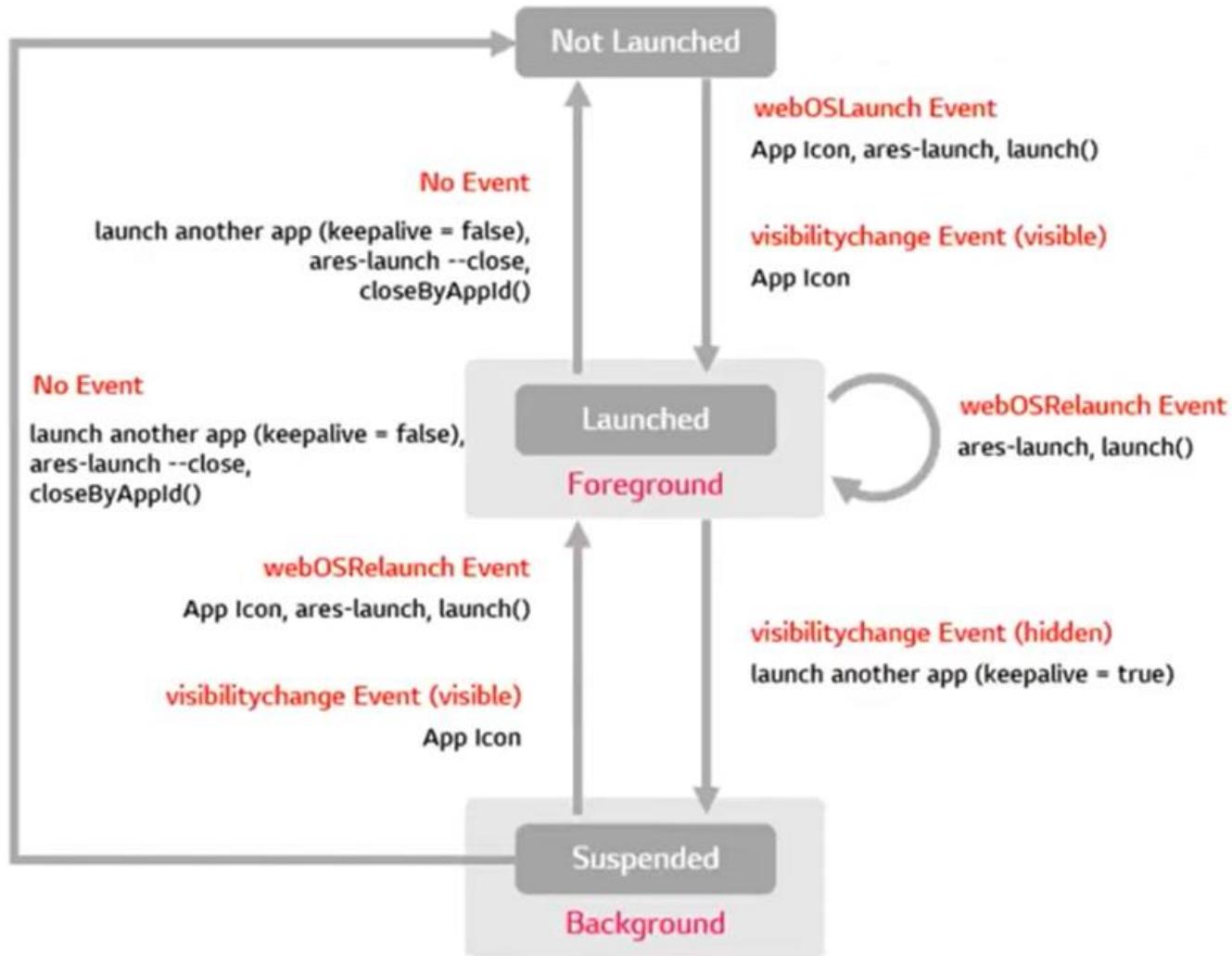
- **System and Application Manager (SAM)** : oversees the behavior of apps. SAM manages each app throughout its lifecycle, including the installation, launch, termination, and removal of the app.
- **Web Application Manager (WAM)**: is responsible for launching and managing web apps. In addition, WAM performs CPU usage optimization, status monitoring and recovery processing, and access privileges management, all based on the running status of web apps.

Core Applications	System UI Home Launcher Notification	System Settings Enact Browser	Sample Apps YouTube IoTivity Sampler							
Application Framework	SDK CLI Emulator Beancrusher Workflow Designer	Web Enact								
Managers & Services	App SAM WAM Activity Mgr Memory Mgr appinstalld2	Display LSM	Media uMS videooutputd audiooutputd audiod Camera Service	i18n/I10n IME Mgr VKB	Diagnostics crashd rdxd	Connectivity Network Mgr Bluetooth Mgr	DB DBB			
	Notification Notification Mgr	Settings Settings Service configd	Development devmode	Misc. Sys Service Download Mgr Event Monitor	Intelligence AI Service TTS Service Context Intent Mgr	External Device PDM	SW Update SW Updater			
Base Components	Bus LS2	Display Qt QPA QtWayland	Media g-media-pipeline PulseAudio GStreamer g-camera-pipeline	i18n/I10n ILib icu Malit automata	Diagnostics journald PmLog pmtrace	Connectivity ConnMan BlueZ IoTivity	JS Service Nodejs nodejs-module	DB LevelDB		
	HAL Nyx	Base Libs OE libs	Boot bootd systemd	Web Engine Chromium	Performance filecache	Intelligence Google Assistant	SW Update libostree			
BSP	Event evdev	Display EGL Wayland EGL Mesa KMS/DRM OpenGL ES	Media OMX IL ALSA	Device USB	Connectivity 100Base-T wpa-suplicant Bluetooth	Performance zram	General hal-libs			
Kernel	Security Smack									

Web App Lifecycle

- Web apps can be launched, suspended or terminated by user interactions or system events
- States:
 - **Not Launched**,
 - **Launched (Foreground)**,
 - **Suspended (Background)**

Web App Lifecycle



Launching an App

- A web app is launched using the Application Manager service.
[com.webos.service.applicationmanager](#)
- The Application Manager service can be invoked by:
 - The Launcher
 - Any type of app
 - A service or a custom JavaScript service running on the device
 - Using the CLI command ares-launch



Handling an App Launch

- A webOSLaunch event is fired by:
 - Clicking on an app icon
 - Using the CLI command ares-launch
 - Calling launch method of Application Manager on LS2 API

```
// webOSLaunch event
document.addEventListener('webOSLaunch', function(inData) {
    // Check the received parameters
    console.log(JSON.stringify(inData.detail));

    // Do something in the foreground
    ...
}, true);

// webOSRelaunch event
document.addEventListener('webOSRelaunch', function(inData) {
    // Check the received parameters
    console.log(JSON.stringify(inData.detail));

    // Do something in the foreground
    ...
}, true);
```

Managing App Visibility

```
document.addEventListener ('visibilitychange', function() {
    if (document.hidden)
        doHiddenCleanup();
    else
        doShowingTasks();
}, true);
```

Terminating an App

Apps in the Launched or Suspended state can be terminated by:

- Launching another app when the keepAlive property of the current app is set to false
- Using the CLI command `ares-launch --close`
- Calling `closeByAppId` method of Application Manager on LS2 API

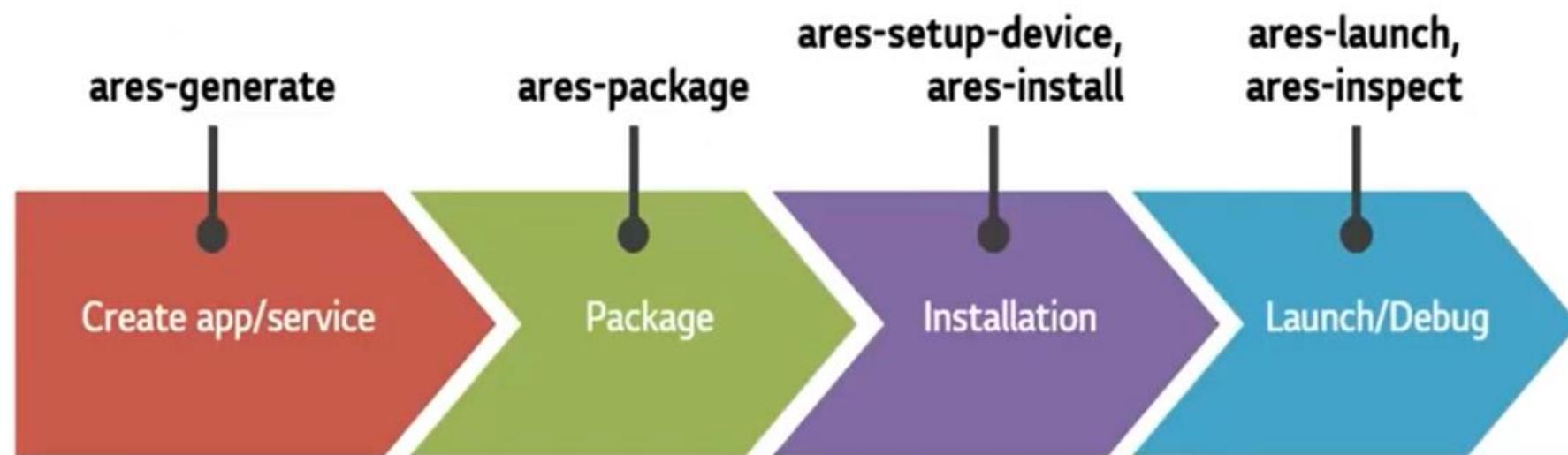
Web App Types

- **External Web App**
 - The web app is installed on the webOS target device.
 - This approach helps 3rd party developers to create a web app running on webOS devices.
- **Built-in Web App**
 - The web app is built into the webOS image.
 - This approach is used by platform developers and contributors to add a web app that enhances the functionality of the platform.

Web App Framework

- webOS OSE provides Enact, a React-based application framework optimized for webOS OSE.
- <https://enactjs.com/>

Web App Development Workflow



Ares CLI guide -

<https://www.webosose.org/docs/tools/sdk/cli/cli-user-guide/>

Creating Web Apps

- Developing an external web app requires the following steps:

[Step 1: Create a Web App](#)

[Step 2: Implement the Web App](#)

[Step 3: Configure the Web App](#)

[Step 4: Package the Web App](#)

[Step 5: Install the Web App](#)

[Step 6: Launch the Web App](#)

<https://www.webosose.org/docs/tutorials/web-apps/developing-external-web-apps/#step-6-launch-the-web-app>

1. Create a Web App

\$ares-generate -t webapp sampleApp

2. Implement the Web App

3. Configure the Web App

<https://www.webosose.org/docs/guides/development/configuration-files/appinfo-json/>

4. Package the Web App

\$ ares-package <APP_DIR> [<SERVICE_DIR>]

5. Install the Web App

*\$ ares-install --device <TARGET_DEVICE>
./com.domain.app_1.0.0_all.ipk*

6. Launch the Web App

\$ ares-launch --device <TARGET_DEVICE> com.domain.app

appinfo.json

appinfo.json (web app, with optional properties)

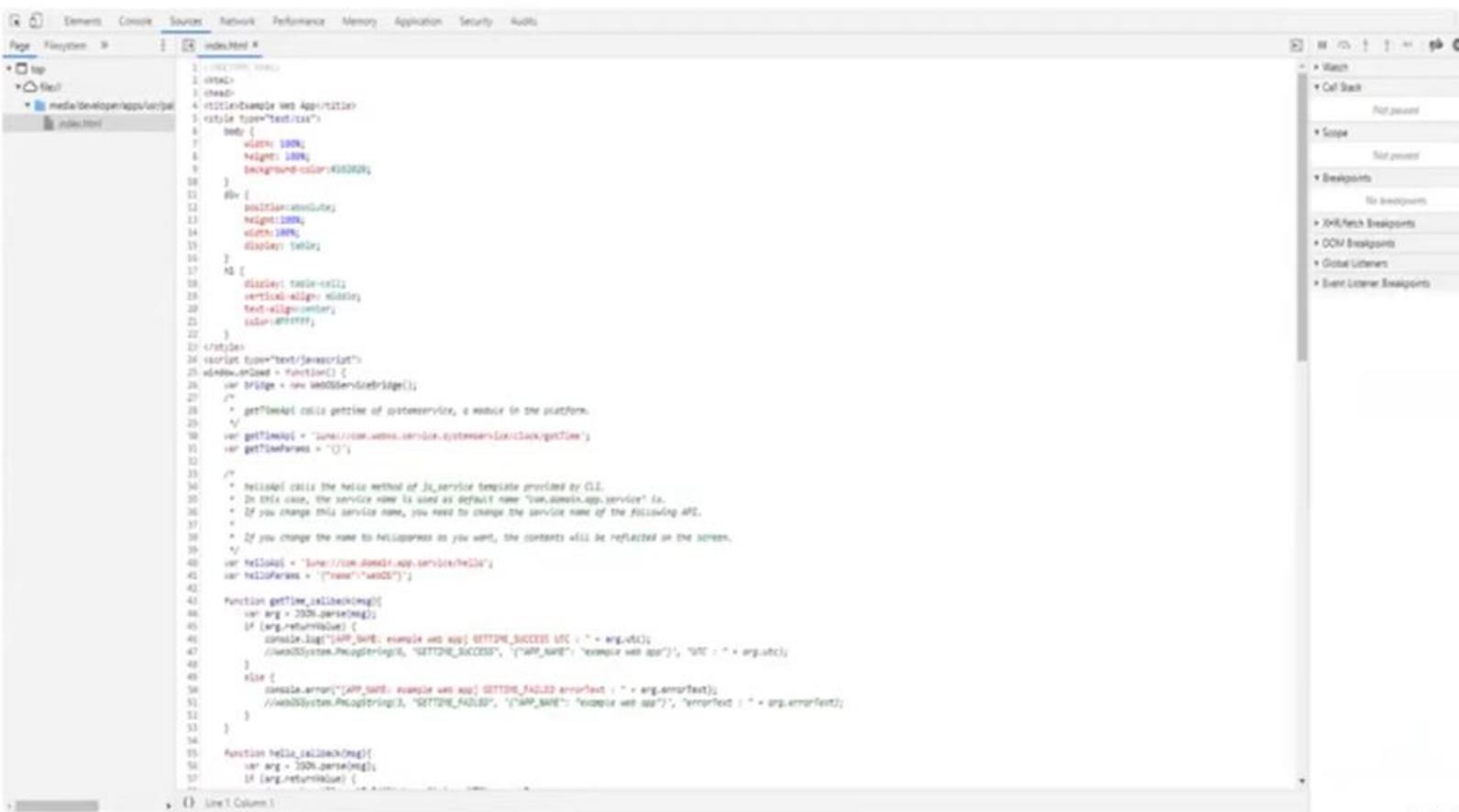
```
{  
    "id": "com.myco.app.appname",  
    "title": "AppName",  
    "main": "index.html",  
    "icon": "AppName_80x80.png",  
    "type": "web",  
    "largeIcon": "AppName_130x130.png",  
    "vendor": "My Company",  
    "version": "1.0.0",  
    "appDescription": "This is an app tagline",  
    "resolution": "1920x1080",  
    "iconColor": "red",  
    "splashBackground": "AppName_Splash.png",  
    "transparent": false,  
    "requiredMemory": 20,  
    "requiredPermissions": ["time", "media"]  
}
```

<https://www.webosose.org/docs/guides/development/configuration-files/appinfo-json/>

Debugging Web Apps

1. Launching the Web Inspector

`$ ares-inspect --device <TARGET_DEVICE> --app <APP_ID> --open`



```
index.html
1<!DOCTYPE html>
2<html>
3  <head>
4    <title>example web App</title>
5    <style type="text/css">
6      body {
7        width: 100%;
8        height: 100%;
9        background-color: #E6E6FA;
10      }
11      #div {
12        position: absolute;
13        height:100px;
14        width:100px;
15        display: flex;
16      }
17      #div {
18        display: flex-cell;
19        vertical-align: middle;
20        text-align:center;
21        color:#FF0000;
22      }
23    </style>
24    <script type="text/javascript">
25      window.onload = function() {
26        var bridge = new WebOSServiceBridge();
27        /*
28         * getHelloApI calls gettime of systemservice, a module in the platform.
29         */
30        var getHelloApI = "com.comwebos.service.systemservice[onclock/getTime"
31        var getHelloName = "(0)"
32
33        /*
34         * helloApI calls the hello method of ls_service template provided by GLB.
35         * In this case, the service name is used as default name "com.dream.app.service" ls.
36         * If you change this service name, you need to change the service name of the following API.
37         *
38         * If you change the name to HelloApI as you want, the contents will be reflected on the screen.
39         */
40        var helloApI = "com://com.dream.app.service/hello"
41        var helloName = ("name","webOS")
42
43        Function getTime_callback(msg){
44          var arg = JSON.parse(msg);
45          if (arg.returnValue) {
46            console.log("APP_NAME: example web app] GETTIME_SUCCESS UTC : " + arg.utc);
47            //WebOSSystem.ReceiverString("GETTIME_SUCCESS", {"APP_NAME": "example web app"}, "UTC : " + arg.utc);
48          }
49          else {
50            console.error("APP_NAME: example web app] GETTIME_FAILED errorText : " + arg.errorText);
51            //WebOSSystem.ReceiverString("GETTIME_FAILED", {"APP_NAME": "example web app"}, "errorText : " + arg.errorText);
52          }
53        }
54
55        Function hello_callback(msg){
56          var arg = JSON.parse(msg);
57          if (arg.returnValue) {
```

Testing a Local Web App

```
$ ares-server ./sampleApp
```

```
$ ares-server ./sampleApp --open
```

Launching Web Apps for Dual Display

- In the params parameter of the launch method, add **displayAffinity** and set its value to 0 or 1. Each value corresponds to each display as below:
 - 0: primary display
 - 1: secondary display

```
root@raspberrypi4:/# luna-send -n 1
luna://com.webos.service.applicationmanager/launch'{
  "id": "com.webos.app.test.youtube", "params": {"displayAffinity": 1}}'
```

Thank You



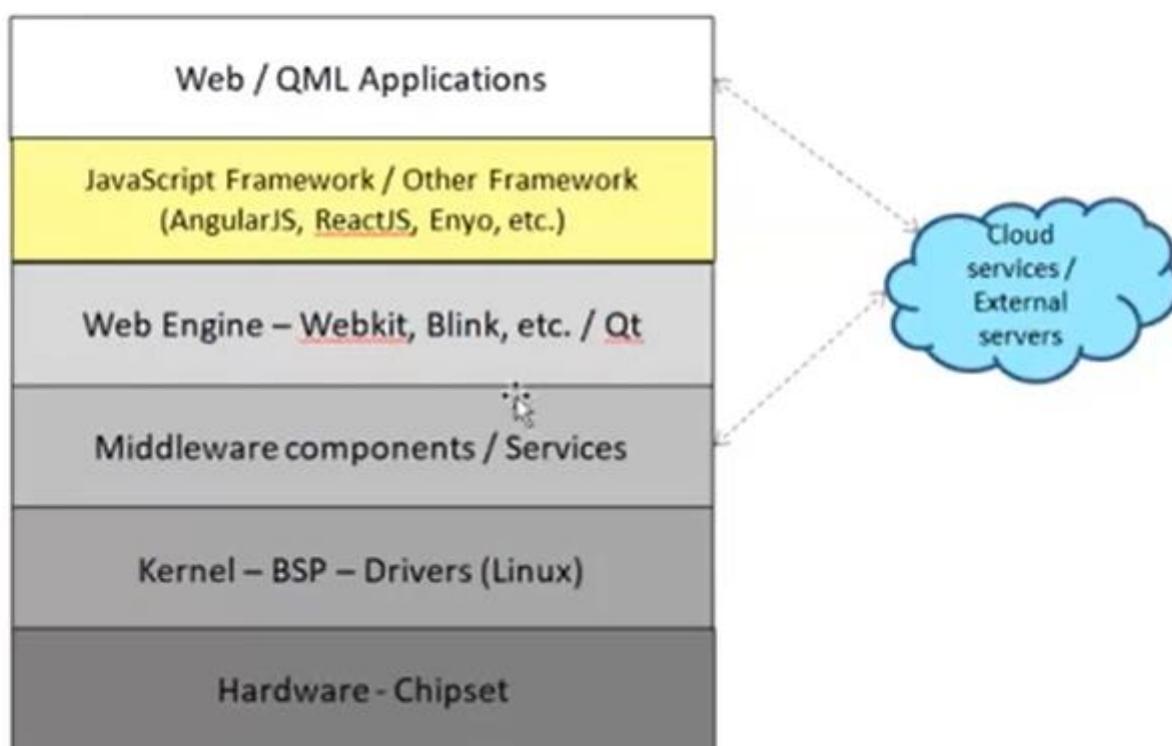
DAY10-2

Web Applications Basics

Context

- Web Apps in webOS device
- Evolution of Communication
- Evolution of Web
- Web Architecture
- Web App Architecture
- Web App Framework
- Popular JavaScript Framework^I
- Enact Framework Architecture

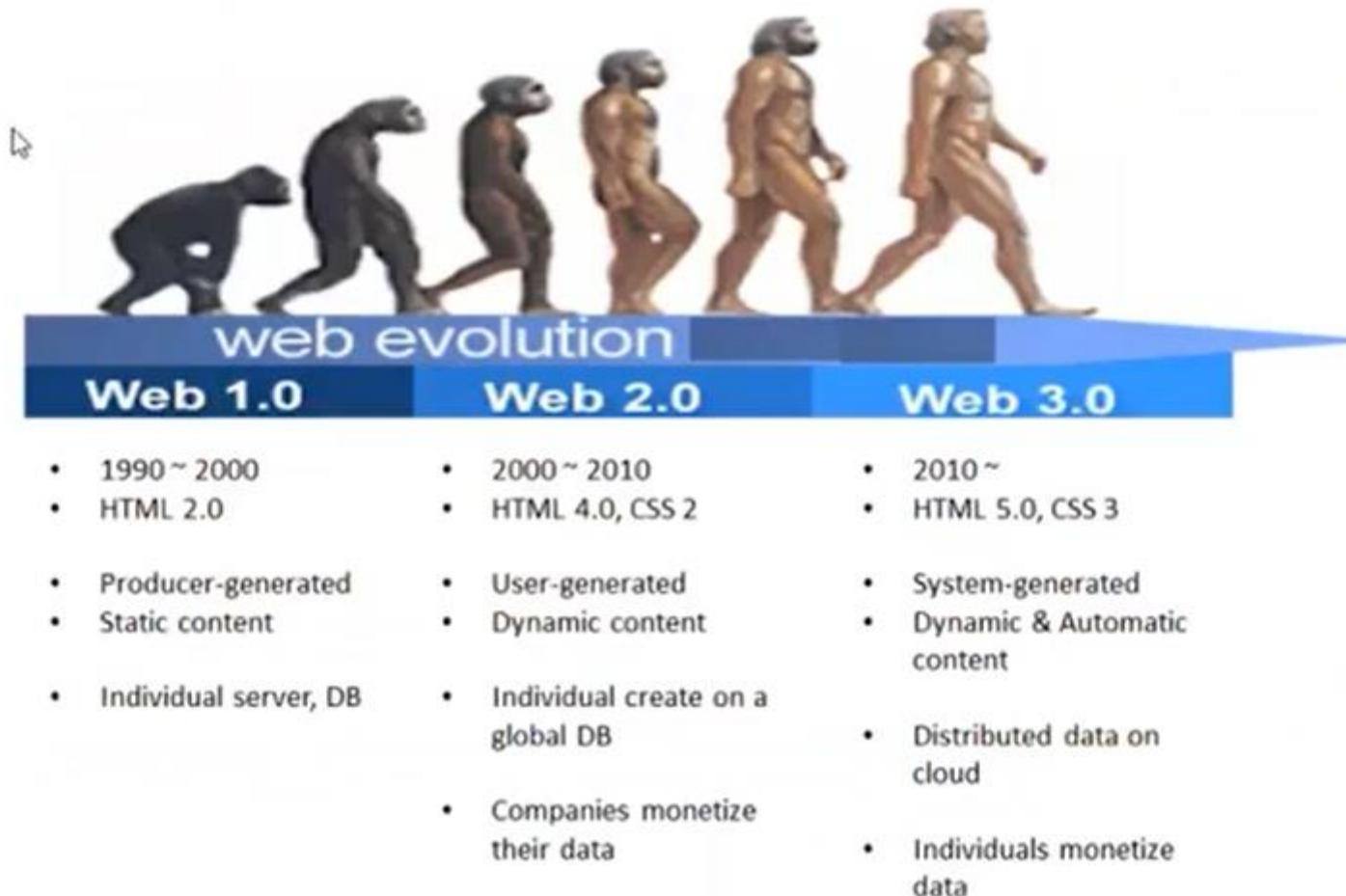
Web Apps in webOS device



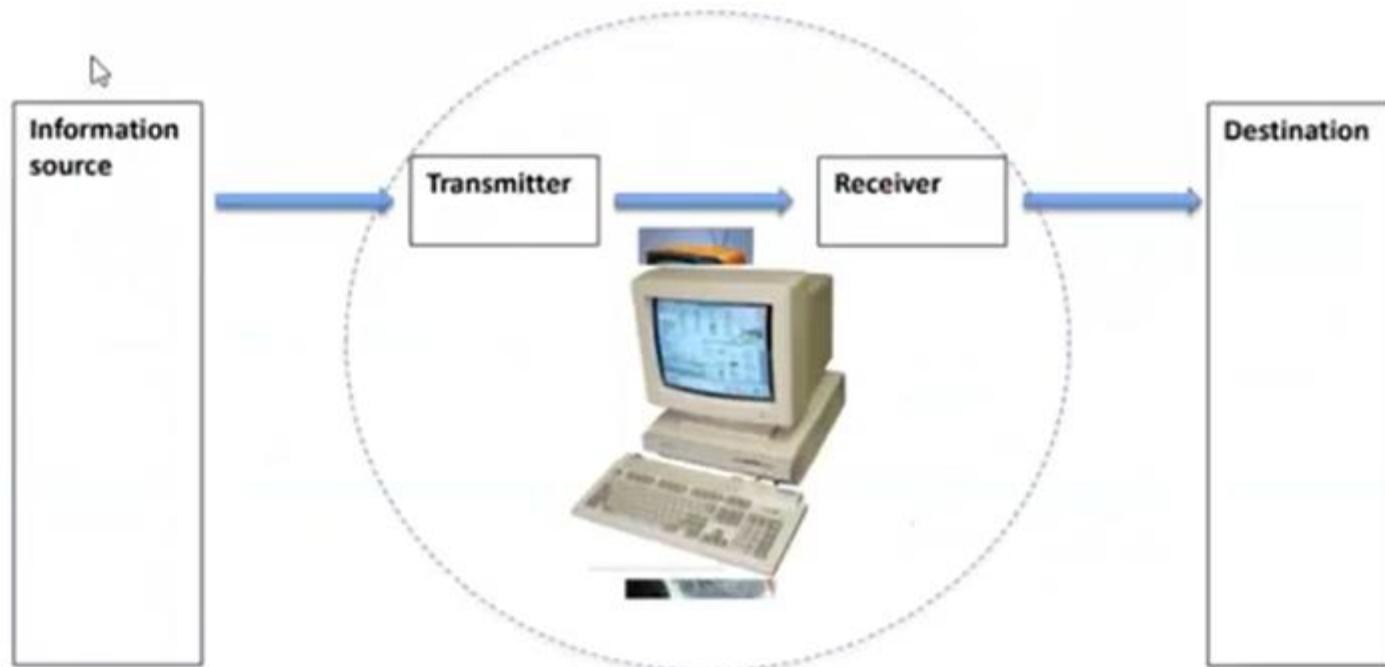
Evolution of Communication



Evolution of Web



Web 1.0



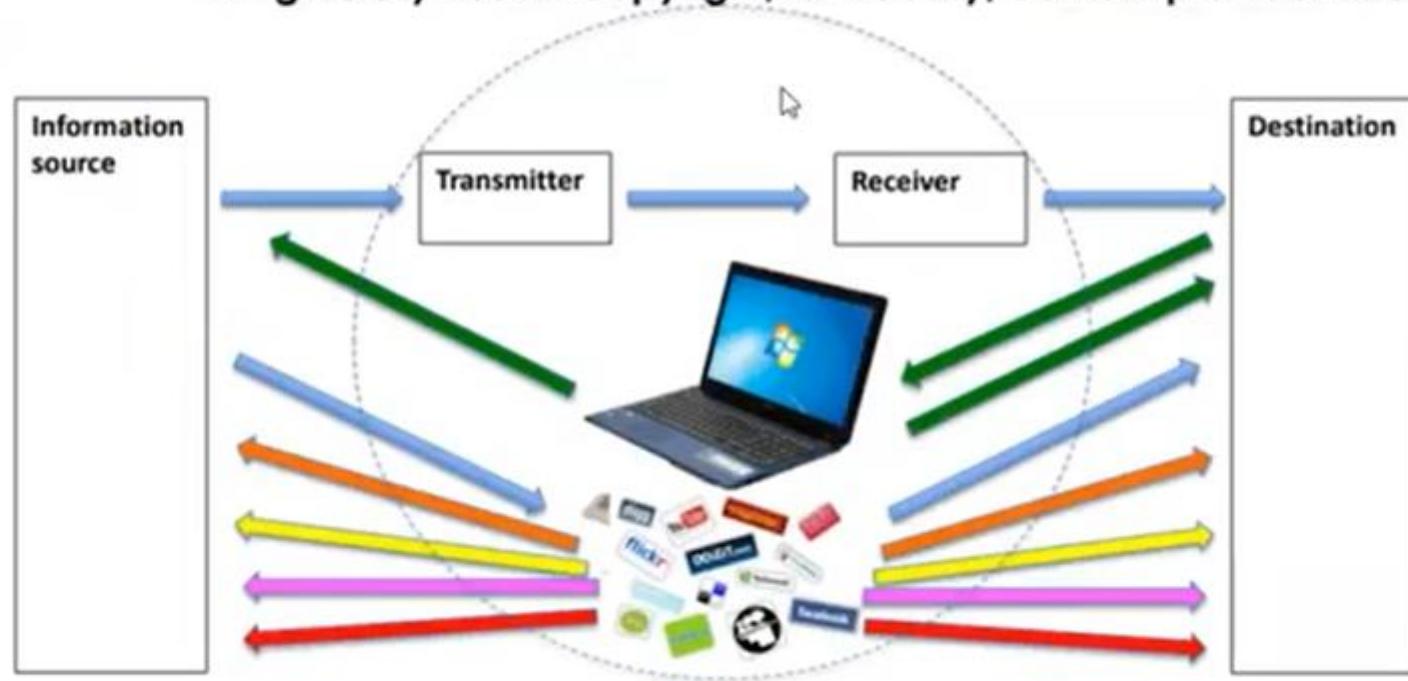
Web 1.0

- Period 1990 – 2000
- Read only(Ex:- Brochure, News)
- Mainly Corporations (Military, Govt, Email)
- HTTP, HTML

Web 2.0

Web 2.0 - User Generated Content

- Regulatory issues: Copyright, ISP liability, content provider liability



Web 2.0

- Period 2000 – 2010 and
- Evolution of Social Media, Blogging, wiki
- Keyword Search
- Rich User Experience(Flash)
- Introduction to Ajax, XML, JSON, HTML4, CSS2
- Raise of Frameworks(React, AngularJs)
- Famous Applications:- Facebook, Youtube, Twitter etc.

Web 1.0 vs Web 2.0

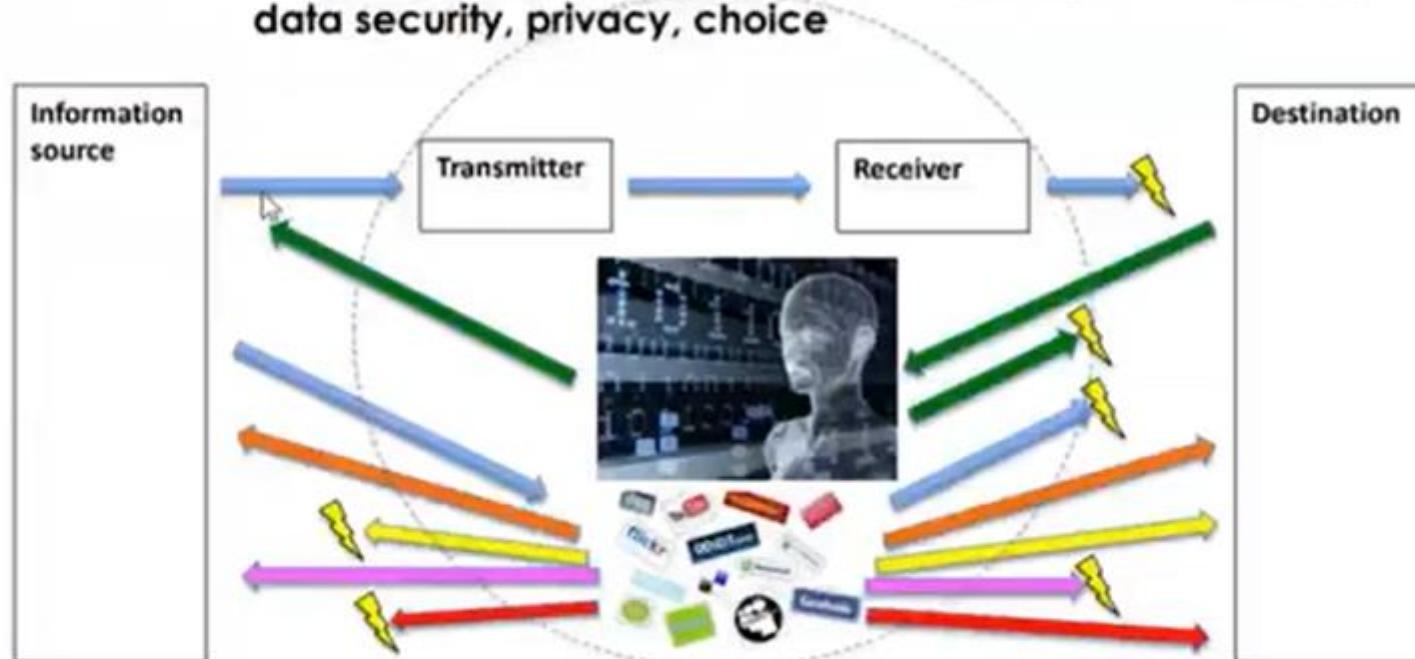
Web 1.0	Web 2.0
Mostly read only Web	Widely read-write Web
Focused on companies	Focused on communities
Home pages	Blogs
CMS	Wiki
Owning content	Sharing content
Portals	RSS feeds
Directories (taxonomy)	Tagging (folksonomy)
Britannica Online	Wikipedia
Advertising	Word of mouth

Source:- http://ai.fon.bg.ac.rs/wp-content/uploads/2015/04/Evolution-of-the-Web-Fall2014_eng.pdf

Web 3.0

Web 3.0 - Semantic web, rise of the algorithms and data economy

- Regulatory issues: Copyright, ISP & content provider liability, data security, privacy, choice



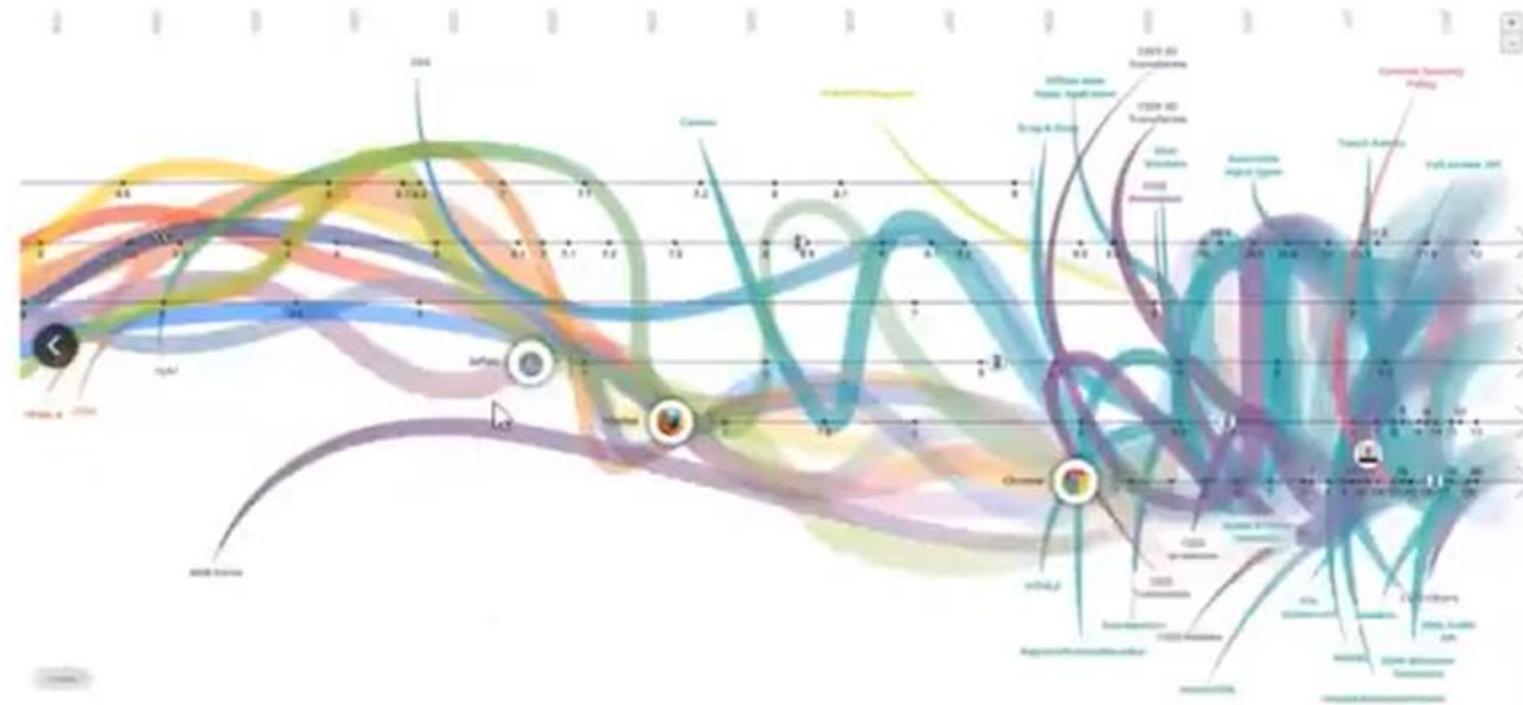
Web 3.0

- Period 2010 – onward
- Wide spread use of AI-based technologies
 - Natural language processing
 - Machine learning
- Personalized web
- Web of Data
- Streaming

Web 2.0 vs Web 3.0

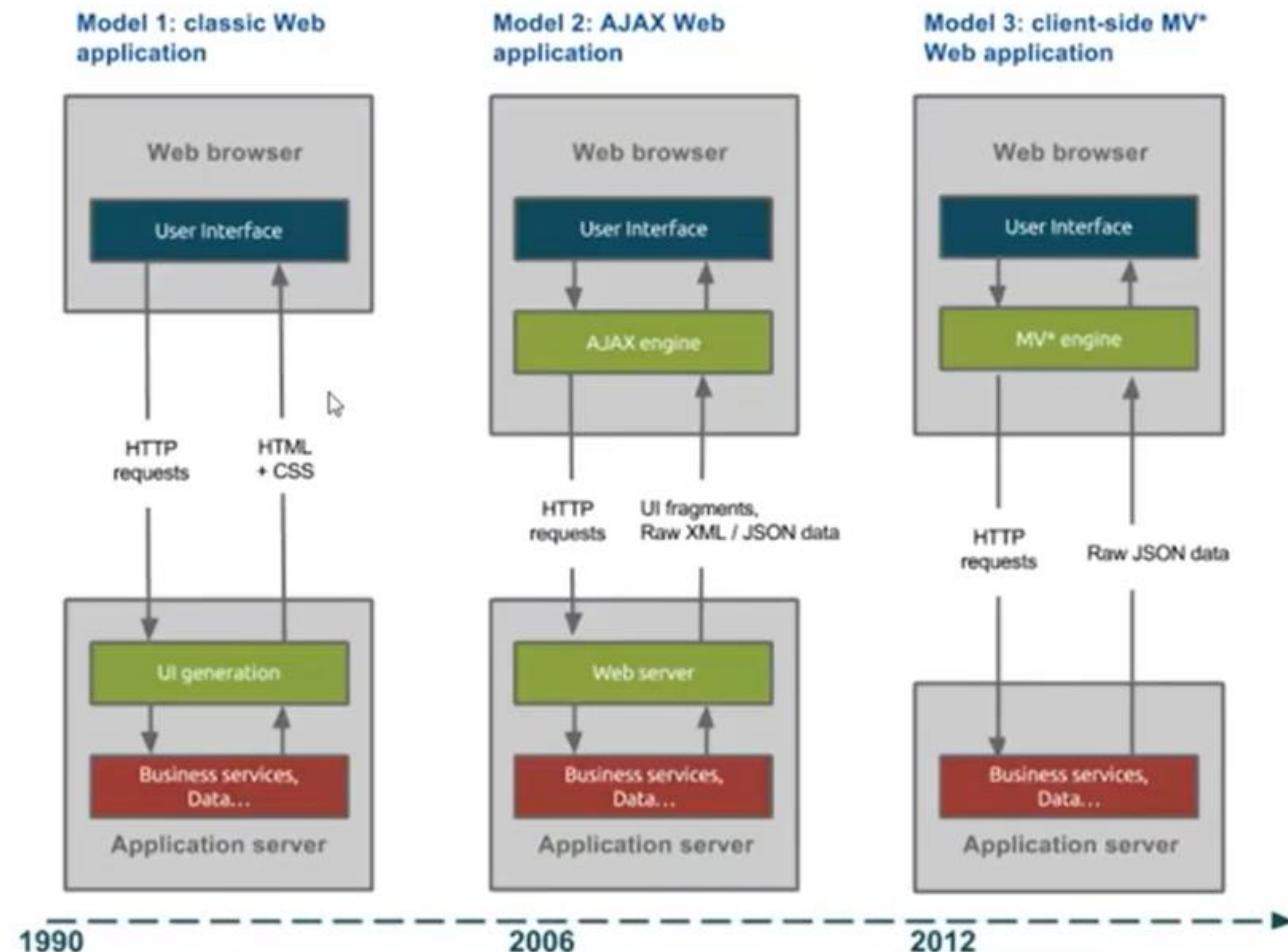
Web 2.0	Web 3.0
Widely read-write web	Portable personal web
Focused on communities	Focused on individual
Blogs	Activity Streams
Sharing content	Integrating dynamic content
XML	JSON, RDF
Web applications	Widgets, drag & drop mash-ups
Relational databases	NoSQL databases
Tagging (folksonomy)	User behavior ('me-onomy')

Timeline of web

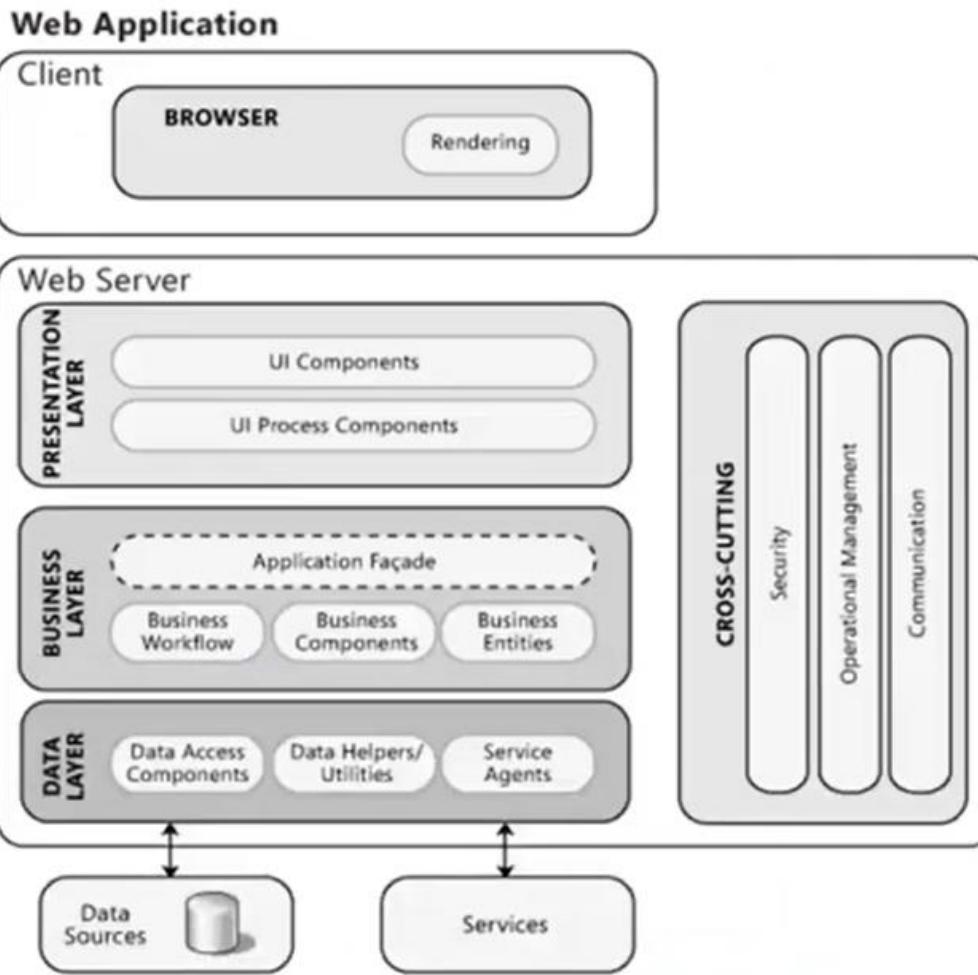


Source:- <http://www.evolutionoftheweb.com/>

Web Architecture



Web App Architecture



Web Apps Overview

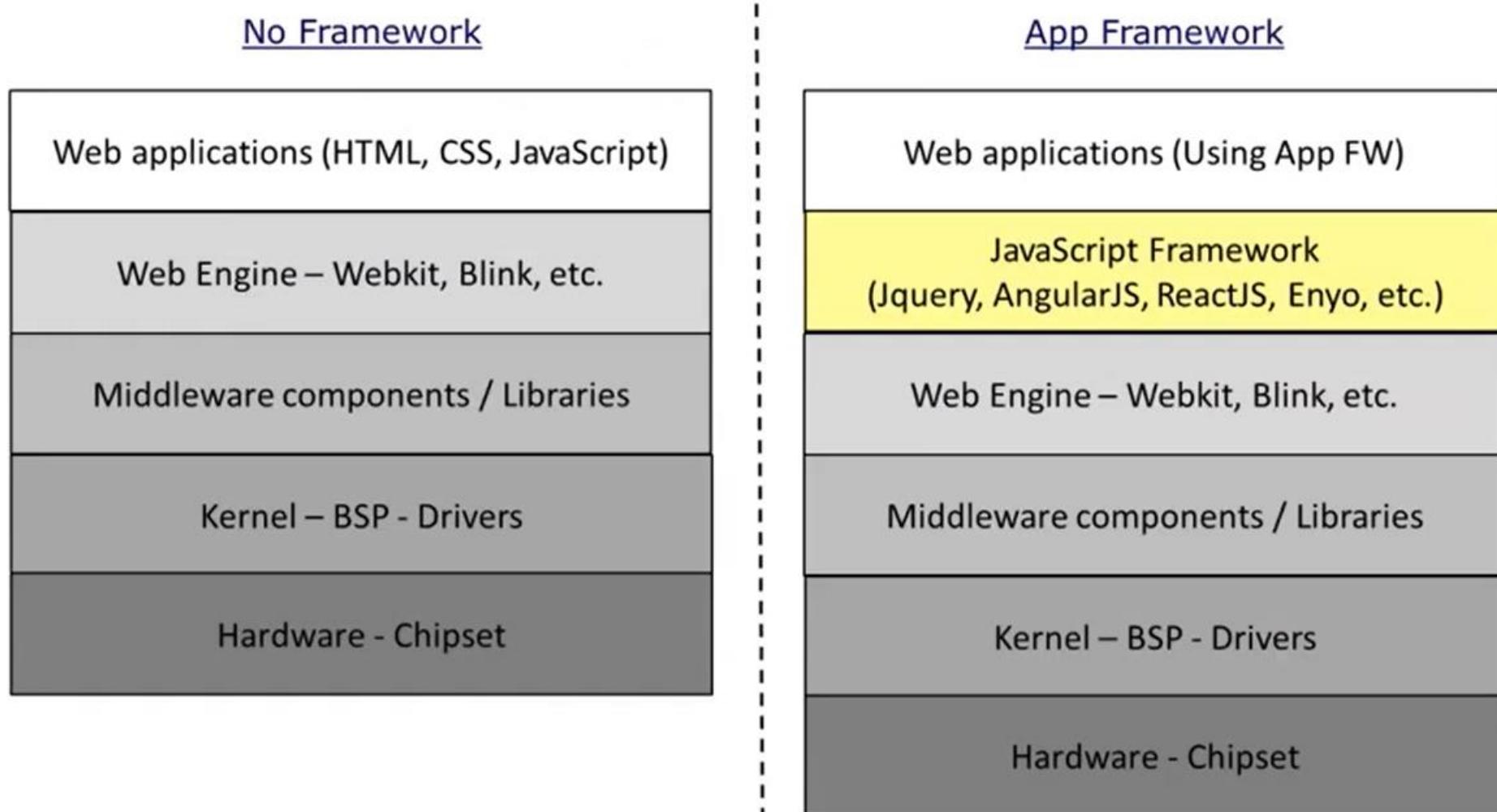


Native
Application Model

Web App Overview

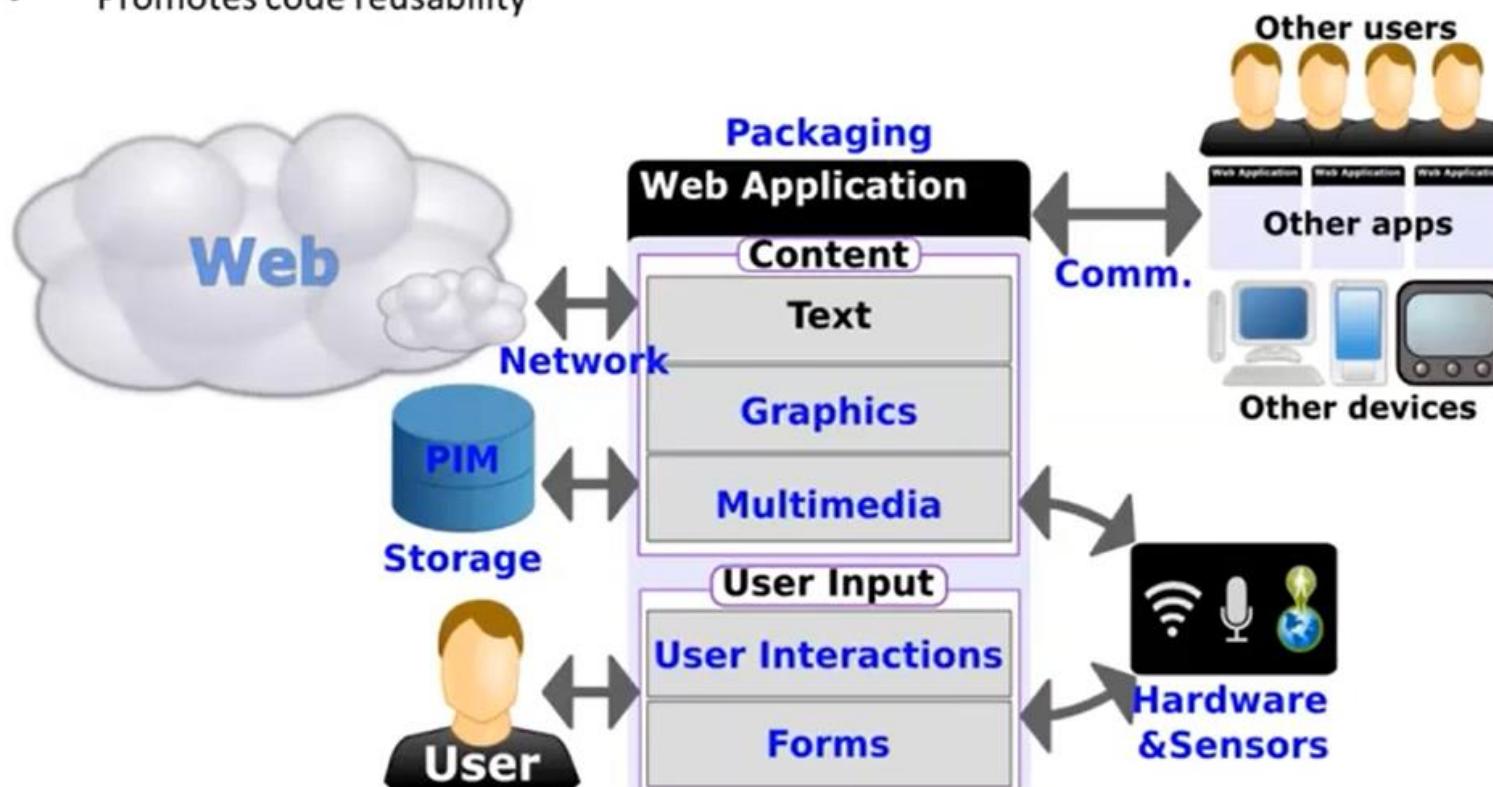
- Web App Uses native application model
- Web App's application data, logic and UI are integrated within an executable installed on OS.
- Has direct access to OS services and data.

Web App Framework



Application Framework - Benefits

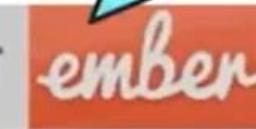
- A Web App Framework makes the following easy for the application:
 - UI Library / Template (Application UI ease & consistency)
 - Graphics / Animation support Lib
 - Database access (by providing a library / API for data store or retrieval)
 - Data Management, binding, etc.
 - Session management
 - Promotes code reusability



Popular JavaScript Frameworks

- For complex front-end apps
- Two-way binding
- Easy to learn

- Powerful View Layer
- Virtual DOM



An object-oriented, cross-platform
JavaScript framework.



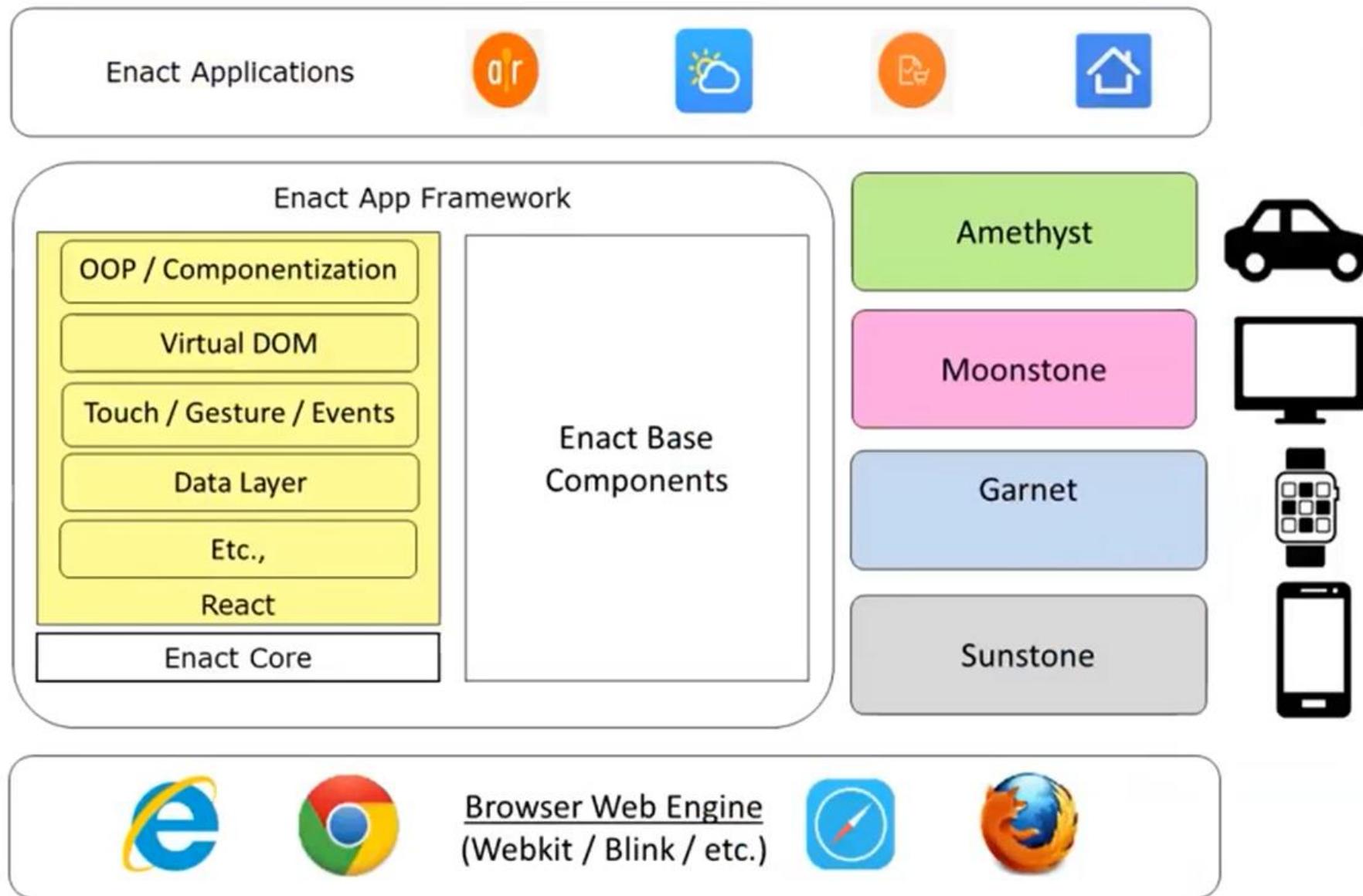
- Templates
- Fast development

- Componentized
- Complex apps

- MVVM Framework

- Full –fledged MVC Framework
- For simple apps
- Single page application specialist

Enact Framework Architecture



Thank You

