Tizen Overview & Architecture

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Overview of Tizen

- Defining characteristics:
  1. Tizen is a Linux Foundation project based on Linux and various open source projects
  2. Targets multiple device categories including smart phones, in-vehicle infotainment devices, smart TVs, computers, cameras, printers, and more
  3. Comprehensive standards-based with widest HTML5 coverage
  4. Strong support from industry
1. Tizen Is Open Source Project

- Upstream projects used by Tizen:
  - X Windows, Cairo, EFL for UI and graphics
  - Gstreamer, PulseAudio, OpenAL for multimedia
  - Connman, BlueZ, libsoup, wpa_supplicant for connectivity
  - WebKit for Web
  - Smack and OpenSSL for security
  - Dbus, glibc for base
  - Sqlite for database and PIM
  - Linux for OS Kernel
  - Eclipse for Tizen SDK
  - QEMU, U-Boot for target Emulator
  - GCC, llvm, cmake, gbs for build
  - And more…
1. Tizen Is Open Source Project | Contribution to OSS

- Intel and Samsung maintain or significantly contribute to:
  - Linux, WebKit, EFL, GStreamer, U-Boot, FFmpeg, WebCL, Cairo, BlueZ, QEMU, GCC, ConnMan, NFC, PulseAudio, Smack, Wayland, oFono, X, wpa_supplicant, Dbus, glibc, OpenGL, Geoclue, and libsoup
  - With notices, attributions, full license statements, and compliance to other obligations

- Virtually everything newly developed for Tizen has been open-sourced under Apache 2.0 License:
  - app-core, WRT(Web Runtime), system-server, sensor-fw, app-service, slp-pkgmgr, libslp-pm, msg-service, email-service, telephony-daemon, audio-session-manager, contacts-service, slp-calendar, accounts-svc, sync-fw, cert-svc, secure-storage, nfc-manager, and more.
2. Tizen Is a Cross-category Platform

Current Profiles

- for mobile
- for IVI

Future Profiles

- for TV
- for camera
- for printer
- for PC
- for washing machine?
3. Tizen Has Strong Industry Support

- Guiding the industry roles of Tizen
- Requirements gathering
- Identification & facilitation of service models
4. Tizen Is Standards-based | HTML5/W3C API Support

- Tizen has the top score in html5test.com
- HTML5 is being adopted rapidly, especially for mobile Web app development

### Tizen Release History

<table>
<thead>
<tr>
<th>Tizen 1.0</th>
<th>April 2012</th>
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<tbody>
<tr>
<td>Web-centric platform</td>
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<tr>
<td>- Highest HTML5 coverage</td>
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<tr>
<td>- Tizen Device Web API</td>
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<td>- Web UI framework (jQueryMobile based Extension)</td>
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<table>
<thead>
<tr>
<th>Tizen 2.0</th>
<th>February 2013</th>
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<tbody>
<tr>
<td>Web/native dual framework</td>
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<tr>
<td>- Native API</td>
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<tr>
<td>- Unified SDK for Web and native</td>
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<tr>
<td>- Web Runtime based on WebKit2</td>
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<tr>
<td>- Web Audio, HTML Media Capture</td>
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<td>- HTML Drag &amp; Drop, Clipboard</td>
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<tr>
<th>Tizen 2.1</th>
<th>May 2013</th>
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<tr>
<td>Hybrid Web/Native, Enhanced Security, and Optimized Perf.</td>
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<tr>
<td>- Hybrid Web and native app support</td>
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<td>- Content security policy</td>
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<td>- Trusted inter-app sharing</td>
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<td>- Account management</td>
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<td>- QR code and image recognition</td>
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<td>- Systemd replacing init daemon</td>
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<tr>
<th>Tizen 2.2</th>
<th>July 2013</th>
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<tr>
<td>Commercial Ready with Enhanced UX</td>
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<tr>
<td>- H/W Menu &amp; Back key</td>
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<td>- Better Font Legibility</td>
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<tr>
<td>- H/W LED Notification</td>
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<tr>
<td>- Integration of Apps w/ Contact</td>
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<tr>
<td>- Native API for Secure Element</td>
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<tr>
<td>- UI Customizer</td>
<td></td>
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<tr>
<td>- Live Web App. Editing</td>
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- Linux kernel 2.6.36
- Linux kernel 3.0 (w/ many 3.4 features backported, such as CMA/IOMMU)
- Memory optimization for graphics (Framebuffer → DRM/GEM, DMABUF)
- eMMC 4.5 support, V4L2 (for codec and camera) support
Tizen Websites and Community

- **Websites**
  - http://www.tizen.org
  - http://developer.tizen.org/sdk
  - http://source.tizen.org/
  - https://developer.tizen.org/documentation
  - http://seller.tizenstore.com

- **Community**
  - Mailing lists: http://www.tizen.org/community/mailing-lists
  - IRC channel: #tizen
  - Wiki: https://www.tizen.org/community/wiki
  - IVI: https://wiki.tizen.org/wiki/IVI
  - JIRA: http://bugs.tizen.org
Tizen Architecture
Architecture Overview in Detail

- **Web framework**
  - Provides state-of-the-art HTML5/W3C APIs, Web UI framework, supplementary APIs, and additional Tizen device APIs

- **Native framework**
  - Supports full-featured native application development and provides a variety of features like background service, image and face recognition, and TTS/STT

- **Core**
  - Underlying layer for Web and native providing common functionalities and a security mechanism
  - HW adaptation layer with plug-in architecture
  - OpenGL® ES/EGL graphics driver
Web vs. Native Framework

- Native and Web frameworks are complementary to each other
  - Web is strong in portability, ease of app development, and has a minimal learning curve
  - Native is relatively better in terms of performance and memory consumption
  - Native enables reusing the existing engine and libraries written in C & C++ in app development
Different combinations for mixing Web and native, depending on the characteristics or requirements of the app to be developed.
Native Framework vs. Core

- Both are native in nature but focusing on different aspects
- Core focuses on:
  - Providing common functionalities to Web and native frameworks
  - No need to guarantee app binary compatibility (ABC)
  - Performance and power optimization
- Native framework focuses on:
  - Application development productivity while guaranteeing ABC
  - Well-documented API references, developer guide, sample codes, and associated tools
Application Types

- **Web and native applications**
  - Apps using only *public* APIs to get full support for package installation and upgrade, security, backward compatibility, and so on
  - Many sample apps included in the SDK

- **Core applications**
  - Apps *using Core APIs* to fully utilize device capabilities such as telephony
  - Usually implemented and preloaded by device implementers
  - Backward binary compatibility is not guaranteed
Web Framework

• W3C standard Web APIs
  • W3C/HTML5 markup, CSS, and JavaScript APIs
• Supplementary APIs
  • De-facto APIs (such as Khronos and Mozilla)
• Tizen Device APIs
  • Advanced access to the device’s platform capabilities
• UI framework
  • jQueryMobile-based
  • Tools, such as widgets, events, effects, and animations
Web Runtime

- Package management (such as installation and update)
- Execution and life-cycle (such as launching, pause, and resume)
- Runtime security (such as API/network access and sandboxing)
- Platform integration
Since 2.0, Tizen is using WebKit2 (http://www.webkit.org)
- Split process model for web content and UI with non-blocking APIs
- UI responsiveness, robustness, security, and better use of multicore CPUs
Web 2D and 3D Graphics

- HTML5 Canvas is accelerated by
  - Cairo OpenGL® ES backend

- WebGL
  - Directly uses OpenGL® ES
  - Triple buffering
Native Framework

- Released in Tizen 2.0
- Set of C++ namespaces with more than 10,000 APIs
  - Base, IO, App, Security, Graphics and UI, Net, Messaging, Social, Locations, Web, etc
- Support for standard C/C++, and popular open source libraries
  - eglibc, STL, libstdc++, libxml2, OpenGL® ES, OpenAL, and OpenMP®
- Multiprocessing support
  - OpenMP, GCD
Core

- Providing common features
  - Various native and Web APIs are implemented using the functionalities of core modules

- Unified management for:
  - Package (un)installation and upgrade
  - Launching applications
  - Windows for different apps with E17
  - Sensor loading and value retrieval
  - Power consumption
  - Connectivity
  - Security enforcement with Smack from the kernel
  - And more..
Tizen IVI Profile
IVI Demands more from Tizen

- Navigation GPS
- Dual Display
- TTS/STT
- Radio

**DRIVER**

- Video playback
- Audio
- Display

**Passenger 2**

- Front – video analytics
- Rear – video analytics

**Passenger 1**

- Mobile Device
- Audio
- Display

**Passenger 3**

- BluRay playback
- Audio
- Display

**SIRIUS**

- Satellite Radio

**Full HD**

- 1080p

**oscon**

- Open source convention
Tizen IVI Release History

**Tizen 1.0**
- **2012**
- **GENIVI Compliance**
  - Fastboot with systemd < 5 secs
  - Rootfs < 500 Mb
  - Sample Navigation App
  - Sample Hands free dialer App
  - Media Player App
  - IVI Home Screen App

**Tizen 2.0**
- **Apr. 2013**
- **Fully functional Web framework**
  - Automotive Message Broker
  - BT HFP dialer application
  - DLNA
  - Murphy Policy Manager
  - WiFi Tethering
  - Dual Display Support
  - Sample IVI apps

**Tizen Next**
- **Focus areas**
  - Wayland
  - Fast Boot
  - Small Footprint
  - Ethernet
  - NFC
  - HW Acceleration
  - Vehicle & Additional Web APIs for Automotive
  - UI Manager
Architecture Overview (IVI profile)

Web Applications

Web Framework

- W3C/HTML5
  - Video
  - CSS3
  - WebGL
  - Worker
  - Automotive (future)

- Device APIs
  - BT
  - LBS
  - NFC
  - Call
  - Msg

Core

- Application Framework
- Graphics & UI
- Multimedia
- Web
- Messaging
- Location
- IVI (Murphy, AMB, Etc.)

- Security
- System
- Base
- Connectivity
- Telephony
- PIM
- Linux Kernel & device drivers
Tizen Development Environment
- Unified IDE w/ Native & Web perspectives (Eclipse-based)
  - Supported OS: Windows XP / 7, Ubuntu, Mac
IDE & UI Builder

- IDE
  - Project management, templates, samples, documentation
  - Debuggers, Profilers, and etc.

- UI & Effects Builder
  - Design your app’s GUI using UI builder in WYSIWYG manner. (for both Web & Native App)
  - 3D content authoring w/ realistic physics based 3D animation w/ Effects builder (for Native)
Emulator, Web Inspector & Simulator

- **Emulator**
  - Emulates various device configuration with QEMU based Emulator
  - Event injection for CALL/SMS, sensors, device orientation, location, and so on.

- **Web Simulator**
  - Run & debug Tizen Web apps on Chrome browser in stand-alone manner (RippleUI based)
  - Simulates Tizen Web APIs via JS backend

- **Web Inspector**
  - Remotely inspect Web apps running on Tizen Web Runtime through Chrome based client
  - Inspection of DOM, styles, and Resources (DB, local storage, cookies, app cache)
  - JS debugging with breakpoint, watch variables, call stack info, etc.
Tizen Going Forward
— Development Model
Tizen 3.0 @ tizen.org

- **Until now**, source code uploaded to tizen.org only at milestones
  - Core platform development has not been shown to public
  - No continuity and transparency

- **From now**, the main area of development and contributions is tizen.org
  - For productization and depending on profile policies, main code tree can be pulled out and built anywhere by anyone

- Moving from **in-out** to **out-in** development
Tizen 3.0

- Configurable and multi-profile support with one code base
- 3.0 is about scalability
  - Many profiles
  - Many devices
  - Many configurations
  - Many architectures

Smartphone device XYZ on ARM produced from same platform code as an IVI device YYY for car ABC running on IA
Conclusions

- Tizen is Standard-based, open source, cross category software platform under Linux Foundation that has strong industry support.

- Architecture:
  - Linux Kernel 3.0
  - Core
  - Web and Native frameworks

- Profiles
  - Mobile
  - IVI

- Tizen 2.2 SDK released, Seller site opened
- Tizen 3.0 Development @ tizen.org