TIZEN Architecture

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What is Tizen

- Open source & standard based software platform
  - ✓ Smart phone, tablet, smart TV나 Netbook 등 다양한 기기에서 작동하는 표준 기반의 개방형 framework
  - ✓ 삼성과 인텔 등 다양한 회사 및 개인 개발자 개발 참여
  - ✓ Cross category platform
  - ✓ W3C/HTML5와 같은 다양한 표준 준수
  - ✓ WebApp, C/C++ 기반 native app 개발 지원

Open source & standard based

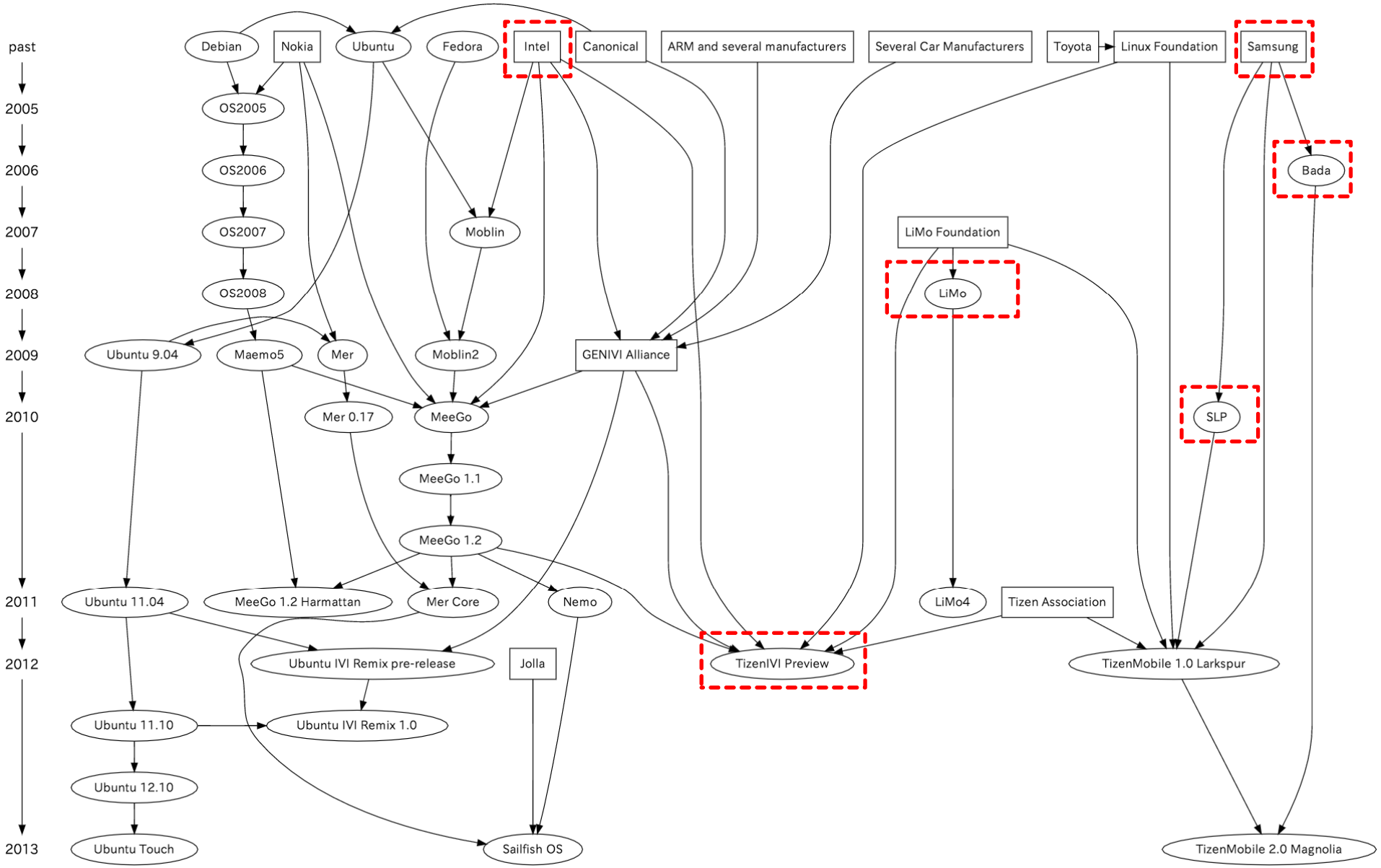
Open source project under the Linux Foundation

"The OS of everything"

Tizen Project

- Under Linux Foundation
- Technical Steering Group
  - ✓ Manages the overall Tizen project
  - ✓ Creating subsystem teams
  - ✓ Delegating work to them as needed
  - ✓ Tracking and managing the state of the Tizen project and subsystems

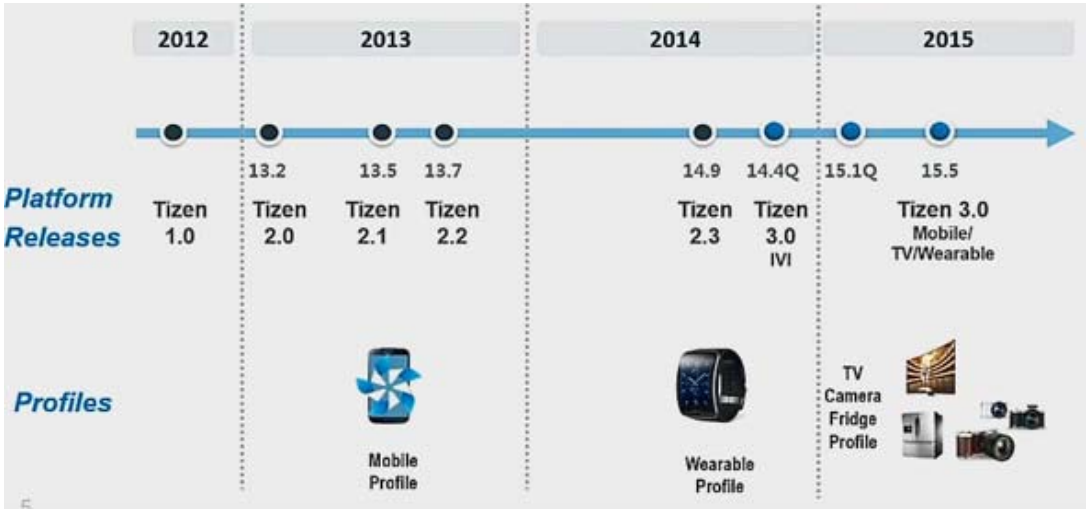
Tizen History



Tizen History (In Construction March, 2013)

Tizen History

- 2012년 4월 : 타이젠 1.0 배포
  - ✓ Larkspur
  - ✓ 웹 애플리케이션 개발 지원
- 2013년 2월 : 타이젠 2.0 배포
  - ✓ Magnolia
  - ✓ 네이티브 애플리케이션 개발 지원
- 2013년 5월 : 타이젠 2.1 배포
  - ✓ Nectarine
- 2013년 7월 : 타이젠 2.2 배포
  - ✓ 플랫폼 프로젝트 EFL 애플리케이션 템플릿 추가
- 2014년 11월 : 타이젠 2.3 배포
  - ✓ 새로운 네이티브 API 도입
  - ✓ 웹 디바이스 API 확장
- 2015년 10월 : 타이젠 2.4 배포
  - ✓ 어플리케이션 백그라운드 정책
  - ✓ 타이젠 확장팩(TEP) – 어플리 케이션 설치

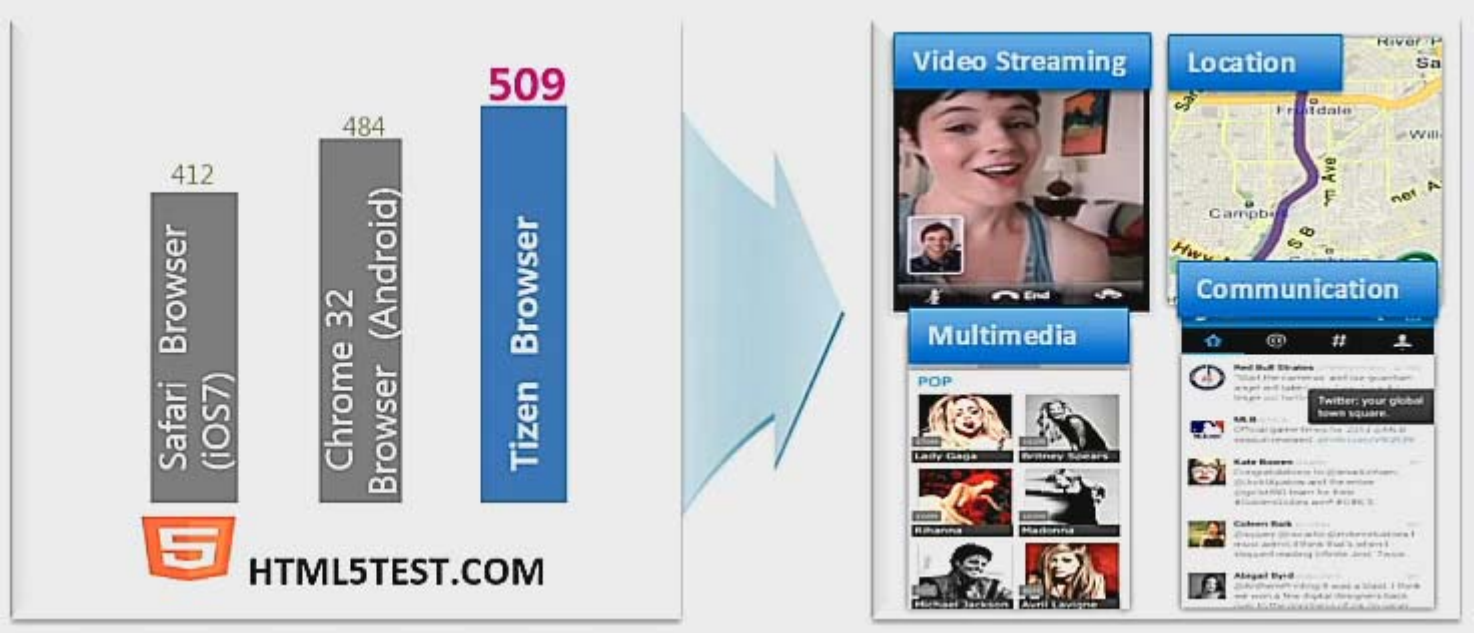


Strengths

- What Tizen offers?

Best HTML5 Support

- Tizen has best HTML5 support



Various Device Support, Cross Category

- Profile based approach to support various device categories
  - ✓ Common platform: components/features belonging to all device categories
  - ✓ Device profile: device specific components/features
  - ✓ Device platform = Common profile + Device profile

2D/3D Graphic Speed

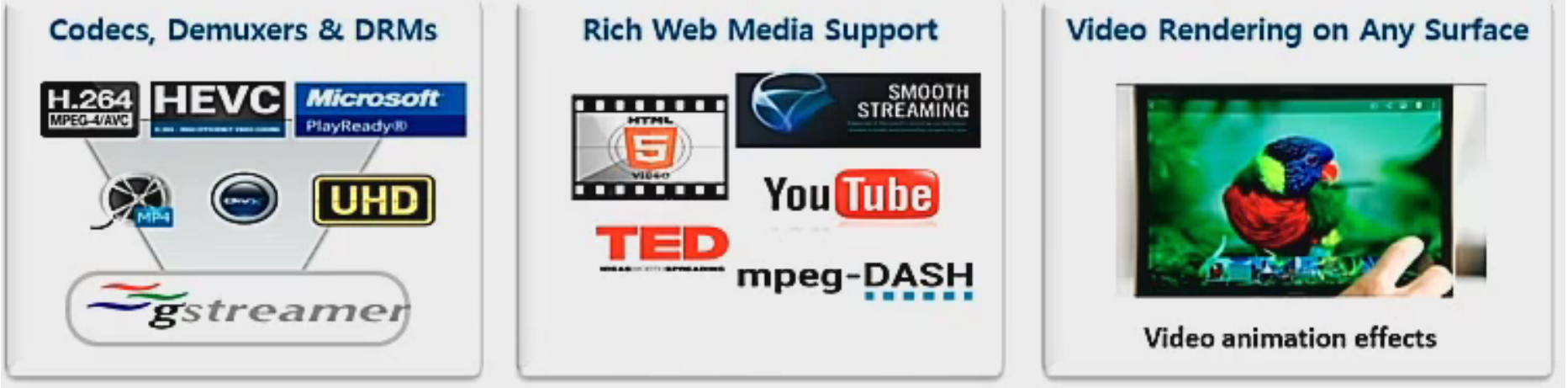
- 2D graphics: Cairo H/W acceleration
- 3D graphics: WebGL support

Boot Time Optimization

- Systemd-based configurable service and booting
  - ✓ Advanced service & daemon management
    - Execute threaded applications in parallel
    - Easier to optimize booting time
    - Easier to configure eservice bring up and management
  - ✓ Result
    - NX300M: 0.5sec
    - Phone: 11sec

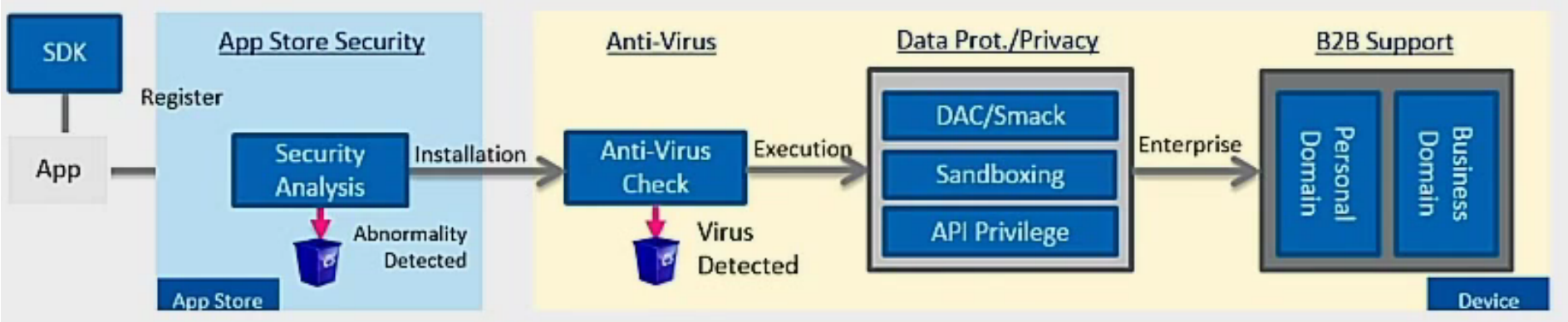
High Quality Audio/Video

- High quality video playback based on plug-in architecture
  - ✓ Play almost every media formats without transcoding
  - ✓ Rich media support for browser and web applications
  - ✓ Covers various scales from wearable device to SmartTV
  - ✓ Support embedded video rendering and video animations effects

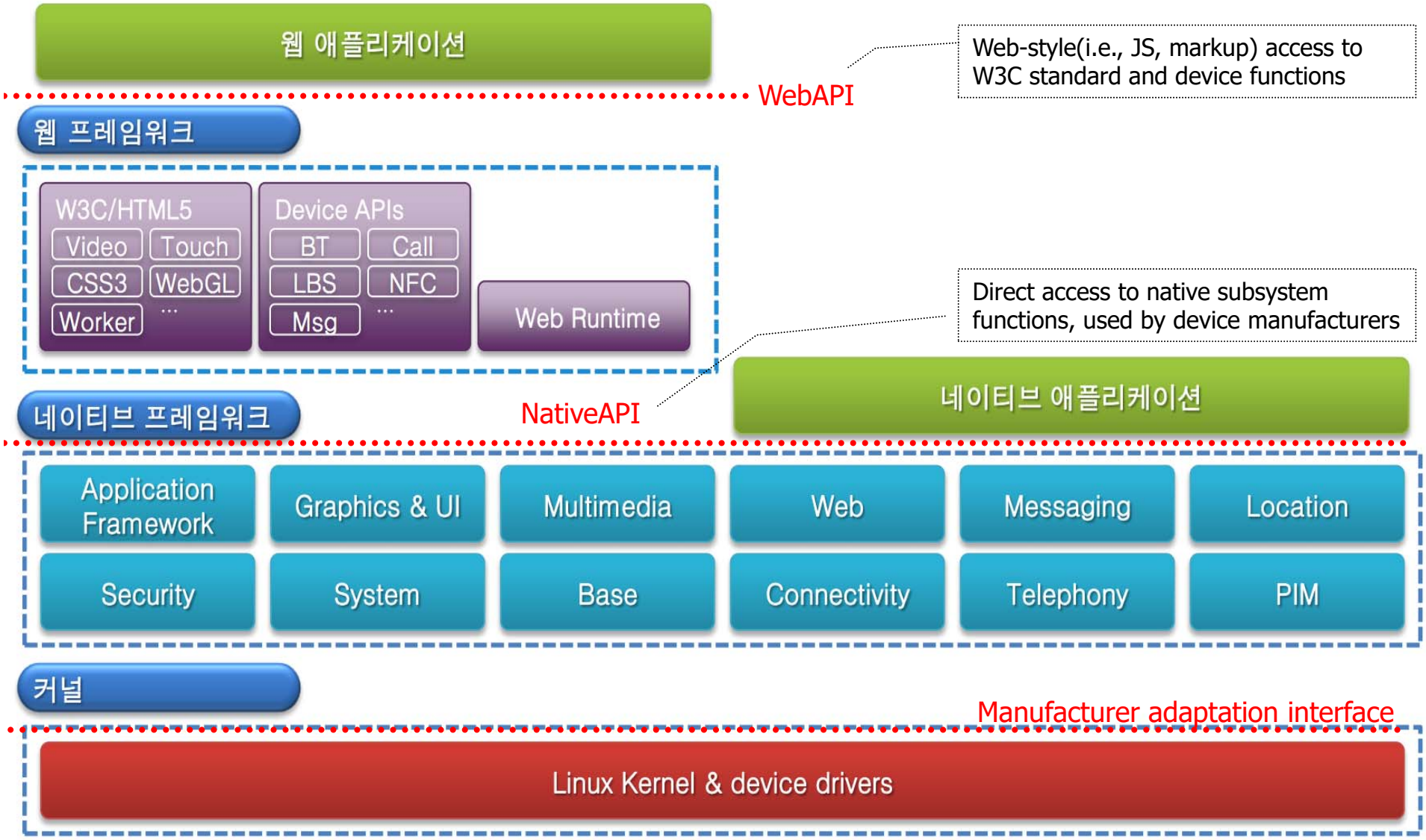


Strong Security

- Securing major points in the whole application life cycle
  - ✓ App store security – static analysis
  - ✓ Anti-virus framework
  - ✓ Data protection and privacy
  - ✓ B2B support

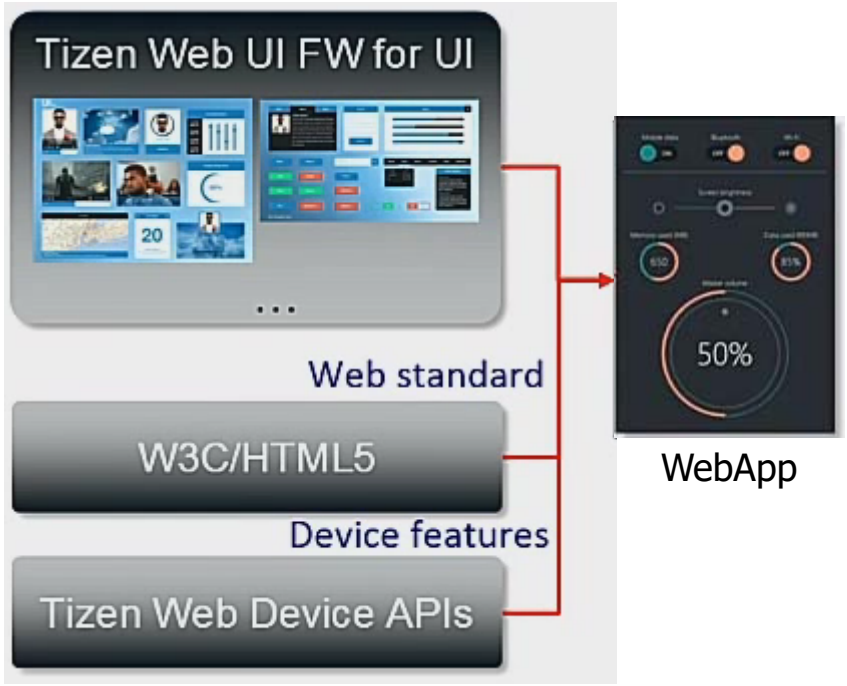


Tizen Architecture



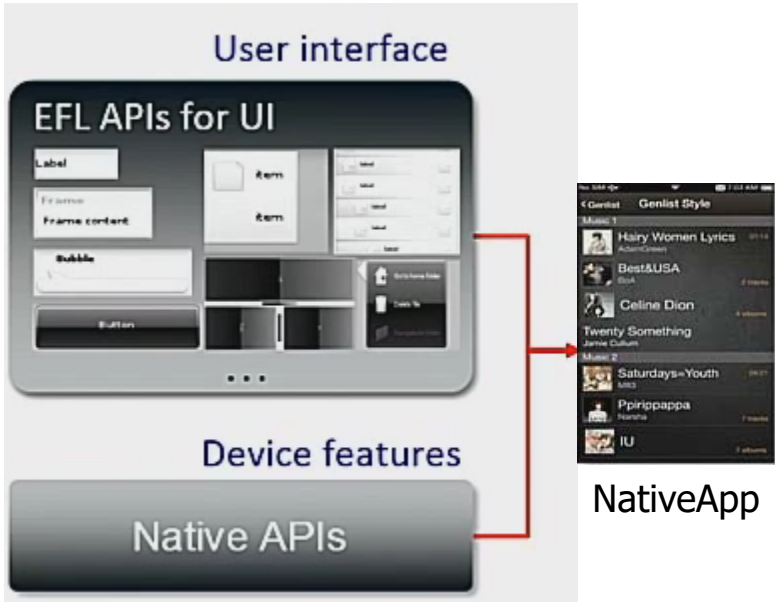
Web Applications

- Application written in WebAPIs for Tizen
- Packaged in W3C widget with configuration
- Good for migration
- User interface
  - ✓ W3C/HTML5, CSS3
  - ✓ Tizen Web UI FW
- Limited access to device features via Tizen Web Device API
- Device features(Tizen defined + W3C)
  - ✓ W3C/HTML5 and de-facto supplementary APIs
  - ✓ Tizen Web Device APIs



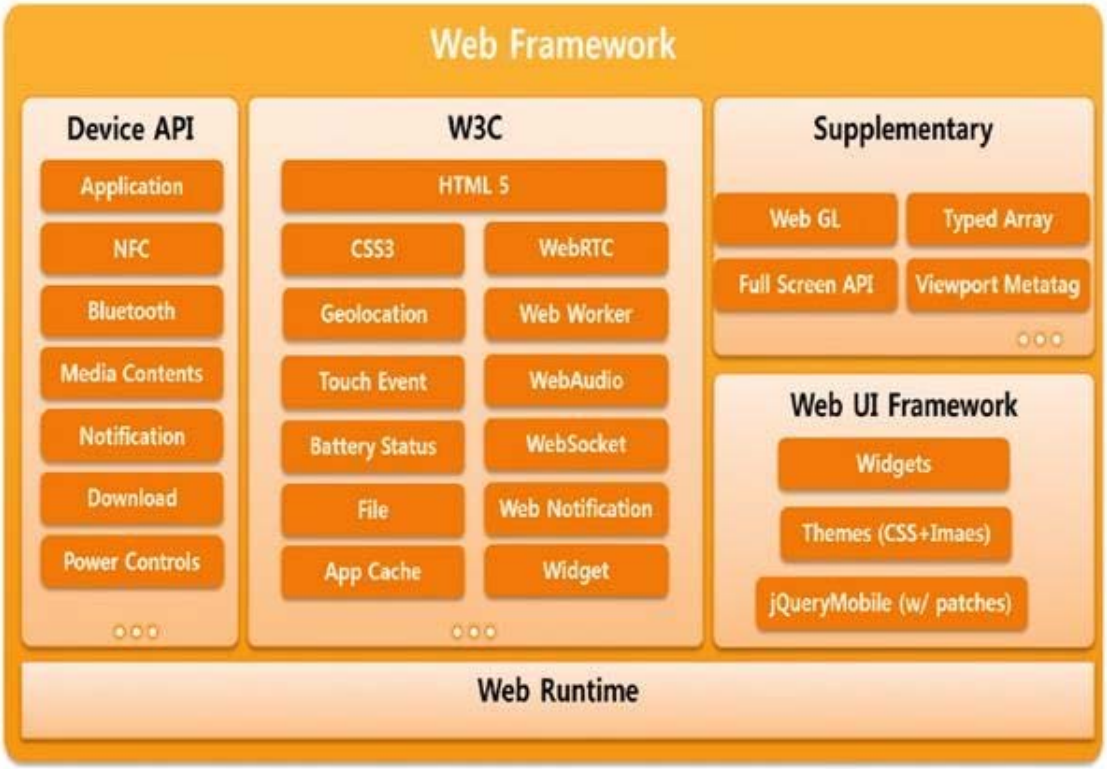
Native Applications

- Application written in NativeAPI for Tizen(C language)
- Packaged into .tpk with privileges and features
- Good for performance
- User interface
  - ✓ Enlightenment Foundation Libraries (EFL)
- Full access to device features
- Device features (Tizen defined + OSS)
  - ✓ App framework: application, package, etc.
  - ✓ Social: contacts, calendar, etc.
  - ✓ Multimedia: image, video, audio, etc.
  - ✓ Other device-related features



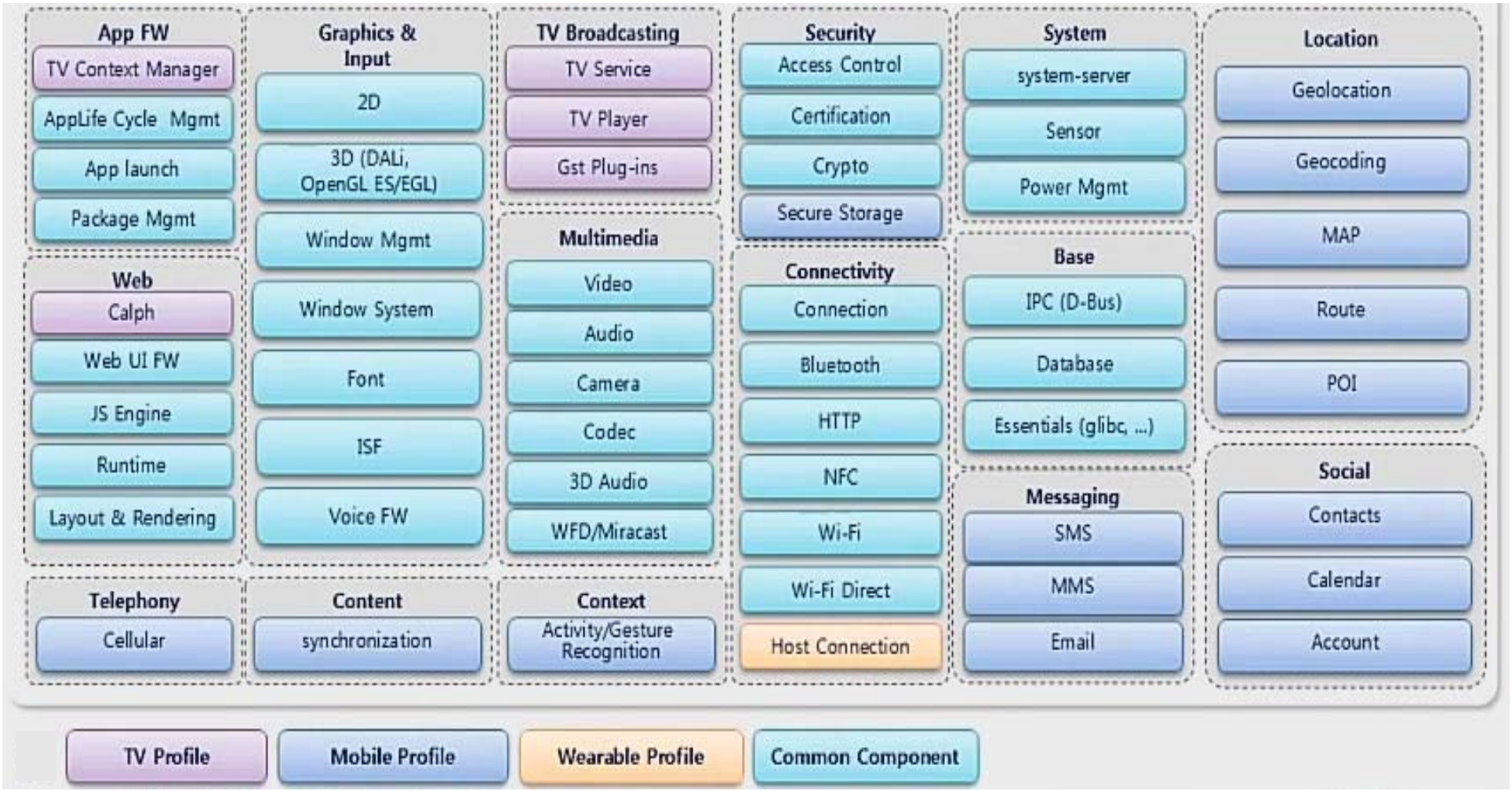
Web Framework Architecture

- W3C standard Web APIs
  - ✓ W3C/HTML5 markup, CSS and JavaScript APIs
  - ✓ Supplementary APIs
    - De-facto APIs
  - ✓ Tizen device APIs
    - Access to the device's platform capabilities
- UI framework
  - ✓ jQueryMobile-based
  - ✓ Tools support



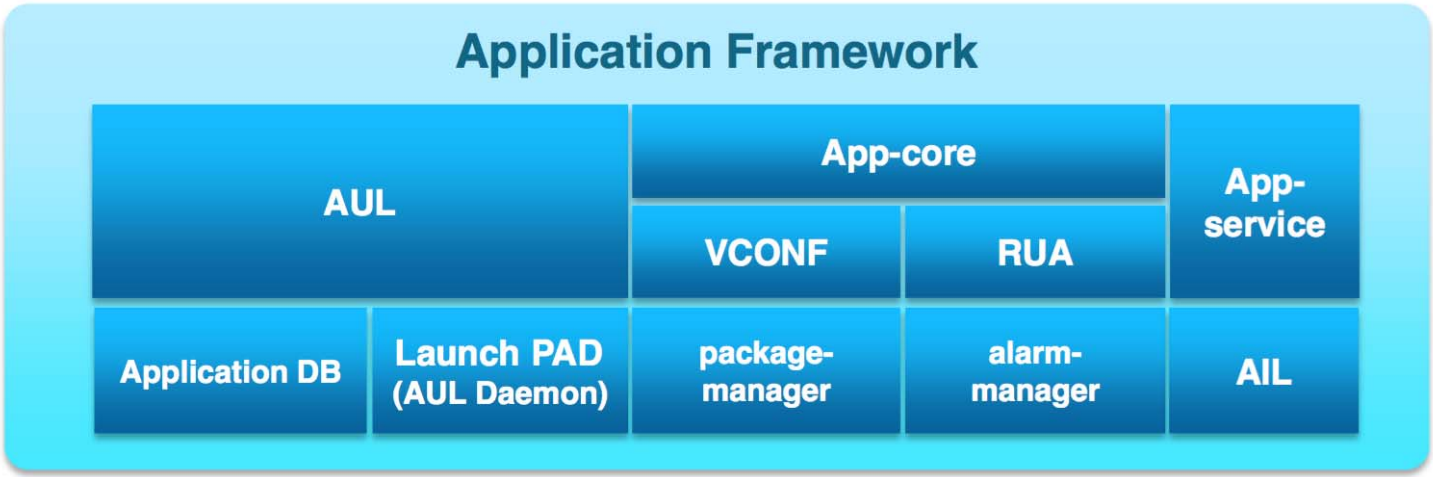
Native Subsystem Architecture

- Unified management
- Flexible architecture with plugins



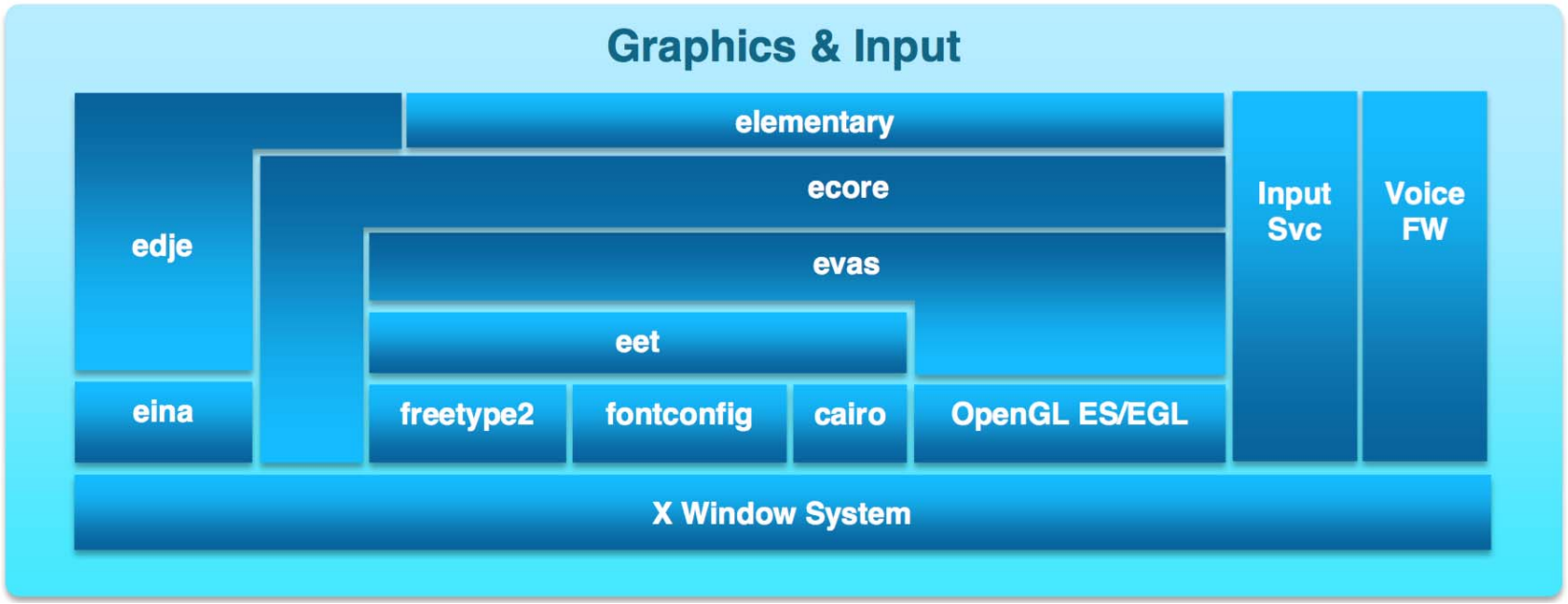
Tizen Core Services

- Application framework
  - ✓ Launching application (aul, app-svc)
    - Explicit or implicit information (combination of Actoin, URI, and MIME) can be used to determine an app to launch
    - Allowed to launch different type of app (i.e., Web→Native, Native→Web)
  - ✓ Application life cycle management and handling system events (app-core)
    - Getting app state change notification or system events through main loop
    - Then, calling registered callbacks for the events
  - ✓ Installing/Uninstalling application (package-manager)
  - ✓ Managing application launched history(librua)
  - ✓ Setting an alarm to launch at specific time (alarm-manager)



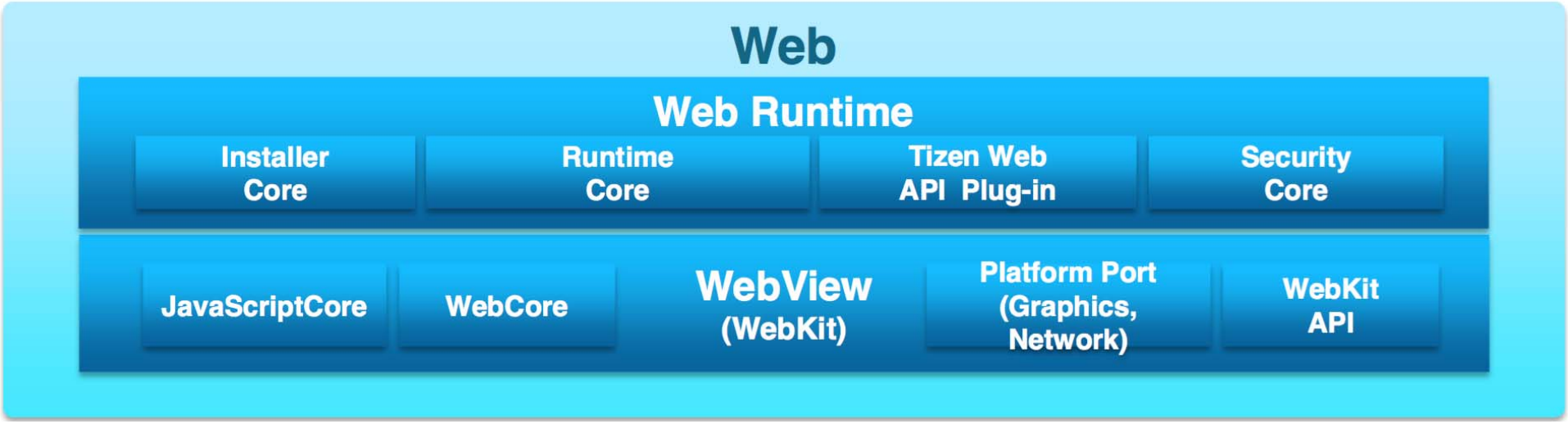
Tizen Core Services

- Graphics & Input
  - ✓ EFL (Enlightenment Foundation Libraries)
    - Rich widgets multiple theme supports by Elementary
    - Retained mode canvas by Evas (Scene-graph, OpenGL ES back-end)
    - Compositing Window Manager
  - ✓ Window System based on X11
  - ✓ 3D (OpenGl ES), Font (freetype2, fontconfig)
  - ✓ Input service (SCIM), Voice FW (STT, TTS)



Tizen Core Services

- Web
  - ✓ Best web experience with browser and packaged Web Apps
    - Focusing on functionality(HTML5), performance(UI responsiveness, 2D/3D acceleration, JS Engine), standard compliance(W3C)
    - More device feature accessibility through Tizen device API
    - jQuery mobile based Tizen web UI FW enables easy WebApp development
  - ✓ WebView (WebKit / EFL) : JavaScriptCore, WebCore, WebKit API
  - ✓ Web Runtime : execution environment for packaged WebApps

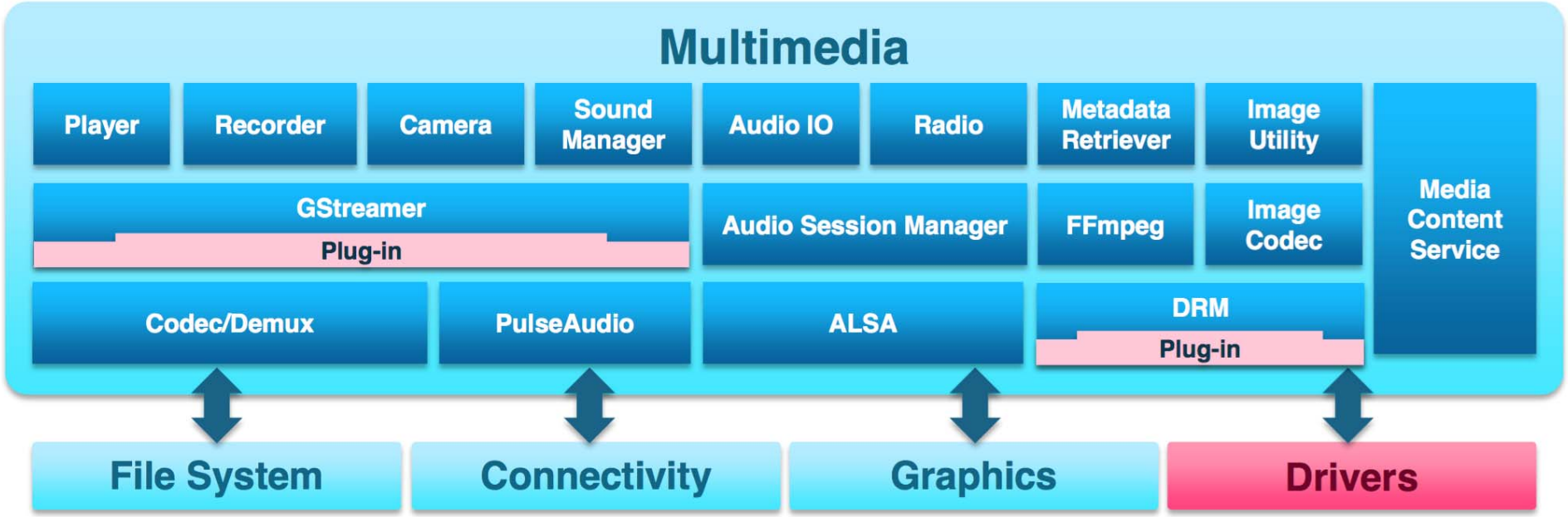


Tizen Core Services

- Multimedia
  - ✓ Provides
    - Playback of audio and video contents (local and streaming)
    - Capturing images and recording audio and video
    - 3D audio sound (OpenAL) specially for games
    - Scanning & playback of radio
    - Determining audio policy
    - Extracting and displaying media content information
  - ✓ Features
    - High quality video playback
      - Full HD (1080p) playback (with H/W codec & render optimization)
      - Support for various kind of multimedia streaming(HTTP, RTP/RTSP)
      - Support for HTML5 video and embedded playback in web browser
    - High quality & high speed camera/recorder
      - High quality image capture & video recording
      - Support for various kind of shooting mode (single, continuous, panorama,etc)

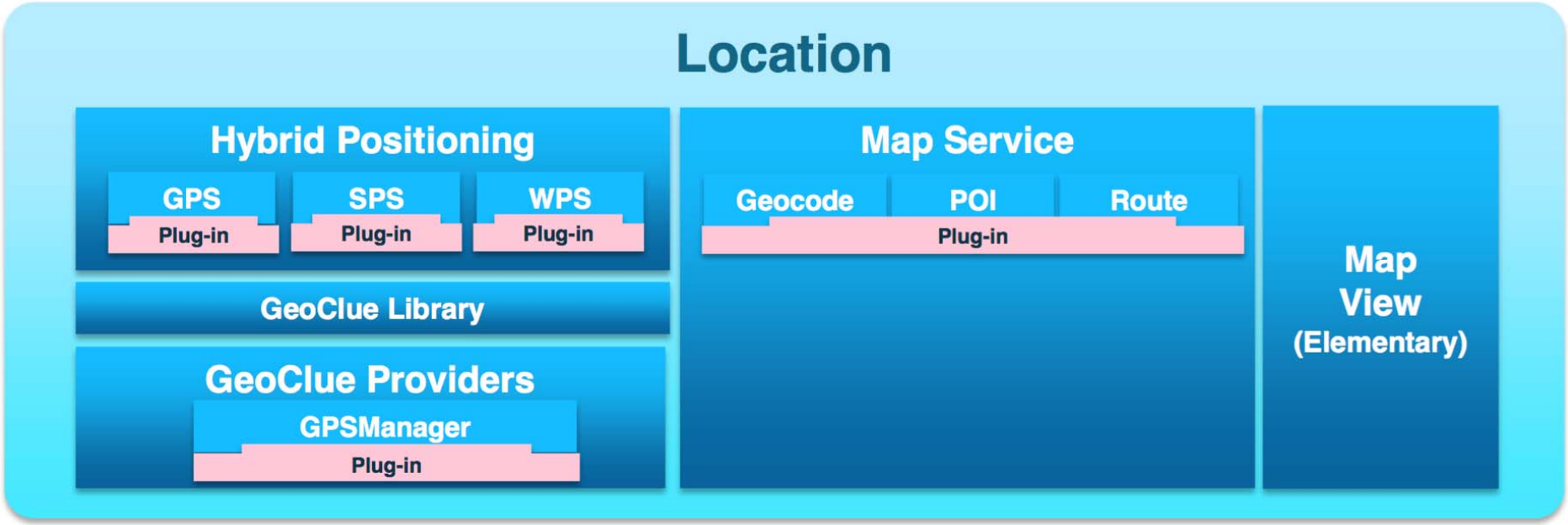
Tizen Core Services

- Multimedia
  - ✓ Gstreamer : audio, video, recording, streaming, editing
  - ✓ Audio session manager : sound policy management
  - ✓ PulseAudio : Software Mixing multiple audio streams
  - ✓ Multiple-format codec : various support of codec
  - ✓ Media content service : content management for media file
  - ✓ Audio I/O: accessing raw audio buffer to manipulate



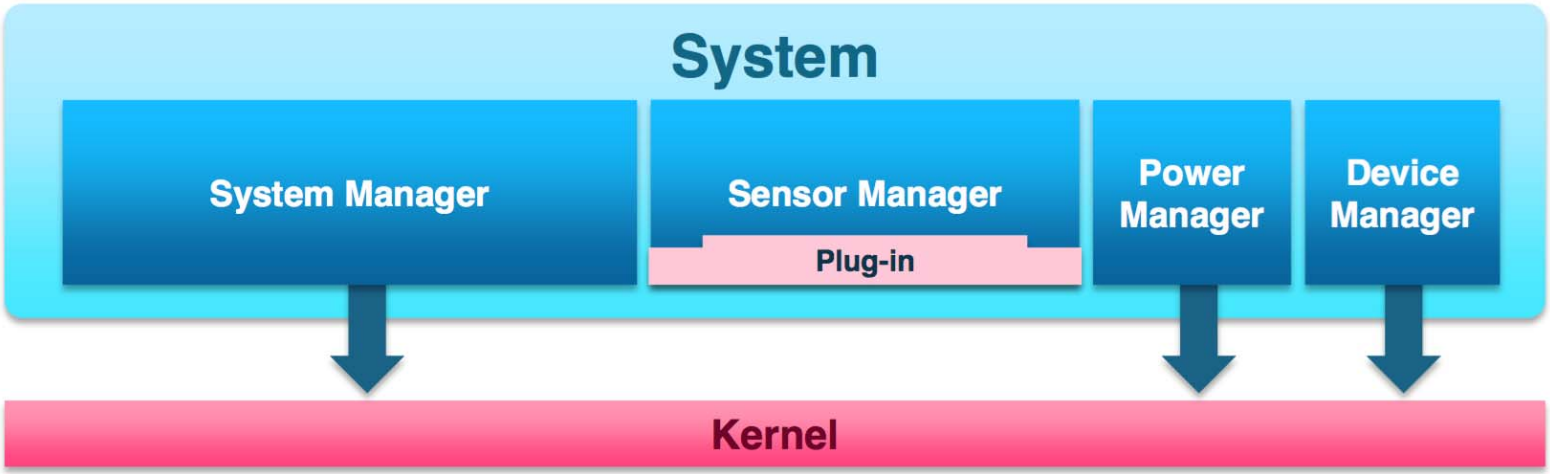
Tizen Core Services

- Location
  - ✓ Provides
    - Hybrid position information (GPS, SPS, WPS)
    - Map service (Geocode, POI, Route)
  - ✓ Key components
    - GeoClue: deliver location info from various positioning sources
      - GeoClue library : an open source geo-information library
      - GeoClue Providers : implement the GeoClue Library API
      - Currently GPS manager in GeoClue providers is provided



Tizen Core Services

- System
  - ✓ Provides
    - System monitoring and events handling functionalities
  - ✓ Key components
    - System Manager
      - Runs as a daemon process
      - Monitors device and system status and handles events from devices (battery, USB, MMC, charger)
    - Sensor Manager : handling sensor events from various sensors
    - Device Manager : setting/getting device values such as brightness
    - Power Manager : controls LCD display backlight and application sleep

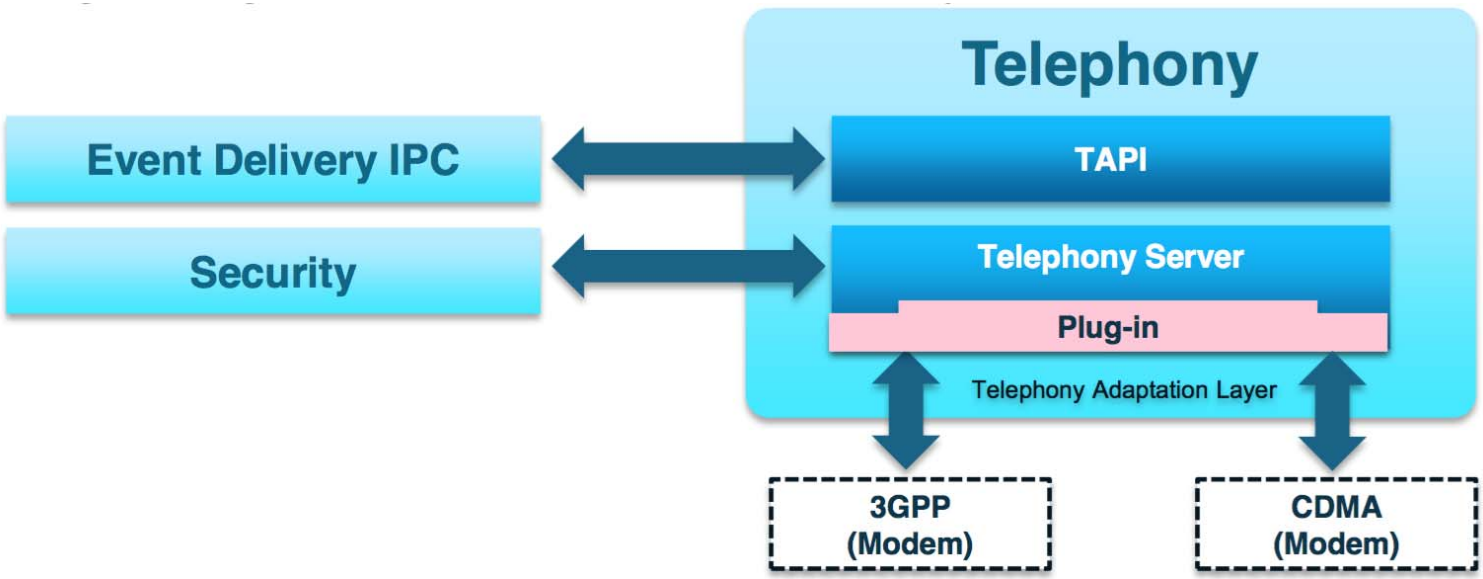


Tizen Core Services

- Connectivity
  - ✓ Cellular and Wi-Fi connection
    - "Always-on" internet connections based on cellular(e.g.3G) and Wi-Fi
    - Connman manages internet connections (allowing automatic connection for available Wi-Fi access point)
    - Managing statistics of data network
  - ✓ Bluetooth
    - Based on Bluez and profiles(OPP, A2DP, RFCOMM, HFP, HDP, etc)
    - Discovering/bonding/exchanging data with remote devices
  - ✓ Tethering
    - Providing three type of tethering: USB, Bluetooth and Wi-Fi
  - ✓ NFC
    - Including NFC Manager to handling NFC plug-ins
    - Supporting P2P, controlling NDEF tag, car emulator
  - ✓ Wi-Fi
    - Scanning and connecting access point
    - Connecting hidden access points

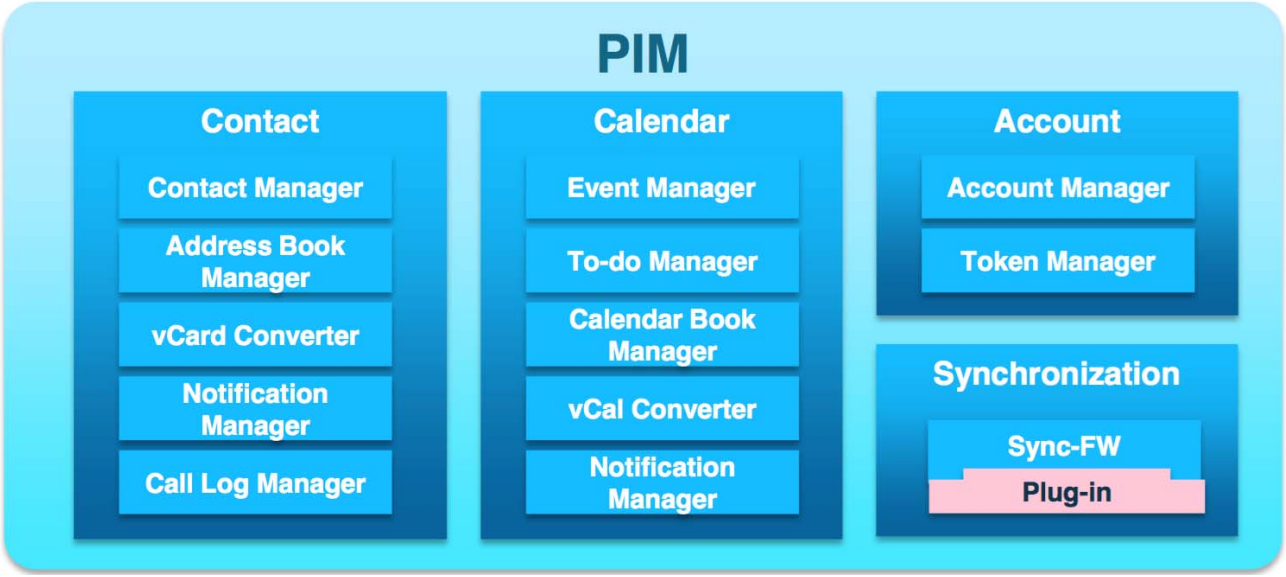
Tizen Core Services

- Telephony
  - ✓ Consists of cellular functionalities for communication with modem
    - Managing call/call-dependent services, packet-related services, network registration and confi guration services, SMS services for UMTS and CDMA
    - Managing SIM application toolkit services for UMTS
    - Managing SIM files, phone book, and security
- Key components
  - ✓ TAPI is available as a library for client
  - ✓ Defining a plug-in architecture for telephony server



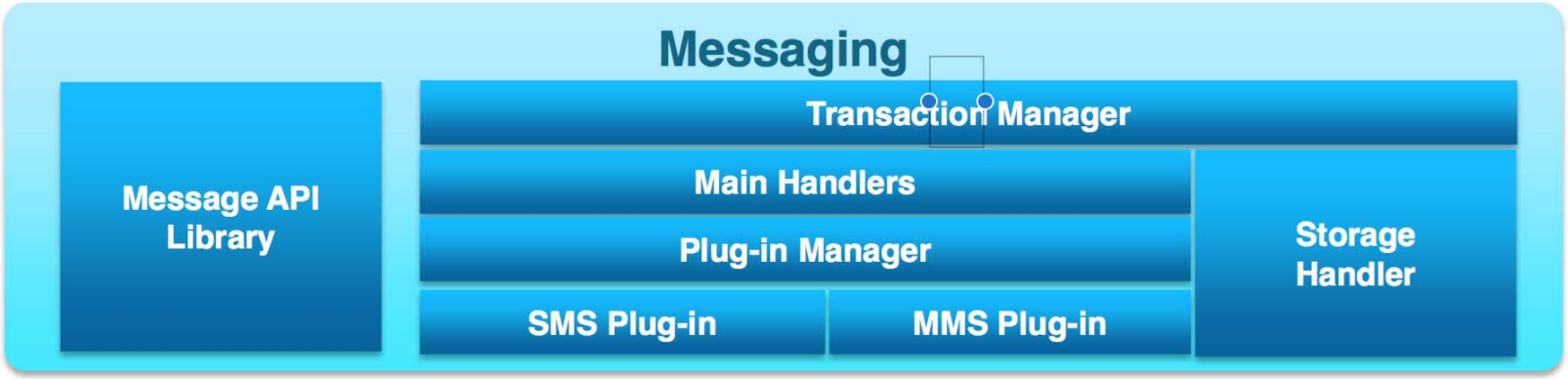
Tizen Core Services

- PIM
  - ✓ Provides: contact, calendar, account, and sync services
  - ✓ Key components:
    - Account : manage accounts to share account information on the device
    - Contact/Calendar
      - Account based, multiple address/calendar books for an account
      - Enough features to satisfy mobile contact/calendar app requirements
      - Supporting vCard 3.0 and vCalendar 1.0 respectively
    - Synchronization (Sync-FW)



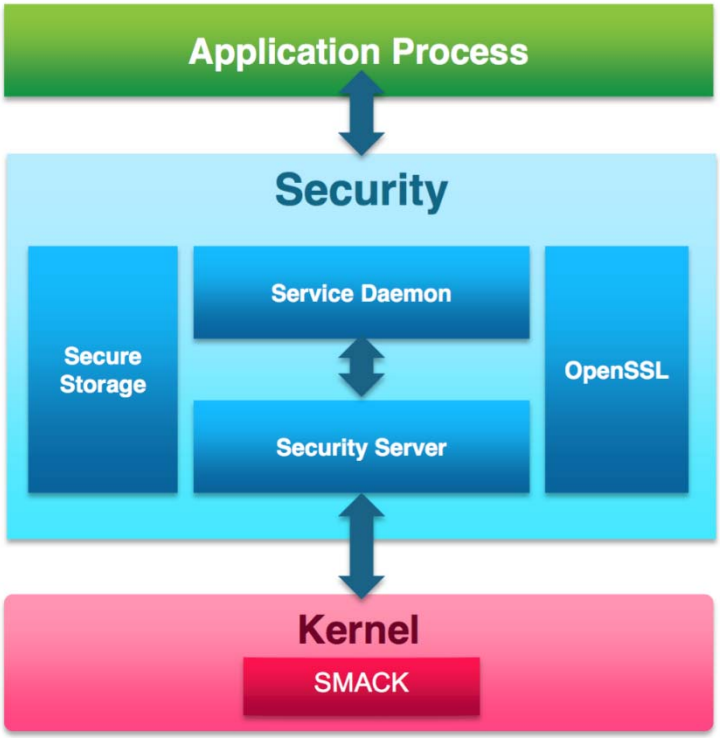
Tizen Core Services

- Messaging
  - ✓ Provides : SMS, MMS, Email
    - SMS, WAP and cell broadcast messages
    - MMS protocols : OMA MMS 1.2.
    - Email protocols : SMTP, IMAP, POP3
  - ✓ Key components
    - Message client API
    - Message server
      - Transaction Manager : manage IPC between message server and library
      - Main Handlers : handle message sending/receiving/filtering/setting
      - Storage Handlers : save on DB
      - Plug-in manager: manage SMS and MMS plug-ins



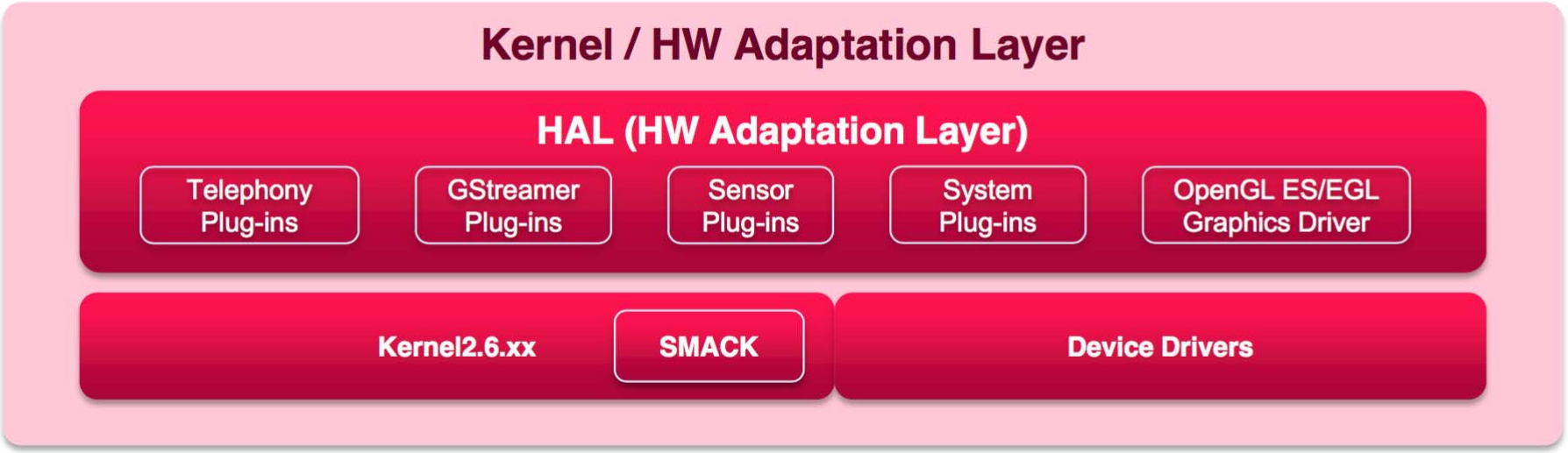
Tizen Core Services

- Security
  - ✓ Provides
    - Certificate management and verification
    - Secure storage for confidential data
    - User space access control management
    - Cryptography and SSL support
    - Mandatory access control support
  - ✓ Security model
    - No root application/No privilege escalation
    - Sandboxed by SMACK
    - Service daemons will make use of SMACK and enforce access control in server side
    - Manifest based permission policy for Apps



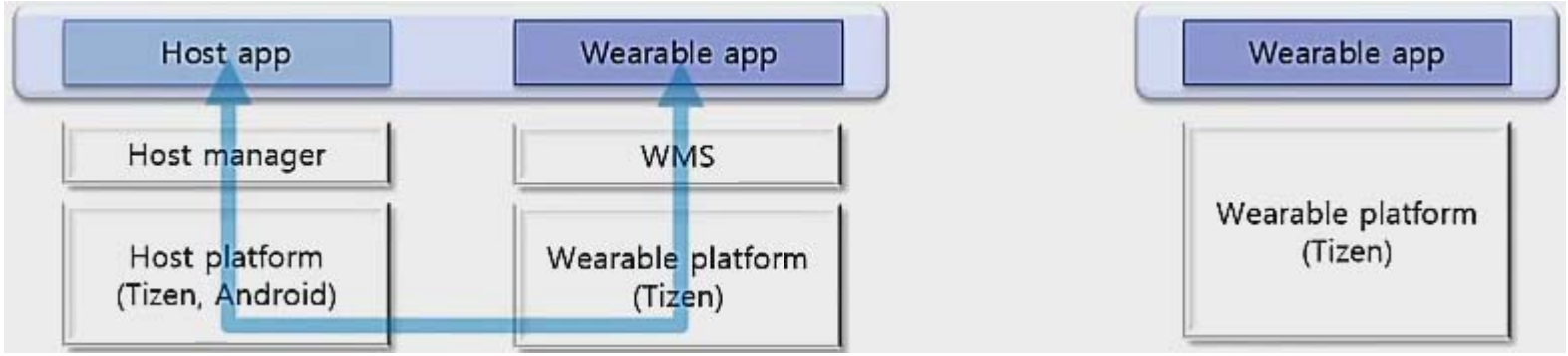
Kernel

- Kernel and hardware
  - ✓ Device driver
  - ✓ H/W adaption layer
    - Plug-ins
  - ✓ OpenGL ES/EGL graphic driver
    - DRM based graphics stack



Wearable Profile

- Dual app model
  - ✓ Companion type
    - One actual application consisting of host app and wearable app vis connectivity
  - ✓ Standalone type
    - Independent wearable app without host app or device

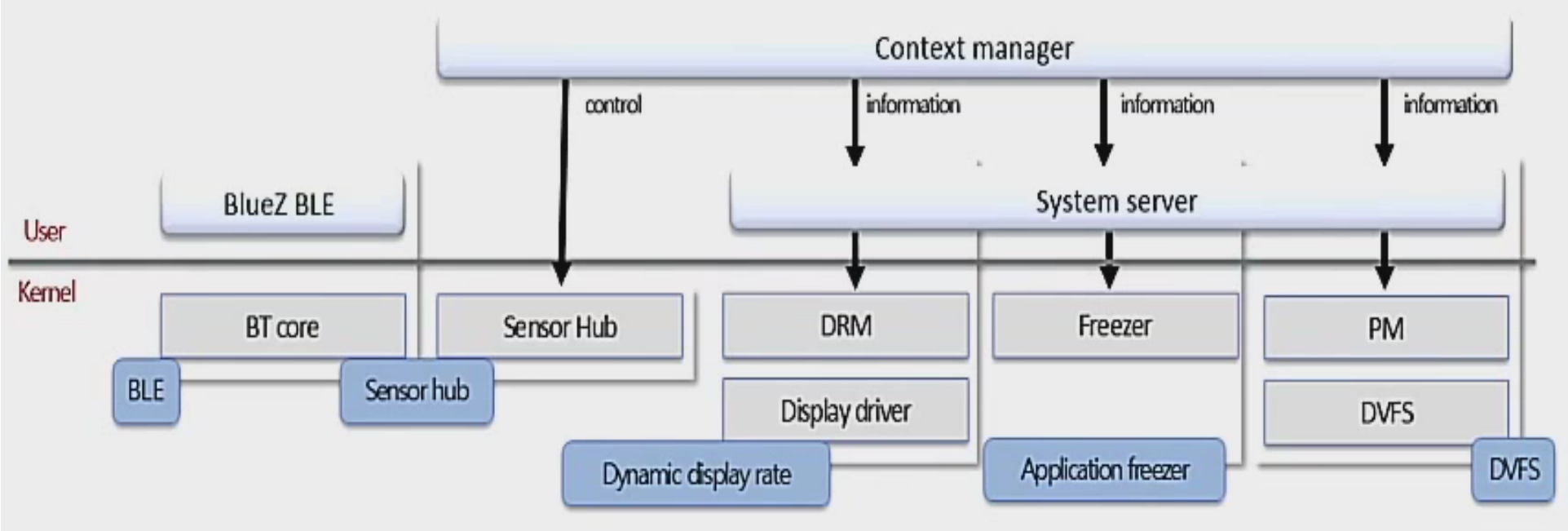


Companion type

Standalone type

Wearable Profile

- Power saving
  - ✓ Bluetooth low energy (BLE)
  - ✓ Sensor hub
  - ✓ Dynamic display rate
  - ✓ Application freezer
  - ✓ Dynamic Voltage & Frequency Scaling (DVFS)



TV Profile

- TV specific additions in native subsystem
  - ✓ TV broadcasting support(ATSC, DVB)
  - ✓ TV specific input & application scenario
  - ✓ TV controls & GUI theme for TV widgets(EFL)
- TV broadcast drivers (linuxdvd, v412)
- Connectivity standards for TV
- WebAPIs (no public mobile OSP APIs)
- Native applications with TV ref. UX
  - ✓ Home screen, Live TV, Web browser, etc.
- Supporting through open reference HW (Odroid U3)

타이젠 전망

- 타이젠 과제
  - ✓ 주도 회사가 사실성 삼성전자뿐
    - 스마트폰 제조사중 타이젠을 쓰는 회사가 삼성 외에는 전무
    - LG나 구글 등 하드웨어나 경쟁기업의 참여 가능성 없음
    - 삼성전자 혼자서 이끌어 나가야 함
  - ✓ 생태계 확보 필요
    - 소비자나 앱 제작자가 타이젠 필요성 낮음
    - 타이젠 디바이스 수의 부족

타이젠 전망

- 타이젠 전망
  - ✓ 타이젠 탑재 기기의 꾸준한 증가
    - RPi, Odroid 등
  - ✓ HTML5시대 와 시기상 긍정적
  - ✓ IoT를 위한 OS 역할 확대
  - ✓ 타이젠 가능성 지속 확대
    - 삼성전자 타이젠 개발자 컨퍼런스
    - SDK 지속 업데이트

Reference

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