**SDK** 

SDK

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SDK	SDK	SDK	SDK	SDK	SDK	
21	22	23	24	25	26 & <u>27</u>	
Lollipop	Lollipop	Marshmallow	Nougat	Nougat	Oreo	<b>—● Codename</b>
5.0.1, 5.0.2	5.1.1	6.0.1	7.0	7.1	8.0 & <u>8.1</u>	<ul><li>Version name</li><li>Following versions</li></ul>
12 Nov 2014	09 Mar 2015	05 Oct 2015	22 Aug 016	7.1.1   O4 Oct 2016	04 Jul 2017 / <u>Dec 2017</u>	Release date
3.16.1    LOLLIPOP	3.16.1    LOLLIPOP_MR1	3.18.10   M	4.4.1     N	4.4.1   N_MR1	4.10 H	<ul><li>Kernel version</li><li>VERSION_CODE const</li></ul>
		Material Design and refined Roboto font			O & O_MR1   Material Design and refined Roboto font	Graphical theme and font
64 bit support (ARM v8, x86-64 and MIPS-64)		Stricter APK validation, an APK must be re-signed if any of the contents are removed	<ul> <li>JIT compiler with code profiling for ART</li> <li>System prevents apps from dynamically linking against non-NDK libraries</li> <li>Seamless system updates (with dual system partition)</li> <li>Jack toolchain preview with lambdas and other Java 8 goodies</li> <li>APK Signature Scheme v2</li> </ul>	-\_(''')_/	<ul> <li>Jack toolchain abandoned (Mar 2017)</li> <li>If an app installs an UncaughtExceptionHandler that does not call through to the default one, the system does not kill the app when an uncaught exception occurs</li> <li>Native libraries no longer load if they contain any load segment that is both writable and executable</li> <li>Neural Network API (NNAPI) introduced</li> </ul>	■ Runtime / APK / Signing / NDK
·	All-or-nothing premission model (since 1.0)	02:00:00:00:00 as constant BT/Wifi MAC	Runtime permissions	Runtime permissions		<ul><li>Permissions</li><li>Bluetooth</li></ul>
		▶ Bluetooth stylus support			audio codec  Bluetooth devices battery level reporting	
advertising (peripheral mode)	─	setCallbackType() w/ScanFilter				
NDEF record containing UTF-8 text data		Android Pay introduced (NFC FICE)		\_(\mathcal{Y})_/		Nrc/ Illialeu
▶ Multiple users on smartphones, "Guest" tempo- rary login ▶ Nofitications on Lock screen			affecting lifecycle	Round (Circular) Icon Resources Pixel Launcher (Pixel only) Google Assistant (debut on Pixel@7.1, available for 6.0+)	<ul> <li>Adaptive icons - 2-layer laucher icons with foreground, background and mask shape</li> <li>Pinning Shortcuts and Widgets</li> <li>Home screen notification badges</li> <li>Device themes, WallpaperColors API</li> <li>Custom Lockscreen shortcuts</li> </ul>	<ul><li>Multitasking / Launcher</li><li>/ Recent / Lock screen</li></ul>
Lockscreen widgets gone, enter lockscreen notifications	— <del> </del>	-\_(w)_/- ·····-		App shortcuts support	<del> </del>	─● Widgets / App shortcuts
Heads up notifications (over other app), notification priority settings  Multiple network connections	Quick WiFi and Bluetooth change from Notification Panel  org.apache.http package and AndroidHttpClient	→ 02:00:00:00:00 as BT/Wifi MAC	<ul> <li>Visual rework, bundled notifications, direct reply and others</li> <li>▶ Quick Settings Tile API</li> </ul> Data Saver - blocks background data usage and	Notification Panel tweaks - pen-style "edit" button and an extra quick settings icon	<ul> <li>Notification channels; notification snoozing; timeouts (time-based auto cancellation); custom background colors; MessagingStyle (conversation-alike condensed style)</li> <li>Navigation bar - two extra icons with customizable KeyCode</li> <li>Notification alert sound max once per second per app</li> <li>Wi-Fi Aware based on the Neighbor Awareness</li> </ul>	<ul> <li>Notifications / Action Bar / Navigation Bar</li> <li>Networks / Wifi</li> </ul>
	class deprecated	<ul> <li>Apps not permitted to modify or delete WifiConfiguration objects created by the user or by other apps</li> <li>Forced Wifi network with disableAllOthers=true (behavior change for SDK&gt;=21)</li> <li>Hotspot 2.0 Release 1</li> <li>AndroidHttpClient removed</li> </ul>	signals apps to use less data in the foreground		Networking (NAN) - ad hoc communication for nearby devices	
++ -\_('Ψ)_/-	► High Definition voice calls	—	► Call Screening	APIs for Carriers and Calling Apps: multi-endpoint calling, CDMA voice privacy property, voicemail and video telephony	<ul> <li>Permission ANSWER_PHONE_CALLS for answering incoming phone calls programmatically</li> <li>AppSpecificSmsToken for one-time incoming SMS intent handling, good for SMS-based authorization/authentication without READ_SMS permission</li> </ul>	/ Calendar
Storage Access Framework, directory subtree level management	—	Adoptable Storage Devices - encrypts and formats the SD card to behave like part of internal storage	<ul> <li>File system permission changes - 0700 app dir permissions</li> <li>StrictMode API policy that prohibits exposing file:// URIs outside your app</li> <li>Direct Boot - LOCKED_BOOT_COMPLETED</li> <li>Scoped Directory Access</li> <li>Virtual Files</li> <li>Seamless system updates (with dual system partition)</li> </ul>		<ul> <li>Cached data with quotas</li> <li>Custom seekable remote DocumentsProviders         <ul> <li>(i.e. for exposing files available on network storage)</li> </ul> </li> <li>SharedPreferences with custom storage method via PreferenceDataStore</li> <li>New StrictMode detectors - UnbufferedIo, ContentUriWithoutPermission, UntaggedSockets</li> </ul>	→ Storage / filesystem
bindService() method now requires an explicit Intent	—-{	<del></del>	—	—-	minutes in background, system stops the app's	Services
Default TLS/SSL changes:  TLSv1.2 and TLSv1.1 protocols are now enabled, AES-GCM (AEAD) cipher suites are now enabled, MD5, 3DES, export, and static key ECDH cipher suites are now disabled, Forward Secrecy cipher suites (ECDHE and DHE) are preferred	Device Protection if device lost or stolen - after wipe it will require you to connect to the internet and then enter the account password of the last Google account on the Android device	<ul> <li>Move from OpenSSL to the BoringSSL</li> <li>Android Keystore provider no longer supports         DSA. ECDSA is still supported</li> <li>USB connections set to charge-only mode by default</li> <li>Confirm Credential - app can authenticate         users based on how recently they last unlocked         their device</li> <li>Assist API - opt-out via FLAG_SECURE</li> </ul>	<ul> <li>File based encryption</li> <li>Key Attestation</li> <li>Network Security Config - custom trust anchors, Debug-only overrides, Cleartext traffic opt-out, Certificate pinning</li> <li>Default Trusted Certificate Authority - apps that target Android 7.0 only trust system-provided certificates and no longer trust user-added Certificate Authorities (CA)</li> <li>default TLS/SSL changes: RC4 disabled, CHACHA20-POLY1305 enabled</li> </ul>	-\_(v)_/-	background services  The install source permission is now limited to only user-authorized apps RecoverableSecurityException for easier handling runtime permissions Authenticators can use their own policy to decide whether to hide accounts from, or reveal accounts to, an app. The Android system tracks applications which can access a particular account Platform no longer supports SSLv3 Values of ANDROID_ID are now scoped per-app instead of per-user	● Security
			h Wah View pay payard by Chroma installed an		new error codes, incl. LOCKOUT_PERMANENT	Fingerprint     WebView / browser
Chromium M37 WebRTC, WebAudio, and WebGL Web Components	—	between native and web content  Support for global bookmarks removed	device  WebView multiprocess, changes regarding Javascript, geolocation		tion Handle API, Renderer Importance API  Programmatic Safe Browsing actions	
Screen capture and screen share, android.media.projection API Android Beam (NFC) in share menu	<del> </del>	<ul> <li>App Linking - associate an app with a web domain, skip prompting users to select an app for a particular web link</li> <li>Auto Backup for Apps</li> <li>Direct Share - at the top of the share list, a list of contacts with app icons next to their names will pop up</li> </ul>	Multi-window Support	<ul> <li>App Shortcuts - from the launcher directly to key actions within your app</li> <li>Demo User Hint - see if the device is running as the demo user (sandbox)</li> <li>Keyboard image insertion (IME mode) w/Com mit Content API</li> <li>Better Wallpaper metadata</li> </ul>	<ul> <li>Autofill framework - manage autofill data and fills other apps' fields</li> <li>Fonts as resources in XML, can be used in fontFamily XML attribute</li> <li>Content provider dataset paging</li> <li>Autosized text view</li> <li>App Categories (android:appCategory) in Manifest</li> <li>Smart sharing - each type of content will have suggested apps to share with (using Intent's EXTRA_CONTENT_ANNOTATIONS)</li> </ul>	share / Text edit / Keyboard / Fonts
Tilt detector, heart rate sensor, interaction composite sensors (gestures)	<del> </del>	<del></del>	<del> </del>	<u></u>	├─ <del> </del>	• Sensors
OpenGL ES 3.1 w/Android Extension Pack	—	—	<ul> <li>User-selectable DPI density</li> <li>Vulkan API</li> <li>OpenGL™ ES 3.2 API w/Android Extension Pack</li> <li>Google "Daydream" VR SDK for Android (name shared with Jelly Bean interactive screensaver mode)</li> </ul>	Night Light display mode (like f.lux) Touch-input latency improvements	<ul> <li>Wide-gamut color display support - incl. bitmaps with color profile (AdobeRGB, Pro Photo RGB, DCI-P3, etc.)</li> <li>Multi-display support, move the activity from one display to another,</li> <li>Seamless rotations for fullscreen activities</li> <li>AnimatorSet API now supports seeking and playing in reverse</li> </ul>	General UI / OpenGL / GPU API / VR
Media playback control (MediaSession API), media browsing, package-specific directories on shared storage for media files	—	➤ 4K Display Mode  ➤ Themeable ColorStateLists	<ul> <li>Synchronous movement to the SurfaceView</li> <li>Custom Pointer API (mouse/touchpad representation)</li> <li>Picture-in-picture (PIP) on Android TV</li> </ul>	—		● Video / Media / UI
camera2 API	— <del> </del> +	<ul> <li>Camera access is now prioritized, previously it was "first come, first serve"</li> <li>Flashlight API (setTorchMode)</li> </ul>	<del></del>	New Camera app (Exposure adjustment, viewfinder grid modes, Smart Burst, and AE/AF Locking)	├─ <del>-</del>	—● Camera
low-latency audio input, Multi-channel audio stream mixing, USB audio peripherals	<del> </del>	► Camera2 Reprocessing API	<del> </del>		├──  New aptX high-quality Bluetooth audio codec ├──	→ Audio
OPUS (audio), HEVC (video)	— <del> </del> +	MIDI	-\_(\v)_/- ·····+	—+······	MPEG2_TS	—● Codecs
Project Volta: JobScheduler Battery historian support Battery Saver mode added	—	► Doze mode ► App Standby	Doze on the Go Project Svelte - optimize the way apps run in the background Sustained Performance API - prev. for Nexus 6P		<ul> <li>Background Location Limits - background apps to receive location updates only a few times each hour (affects apps targeting older SDKs)</li> <li>Background Execution Limits - after several minutes in background, system stops the app's background services</li> <li>Apps can no longer register broadcast receivers for implicit broadcasts in their manifest (with whitelisted exceptions)</li> </ul>	Optimizations / Job schedulers
+ -\_(\mu)_/-	<del> </del>	<del></del>	bilingual use-cases  Emoji - variation selectors, skin tone  IU4J API partial support	New emoji that represent a wider range of professions for women as well as men	TTS language detection, accessibility button, fingerprint gestures, word-level highlighting, hint text (even for controls which doesn't display hint text), continued gesture dispatch	→ i18n / Emoji / Accessibility
Managed provisioning, apps with Work badge, unified notifications, device owner apps	—	Changes affecting work contacts in personal contexts, Wifi configrations, Device Policy Controllers and others Silent install and uninstall of apps by Device Owner, runtime permission management and other changes Work status notification (briefcase icon when managed app has activity in foreground)	<ul> <li>Accessibility Enhancements</li> <li>Work Mode on/off switch button in Notification panel</li> <li>Security challenge, always on VPN, customized provisioning</li> <li>Changes to certificate installation, password resetting, secondary user management, and access to device identifiers</li> </ul>		<ul> <li>The ability to use a managed profile on a corporate-owned device.</li> <li>An overhauled work profile featuring a user-friendly setup flow</li> <li>Enterprise management for file-based encryption.</li> <li>Delegation of app management APIs</li> </ul>	● Android for Work and Education
Screen pinning, kind of kiosk mode:	— <del> </del>	COSU - Corporate-Owned, Single-Use device	— <del> </del>	<del></del>	-\_(w)_/	■ Kiosk mode
blank status bar, home and recent hidden, no new task starting; feature connected with device owner		disable or re-enable keyguard, status bar, safe boot				and the

Printing

Android TV device debutes with leanback UI | New Screen Densities for Wear Devices | Android TV: Picture-in-picture (PIP) multiwindow | Android TV: Picture-in-

► Android Auto supported