

# Google Chromecast

(Diapositivas 2 y 3)

<b>Developer</b>	Google
<b>Manufacturer</b>	Google
<b>Type</b>	Digital media player
<b>Release date</b>	<b>1st generation:</b> July 24, 2013
	<b>2nd generation &amp; Audio:</b> September 29, 2015
	<b>Ultra:</b> November 6, 2016
	<b>3rd generation:</b> October 10, 2018
	<b>1st, 2nd, 3rd generation, &amp; Audio:</b> US\$35/ £30
<b>Introductory price</b>	<b>Ultra:</b> US\$69
<b>Units sold</b>	30–55 million
<b>Display</b>	<b>1st, 2nd, &amp; 3rd generation:</b> 1080p
	<b>Ultra:</b> 4K Ultra HD
	<ul style="list-style-type: none"><li>• Wi-Fi</li><li>• HDMI(video models)</li></ul>
<b>Connectivity</b>	<ul style="list-style-type: none"><li>• 3.5 mm audio jack/ mini-TOSLINK socket (Audio model)</li><li>• Ethernet (with optional USB adapter)</li></ul>
<b>Power</b>	Micro-USB
<b>Predecessor</b>	Nexus Q

## Hardware and design

Chromecast devices are dongles that are powered by connecting the device's micro-USB port to an external power supply or a USB port. Video-capable Chromecasts plug into the HDMI port of a high-definition tv or monitor, while the audio-only model outputs sound through its integrated 3.5 millimetre audio jack/ mini-TOSLINK socket. By default, Chromecasts connect to the Internet through a Wi-Fi connection to the user's local network; a standalone USB power supply with an Ethernet port, introduced in July 2015 for US\$15, allows for a wired connection.

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## What is Chromecast and how does it work?

Chromecast is a streaming media player that plugs into your TV via HDMI, letting you stream video from services such as Netflix.

But instead of including a traditional remote control, Chromecast uses the apps that are already on your phone or tablet to send video to the television. Supported apps display a Cast button, which you can press to connect with Chromecast. Select a video and playback begins on your television a few seconds later. This works with both iOS and Android apps.

If you have a laptop or desktop running Google's Chrome browser, you can also cast from the websites of some streaming services, provided you first install the Google Cast Extension. Just look for the Cast button among the website's playback controls.

## Can I mirror my device's display on the big screen?

Screen mirroring is supported on phones and tablets running Android 4.4.2 or higher. There's no way to mirror from iOS devices. Laptops and desktop PCs can mirror any open browser tab in Chrome with the Google Cast extension installed.

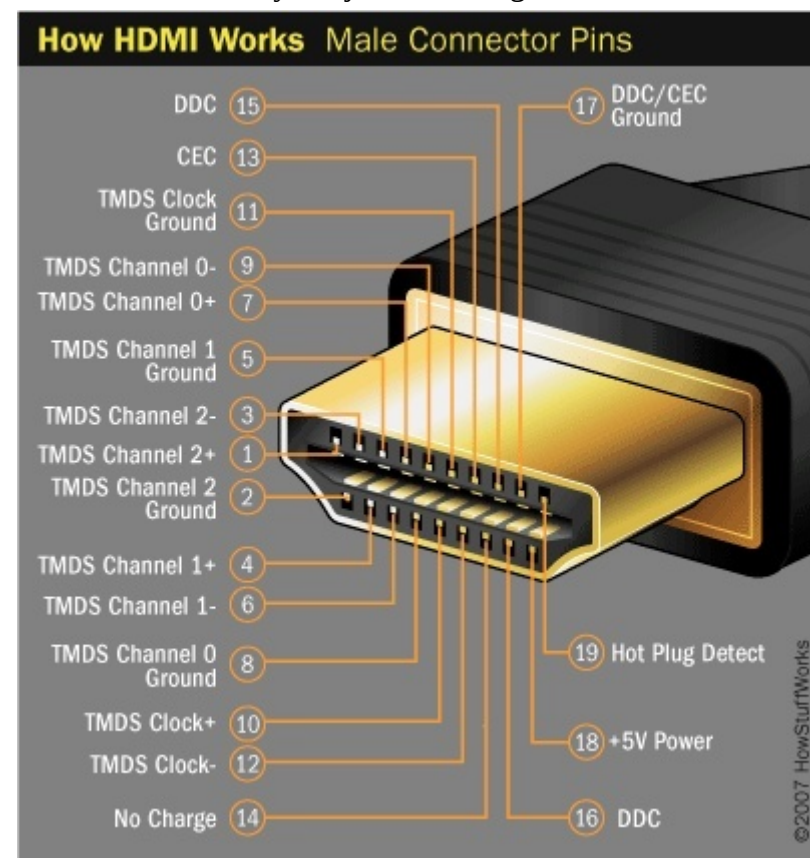
While mirroring can be useful for watching content that doesn't support Chromecast natively, it does have some downsides: The quality of the stream can be unreliable, and it's a major drain on battery life.

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## Which streaming services are supported?

Most of the major streaming-video services are on board, including Netflix, Hulu, YouTube, HBO Now, Showtime, and Sling TV. One noteworthy exception is Amazon Video.

Chromecast also supports a fair number of streaming-music services, such as Pandora, Spotify, and iHeartRadio. And beyond just streaming media, Chromecast has apps for viewing photos, sharing presentations, and playing games.



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## Do I need a separate remote control for volume and other things?

You might. Most apps have built-in volume controls for Chromecast, but these are separate from your television's master controls and will not exceed the highest volume you've set on the TV itself.

If your TV supports HDMI-CEC, you're in slightly better shape as Chromecast can automatically turn on the television and switch to the appropriate input when you start Casting a video. (You may have to find and enable HDMI-CEC in your TV's settings first). Even then, you'll still want a remote to turn the TV off after a Casting session.

## What is HDMI CEC?

**Consumer Electronics Control (CEC)** is an HDMI feature designed to allow the user to command and control up to ten CEC-enabled devices connected through HDMI by using just one of their remote controls. CEC also allows for individual CEC-enabled devices to command and control each other without user intervention.

HDMI-CEC is a one-wire bidirectional serial bus that uses the industry-standard AV.link protocol to perform remote control functions. CEC wiring is mandatory, although implementation of CEC in a product is optional. USB to CEC Adapters exist that allow a computer to control CEC-enabled devices.

### Some of the available HDMI-CEC commands

- One Touch Play: the device will become active source when playback starts
- System Standby: switches all connected devices to standby
- Preset Transfer: transfers the tuner channel setup to another TV set
- One Touch Record: start recording immediately
- Timer Programming: allow one device (e.g. a TV set or HTPC) to set the timer programming of another (e.g. a PVR/DVR or DVD-recorder)
- System Information: checks all components for bus addresses and configuration
- Deck Control: playback control
- Tuner Control: control the tuner of another device
- OSD Display: use the OSD of the TV set to display text
- Device Menu Control: use the menus of another device
- Routing Control: control the switching of signal sources
- Remote Control Pass Through: pass through remote control commands
- Device OSD Name Transfer: transfer the preferred device names to the TV set

## Why You Want HDMI-CEC

HDMI-CEC allows devices connected to your TV through HDMI ports to communicate back and forth with your TV. The devices can have some control over the TV, and the TV can have some control over the devices.

For example, let's say you have a Chromecast connected to your TV, but you're not using the Chromecast right now. Instead, you're watching TV or playing Xbox. With HDMI-CEC, you can start casting to your Chromecast from another device, and the Chromecast will send a signal to the TV, forcing the TV to switch to the Chromecast's input. You won't have to fumble with the TV's remote control and switch to the appropriate input on your own.

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# What's this "Google Cast" I keep hearing about?

Google Cast is the underlying technology, which appears in other products beyond Chromecast. Android TV devices, for instance, are Google Cast-enabled, giving them all the same capabilities as Chromecast. There are also Google Cast-enabled home speakers, which stream Internet music from the same apps that Chromecast supports. Chromecast is basically a cheap product for adding Google Cast capabilities to devices that don't have them built in already.

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## Google Chromecast Operating system

At the introductory press conference the Google's VP of Product Management, said that the first-generation Chromecast ran "a simplified version of Chrome OS." Subsequently, a team of hackers reported that the device is "more Android than ChromeOS" and appears to be adapted from software embedded in Google TV. As with Chrome OS devices, Chromecast operating system updates are downloaded automatically without notification.

The chromecast uses an operating system specially designed for him, which uses miracast in order to display content.

**Miracast** is a standard for wireless connections from devices (such as laptops, tablets, or smartphones) to displays (such as TVs, monitors or projectors), introduced in 2012 by the Wi-Fi Alliance. It can roughly be described as "HDMI over Wi-Fi", replacing the cable from the device to the display.

Devices that are Miracast-certified can communicate with each other, regardless of manufacturer. Adapters became available that plug into HDMI or USB ports, allowing devices without built-in Miracast support to connect via Miracast.

Miracast employs the peer-to-peer Wi-Fi Direct standard (standard enabling devices to easily connect with each other without requiring a wireless access point. Wi-Fi Direct allows two devices to establish a direct Wi-Fi connection without requiring a wireless router). It allows sending up to 1080p HD video and 5.1 surround sound. The connection is created via WPS (Wi-Fi Protected Setup is a network security standard to create a secure wireless home network ) and therefore is secured with WPA2. IPv4 is used on the Internet Layer. On the transport layer, TCP or UDP are used. On the application layer, the stream is initiated and controlled via RSTP (Real Time Streaming Protocol, a network control protocol designed for use in entertainment and communications systems to control streaming media servers), RTP (Real-time Transport Protocol, it is a network protocol for delivering audio and video over IP networks for the data transfer)

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## Protocol overview

Chromecast uses the mDNS protocol to search for available devices on a Wi-Fi network. Chromecast previously used the DIAL protocol.

## Multicast DNS

The **multicast DNS (mDNS)** protocol resolves host names to IP addresses within small networks that do not include a local name server. It is a zero-configuration service, using essentially the same programming interfaces, packet formats and operating semantics as the unicast Domain Name System (DNS). It can work in concert with standard DNS servers, and uses IP multicast User Datagram Protocol (UDP) packets.

Android contains an mDNS implementation and it has been implemented in Windows 10, but its use there is limited to discovering networked printers.

When an mDNS client needs to resolve a host name, it sends an IP multicast query message that asks the host having that name to identify itself. That target machine then multicasts a message that includes its IP address. All machines in that subnet can then use that information to update their mDNS caches.

(An IP multicast is a method of sending Internet Protocol (IP) datagrams to a group of interested receivers in a single transmission. It uses specially reserved multicast address blocks in IPv4 and IPv6).

Any host can relinquish its claim to a domain name by sending a response packet with a time to live (TTL) equal to zero.

By default, mDNS only and exclusively resolves host names ending with the .local top-level domain (TLD). This can cause problems if that domain includes hosts which do not implement mDNS but which can be found via a conventional unicast DNS server. Resolving such conflicts requires network-configuration changes that violate the zero-configuration goal.

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## Discovery and Launch (DIAL)

DIAL is a protocol co-developed by Netflix and Youtube with help from Sony and Samsung. It is a mechanism for discovering and launching applications on a single subnet, typically a home network. It relies on Universal Plug and Play (UPnP), Simple Service Discovery Protocol (SSDP), and HTTP protocols. The protocol works without requiring a pairing between devices. As mentioned before, it was formerly used by the Chromecast media streaming adapter that was introduced in July 2013. DIAL enables what the TV industry calls "2nd screen" devices, such as tablet computers and mobile phones to send content to "1st screen" devices, such as televisions, Blu-ray players,...

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**Universal Plug and Play (UPnP)** is a set of networking protocols that permits networked devices such as personal computers, printers, Internet gateways, Wi-Fi access points and mobile devices to seamlessly discover each other's presence on the network and establish functional network services for data sharing, communications, and entertainment. UPnP is intended primarily for residential networks without enterprise-class devices.

UPnP assumes the network runs Internet Protocol (IP) and then leverages HTTP, SOAP and XML on top of IP, in order to provide device/service description, actions, data transfer and eventing. Device search requests and advertisements are supported by running HTTP on top of UDP (port

1900) using multicast (known as HTTPMU). Responses to search requests are also sent over UDP, but are instead sent using unicast (known as HTTPU).

Conceptually, UPnP extends plug and play—a technology for dynamically attaching devices directly to a computer—to zero configuration networking. UPnP devices are "plug and play" in that, when connected to a network, they automatically establish working configurations with other devices.

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**SOAP** (originally **Simple Object Access Protocol**) is a messaging protocol specification for exchanging structured information in the implementation of web services in computer networks. Its purpose is to induce extensibility, neutrality and independence. It uses XML Information Set for its message format, and relies on application layer protocols, most often Hypertext Transfer Protocol (HTTP) or Simple Mail Transfer Protocol (SMTP), for message negotiation and transmission.

SOAP allows processes running on disparate operating systems (such as Windows and Linux ) to communicate using (XML). Since Web protocols like HTTP are installed and running on all operating systems, SOAP allows clients to invoke web services and receive responses independent of language and platforms.

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**Extensible Markup Language (XML)** is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.

The design goals of XML emphasize simplicity, generality, and usability across the Internet. It is a textual data format with strong support via Unicode for different human languages. Although the design of XML focuses on documents, the language is widely used for the representation of arbitrary data structures such as those used in web services.

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The **Simple Service Discovery Protocol (SSDP)** is a network protocol based on the Internet Protocol Suite (*conceptual model and set of communications protocols used on the Internet and similar compute networks. The foundational protocols in the suite are the TCP and the IP. It provides end-to-end data communication specifying how data should be packetized, addressed, transmitted, routed, and received. This functionality is organized into four abstraction layers , which classify all related protocols according to the scope of networking involved. From lowest to highest, the layers are the link layer, containing communication methods for data that remains within a single network segment (link); the internet layer, providing internetworking between independent networks; the transport layer, handling host-to-host communication; and the application layer, providing process-to-process data exchange for applications*) for advertisement and discovery of network services and presence information. It accomplishes this without assistance of server-based configuration mechanisms, such as DNS, and without special static configuration of a network host.

## Hence, what is the underlying technology behind how Chromecast wireless works? (RECAP)

The device 'works' by announcing itself to the local network, and then devices which are connected

to the local WIFI or network, which are running 'Chromecast' sentient applications (like Netflix), the user's device can then direct the Chromecast device to access the video server, and present the media on the display.

Security is provided by the WIFI, so if you are using a WIFI with no password protection, some nefarious evil doers can monitor your content, or even control what the Chromecast device is feeding the display... and the controlling application (Netflix) manages the username/password authentication for accessing the media stream.

Now Chromecasts use mDNS protocol, which uses IP multicast UDP packets. The first generation used DIAL, a protocol which relies on:

- UpnP → assumes the network runs Internet Protocol (IP) and then leverages HTTP, SOAP and XML on top of IP. Device search requests and advertisements are supported by running HTTP on top of UDP (port 1900) using multicast (known as HTTPMU). Responses to search requests are also sent over UDP, but are instead sent using unicast (known as HTTPU).
- SOAP → messaging protocol specification for exchanging structured information in the implementation of web services in computer networks. It uses XML Information Set for its message format, and relies on application layer protocols, most often Hypertext Transfer Protocol (HTTP) or Simple Mail Transfer Protocol (SMTP), for message negotiation and transmission.
- XML → markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.
- SSDP → network protocol based on the Internet Protocol Suite for advertisement and discovery of network services and presence information. It accomplishes this without assistance of server-based configuration mechanisms, such as DNS, and without special static configuration of a network host.

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