# minecraft.org

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## Contents

## 1   Minecraft

In this chapter I will provide a brief overview of what Minecraft is, some of it's most important aspects and limitations. Hopefully, after reading this chapter, reader will agree that Minecraft is quite interesting game with a lot of potential.

## 1.1 What is Minecraft

### 1.1.1 Overview

Minecraft is a indie game developed by Markus Presson and Mojang which was published in 2011. It's a open world game, in which players are placed in a world made of blocks. These blocks can be mined and used as a building material.

Players use these blocks to build various either items or kind of structures. For example, there has been successful attempts to build USS Enterprise, Taj Mahal, Eiffel Tower and basically anything one could imagine.

### 1.1.2 Maps

When a game of Minecraft is started, player may choose to generate a new map. This is done using map generator, with random initial seed (player may also choose to use specific seed). When a game starts, Minecraft server generates a small area around player. As the player moves around the map, more and more parts of the map are being generated as needed.

Maps in Minecraft are made of blocks. To organize these blocks, maps are split into so called *chunks*. These chunks are simply 16 blocks wide, 16 blocks deep and 128 blocks high [1]. When a client connects to server, server sends the map using these chunks.

Maps can be very large. There is a hard limit of 256 block on the height of the map. The depth and length of the map, however, is has a soft limit of $2^3 2$ (because of limits of integers in Java) (if player moves further then that, the map chunks starts to get overwritten). Which means that there can be up to $2^{2*32+8}$ blocks per map. Even if every block was represented by 1 byte, it can be quite challenge to represent such a large object efficiently.

### 1.1.3 Blocks and Items

There is a number of different blocks in Minecraft. Among the most common ones there is dirt, stone, sand and gravel. There are also trees, which can be broken down into wood. There are also rare blocks, such as coal, iron, gold and diamond. Each of these blocks has various properties and uses.

When mining these, player can use either a bare hands or craft an item that would aid him. There is a lot of items player can craft in Minecraft, but the basic ones are axe, shovel, hoe and pickaxe. Each of these can be made from either wood, stone, gold, iron or diamond which determines it's

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[1]http://notch.tumblr.com/post/3746989361/terrain-generation-part-1

quality. Items are crafted by placing blocks into 2x2 or 3x3 matrix into different shapes, which determines the item to be crafted.

Tools described above are useful for increasing efficiency of gathering blocks. For example iron pickaxe can crack stone a lot faster then wooden pickaxe. Some of the blocks can't even be gathered without good enough tool. Diamond block, for instance, require at least iron pickaxe.

There are other items player can craft, though. For example, player can create a furnace, which uses coal blocks as fuel and can smelt ores into bar as well as cook food from raw meat that can be gathered from sheep, cows or pigs. It can also "cook" sand block into glass or cobble stone into smooth stone.

Minecraft also supports alternative forms of transportation with boats or mine carts, which can be placed upon a rails in order to move faster between locations. Rails make use of so called *Redstone energy*, which is described below.

In order to protect himself, player can create and equip armor and weapons in either leather, gold, iron or diamond quality. There are 4 pieces of armor: helmet, chest piece, trousers and boots. As weapons there is only sword and bow and arrows. Armor reduces damage taken from monsters while weapons increase players damage to monsters and fauna of Minecraft worlds.

### 1.1.4 Monsters & health

Every player has 10 hearts that symbolize his health. Every heart can be either full, half empty or empty. When all hearts are empty, player dies and is either re spawned, or in case the player plays in *hardcore mode* the entire world is deleted and all game content is lost.

There is also a food counter, which represents how well fed the player is. If the bar is full, player automatically regenerates health if he has not taken any damage in recent history. This is to prevent health regeneration while fighting enemies.

Plenty of opportunities to loose health are implemented in Minecraft. Player looses health when dropping from high enough edge, while being under water for too long or while standing in fire or lava.

The most common cause of health loss, however, are monsters. There is a number of monsters in Minecraft:

- Zombie
  Slow melee monster that deals quite a lot of damage, when killed drops meat that can be cooked and eaten.

- Skeleton
  Shoots arrows, when killed drops arrows or bones.

- Creeper
  Very quiet monster which creeps up on player and explodes when in proximity of player. Makes sizzling noise before detonation.

- Spider
  Melee creature, which only attacks player during night or when attacked.

- Silverfish
  Melee creature spawning from blocks which look exactly the same as stone blocks in randomly generated fortresses and dungeons.

- Enderman
  Melee creature that can teleport, but attacks player only if player looks at it first. Otherwise it's not hostile.

  Monsters spawn in the places where there is no light available. Light can come either from sun, torches, fire or lava.

### 1.1.5 Redstone

Redstone is one of the most interesting features of Minecraft. Redstone is a rare ore that can be found deep in the ground. When mined, it produces several Redstone crystals.

These crystals can be either used for crafting, or laid on other blocks. Player can use these to create kind of a wire made of the Redstone crystals. The wiring acts like a carrier of logical values. By default, the value transmitted by the wire is 0. It can be changed, though. In Minecraft community, this is usually called *Redstone energy* and the state in which logical 0 is transmitted via wire is considered as lack of *Redstone energy*.

There is a couple of ways how to send logical 1 via Redstone wire:

| Item | Description |
| --- | --- |
| Redstone torch | Sends 1 permanently |
| Button | Sends 1 as impulse |
| Leaver | Sends 1 as long as the leaver is triggered |
| Pressure pad | Sends 1 as long as something is on the pad |

There are also items that can 'consume' Redstone wire in order to perform action (non exhaustive table):

| Item | Action |
| --- | --- |
| Door | Open while 1 is transmitted |
| TNT | Triggers explosion once 1 is transmitted |
| Note block | Emits sound once per 0 to 1 value change |
| Dispenser | Dispenses object once per 0 to 1 value change |

Using these tools, Minecraft users were able to create some very impressive structures. There is for example a calculator implementation, song playing machines or even games created with Redstone infrastructure.

Other than that, Redstone circuits are often used in *addventure maps* for creating puzzles and challenges. Typical example of Redstone usage would be asking player to find a button, in order to open doors into next part of the map. It can also be used for creating traps, by wiring TNT to pressure pads or dispensers with arrows.

### 1.1.6 Nether

Nether is an alternative map which is available to players via portals. Portal is a 5 blocks high and 4 blocks wide frame with 3 blocks high and 2 blocks wide space inside made of obsidian, which is lit using flint and tinder. Obsidian is a block that is created by pouring water over lava blocks.

It symbolizes kind of an evil realm with some unique resources, but overall is not overly interesting. The portal system, however, is used quite often in *adventure maps.*

### 1.1.7 Goal

Minecraft is very open ended game, so there is no real ending to the game. The only formal ending to the game requires player to find one of many randomly generated underground fortresses, build a portal inside and go through. There the player will find a dragon, which he must slay. However, once that is done and credits have passed, the game still can be played.

More often than not, though, players don't even bother with this quest and play the game only for the joy of building interesting structures. Game usually ends when player gets bored. Unless player plays on hardcore mode, which automatically deletes the world upon players first death.

### 1.1.8 Creative mode

Creative mode was added to Minecraft in order to make it easier for people to create impressive structures. Those people may not want to necessar-

ily deal with all the stuff Minecraft contains, such as monsters, inventory management, mining blocks and so on.

In creative mode, player has access to infinite resources from within his inventory. He can also destroy any block with 1 hit and is allowed to fly. He also takes no damage and spawning of monsters is disabled.

Player may choose to play in creative mode when starting a new game. There are extensions, however, that allow player to switch creative mode on and off at will.

### 1.1.9 Adventure maps

One of the reasons Minecraft got so popular are maps made by players, which usually contain a story, quests and riddles for player to go through.

Adventure map is a regular map, which one would download, which usually contains additional document which describes the story, rules of the map (usually forbids player to destroy any blocks) etc. Adventure maps heavily utilize the use of redstone wiring for any kind of "scripting" of events.

## 1.2 Extensions

As one might imagine, Minecraft would be a very good platform and engine to build on. Unfortunately, there is no api for players to build upon. Players still managed to reverse engineered the code, though, in order to create plugins and extensions for the game. And they really managed to make some amazing plugins. In this part, I will mention few of the most interesting extensions.

### 1.2.1 Tekkit mod

Tekkit is a collection of multiple extensions, which adds concept of the electrical power to the game (among other things). It adds randomly generated pools of oil into the maps, which can be gathered, processed to fuel and used in electrical engines to power machines. There is a lot of machines that consume electricity, but the most interesting one is a quarry, which automatically mines selected area.

There are other ways to gather electricity, though. There are for example nuclear reactors, which players can build. They need to be cooled down, however, or they will explode and contaminate area with radioactivity.

### 1.2.2 Computercraft

Another very interesting extension is Computercraft. It adds programmable robots into the game. Robots are programmed via in game terminal using embedded LUA [2] programming language (added by the extension).

There are for example mining probes, which can be programmed to search for given materials, mine only those and return them to the owner. It can also be used for password protecting doors. It can be even used to implement an text-based RPG (in game terminals are text-only and computer craft doesn't include any tools for creating graphical UI).

### 1.2.3 Other extensions

There is a great number of extensions. Just quickly mention a few others, there is an extension that adds mini map for players. There is an extension that adds gps-like navigation and ability to create points of interest. There are extensions that add new items, enemies or blocks and so on.

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[2]www.lua.org