Chunks

Information regarding minecraft bedrock edition's chunk system.

- Unloaded chunks
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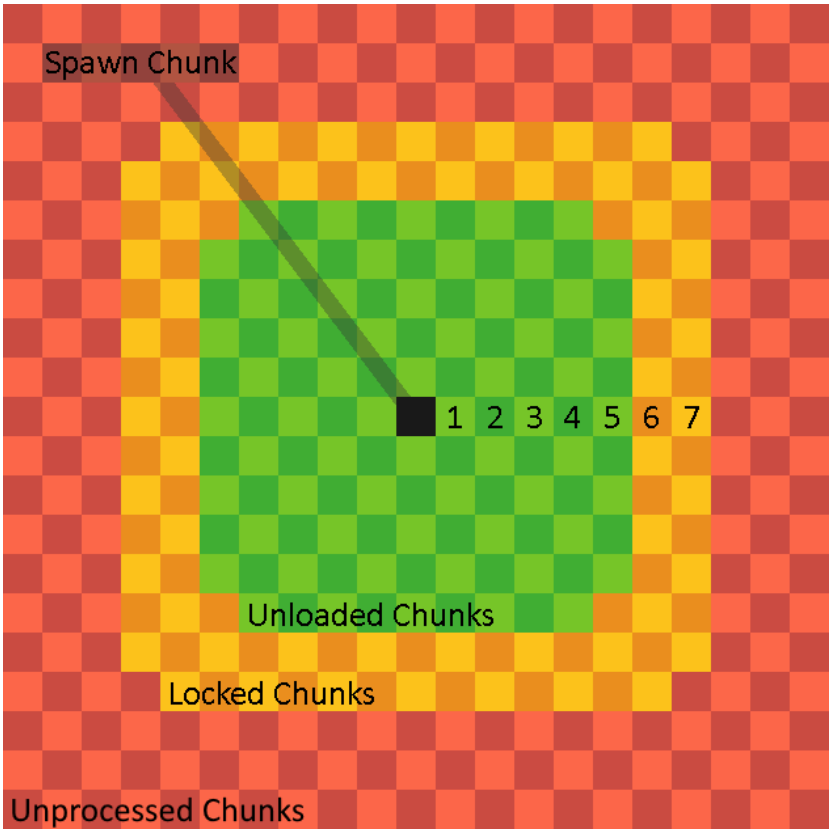
- Chunks

Unloaded chunks

Spawn Chunks

Spawn Chunks

Against popular belief spawn chunks DO exist on bedrock edition. These chunks around the central world chunk (x 0, z 0) are there mostly for performance reasons. If you have ever went into a portal and came back you will know that the transfer from nether to overworld is much faster than the opposite. This is because of spawn chunks. This can help you load those chunks to the loaded status much quicker than if they were fully unprocessed. These chunks form a rounded 11x11 square of unloaded chunks and of course bordering them is a rounded 15x15 square of locked chunks.



(Visualization by @kiwixite on discord)

> These chunks will become unprocessed on server/world shutdown until loaded again. After which they will stay persistent across *that* session.

Map-Induced Chunk Unloading

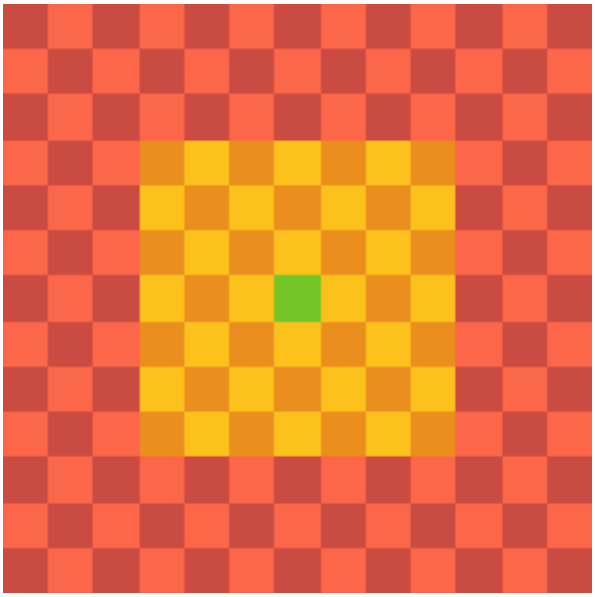
Locked Chunks

Locked Chunks

Locked chunks are chunks that exist and have references in memory but do not process any events. These chunks may behave like unprocessed chunks to the untrained eye, but if you put an entity in one and use **/testfor** you will see that it does still exist. These chunks are generally out of the way in terms of where they appear, so you aren't likely to interact with them in day to day gameplay. Locked chunks are only seen in one natural instance and that is bordering unloaded chunks.

Where are they

As stated previously they appear around unloaded chunks, but in what way? Locked chunks create a 5x5 square around a given unloaded chunk. This is good to know when testing with unloaded chunks, because these chunks may cause unexpected behavior when you are building.



(Green is the Unloaded chunk and the yellow/orange is locked)

Unloaded Chunks

Unloaded Chunks

Unloaded Chunks or Cached Chunks (but officially called unloaded chunks) are chunks that have most but not all functionality disabled within them. These chunks are not simulated and cannot process things like block updates and pending ticks. There are three main natural instances of unloaded chunks in a Minecraft world, Spawn Chunks, Chunks in your render distance, and the "perma-cache" phenomenon. These chunks do process some events however and knowing what does and does not work will help you be able to interact with these chunks in much more confidence.

What Works In Them

The things we know to work in unloaded chunks:

- Redstone circuit structure
- Capacitors (E.g, Redstone Torches, Repeaters, Comparators)
- Redstone Dust
- Global Entities (Player Owned Projectiles, Ender Dragon, fireworks, lightning)
- Block state changes from a wind charge
- Sculk Spread
- Block Creation
- Tripwire
- Target Block
- Pressure Plate
- Damaging/Killing Entities (Non-Global Entities will not be fully dead/deleted until simulated)
- Artificial Entity Spawning
- Breeze Projectile Redirection
- Pending Tick Scheduling (Not execution)
- Wind Charging effect.
- Weaving Effect

Although Observers are a "Pulse Capacitor" they cannot fire in unloaded chunks due to their reliance on pending ticks.

Since tridents are player-owned projectiles, they can fall through the world if they spawn in an unloaded chunk before the chunk’s block collision map is initialized especially when the world is running slowly. Grindstones are used to combat this.

Perma-Caching

Perma-Caching is an unexplained phenomenon that happens when a player spends enough time in a given part of their world. The game will generate a seemingly random arrangement of chunks around the area that will not become unprocessed and stay in the unloaded state. This phenomenon does not seem to go away with relog or waiting.

Why "Unloaded Chunks"

We call them unloaded chunks because, in game, functions like these refer to them as unloaded chunks. This allows us to keep consistency with what the game developers at Mojang refer to them as internally. We do this because it helps us know what to look for when learning about something related to them.

```
void Dimension::transferEntityToUnloadedChunk(Actor& actor, LevelChunk* oldChunk)
```

These chunks are represented by the hex values 0x0000 through 0x0008 but each value is a different state of an unloaded chunk.

Invalid Chunks

Invalid Chunks

Invalid Chunks are chunks that simply do not exist anymore. These chunks have no references in the game's memory and are stored entirely on disk until they need be accessed again. These chunks fully delete anything that passes through them and save their current NBT state. These are the chunks that you get the "Chunk still loading. You may encounter some mild performance issues." so next time you get that message when teleporting or going too fast you have those chunks to thank. These chunks also process absolutely nothing as you might expect.

Uses

The main use for these chunks is falling block duplication. When a falling block turns into a block there is still 3 tick in which the entity still exists. Because an these chunks delete the entity references we can essentially bypass the deletion mechanism allowing us to have both the entity and the block.

A more niche use is for NBT state saving. Using these chunks we save the NBT (Named Binary Tag) of an entity just as if it was loaded from a structure block. This allows us to keep certain tags that are useful for example the **minecraft:raid_configuration** tag. This tag is useful because it is what makes witches throw healing/regeneration potions. This tag saving can be done by simply putting a the entity of choice into a portal. This will destroy the reference normally used to remove those tags when they aren't being used.

> These are represented by -1 in the game code.

Loaded Chunks

Loaded Chunks/Simulated Chunks

Loaded Chunks also known as simulated chunks are the chunks that anything can normally process in. These chunks only occur around a player or created with the use of **/tickingarea** or **Add-ons.** These chunks are what players will spend their time interacting with a majority of the time.

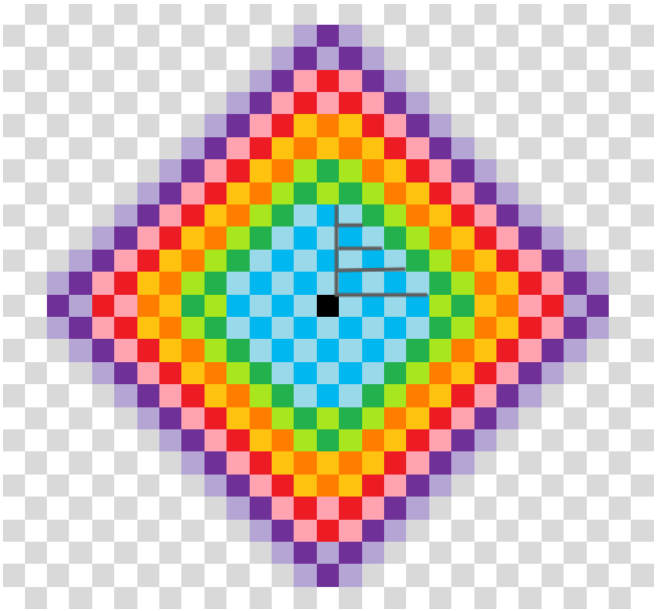
> These chunks are represented by the hex code 0x0009 in the game code.

Buffer Chunks

Around every loaded chunk is a buffer of unloaded chunks this is to improve load times and general stability of the game.

Loaded Area Size

The size of the area of loaded chunks around a player is dependent on the **simulation distance** setting in the world settings and it comes in four different sizes 4 chunks, 6 chunks, 8 chunks, and 12 chunks. These sizes are not radii as you may be inclined to believe but instead follow taxicab geometry, going from each corner of the central chunk containing the player.



(blue: sim 4, green: sim 6, yellow/orange: sim 8, pink/red: sim 10, purple: sim 12)

Functions

Chunks that are loaded/simulated are able to process anything you will find in normal gameplay such as:

- Entity AI/Events
- block ticking
- random ticks
- Entity states

> It is important to note that events can happen outside of these loaded chunks. See unloaded chunks for more information.

Slime Chunks

Slime Chunks

Slime Chunks are chunks that have the ability to spawn the slime entity when a player is within spawning range. Slime chunks spawn slimes regardless of light level as long as there is a valid place for them to spawn. The game will only spawn slimes in slime chunks at y=40 and below so you don't have to worry about ever seeing them on the surface. Slime chunks are not randomized by seed and their positions can are interchangeable between worlds. If you find a slime chunk in one world you can go to those coordinates in another world and find the same place spawning slimes.

How to find them

Slime chunks can be found by four main methods.

- Chunkbase
- Resource Pack
- Trial and Error
- Already knowing the locations

Depending on your use case and conditions one option may be more suitable than the others.

Chunks

Chunks, What are they?

Chunks are 16x16 partitions of space on a Minecraft world that the game will load individually around a player or based on certain conditions. The reason why this is done is because the game is 30 million blocks by 30 million blocks big and loading all that at once would be take an extremely large amount of computation. There are a few differences in chunks that dictate what they can and cannot do, these differences are very important to memorize if you want to get into technical Minecraft.

Chunk States/Types

There is a variety of chunks which do certain things these include:

- Slime Chunks
- Loaded Chunks
- Unloaded Chunks
- Locked Chunks
- Unprocessed Chunks

Subchunks

Subchunks are 16x16x16 subdivisions of a given chunk to improve load times and to help prevent the game from loading things that don't need to be. Subchunks divide the parent chunk along the vertical axis and inherits the load state of it. A given Subchunk may determine very small things and is mostly related to client side rendering. The reason why Subchunks exist is to try and avoid storing an entire chunk in a single giant array and prevent unneeded lag for the same reason chunks exist.

Chunk Codes

Bedrock edition defines a given chunk by an internal assigned code system; these are used to keep track of what chunk state a given chunk is in.

	Byte Code
Unloaded	0x0000
Generating	0x0001
Generated	0x0002
PostProcessing	0x0003
PostProccessed	0x0004
CheckForReplacementData	0x0005
NeedLighting	0x0006
Lighting	0x0007
LightingFinished	0x0008
Loaded	0x0009
Invalid	-1

World Generation

When a chunk is generated for the first time, it looks at the seed and generates terrain deterministically with a pseudo-random algorithm based on it. This terrain can be found again in a new world of the same seed because of it being deterministic.

Structures generate based on chunks as well and their position in a chunk it loads is often predictable.

- Buried Treasure: Southwest block of the chunk's center four blocks.
- Pillager Outpost: Southeast corner of the chunk.
- Stronghold Spiral Staircase (Stronghold start structure): Northwest corner of the chunk
- Temple: Northeast corner of the chunk.
- Ruins: Center of the chunk.
- Mineshaft Starter: Northwest corner of the chunk.
- Amethyst Geode: Northwest corner of the chunk.
- Ruined Portal: Structure loading will start in northwest corner of a chunk but bleed into a random direction.
- End Fountain: (0, 64, 0) or Northwest corner of the chunk.
- End City: Southeast block of the chunk's center four blocks.
- Ocean Monument: Center of the chunk.
- Mansion Entrance: Southeast block of the chunk's center four blocks.
- Fortress Starting Intersection: Southeast block of the chunk's center four blocks.

- Igloo: Structure loading will start in northwest corner of a chunk but bleed into a random direction.
- Witch Hut: Northwest corner.

> Not all structures in Minecraft generate in a perfectly predictable way.

Per-Chunk Processing

Chunks may process some things separately from each other and knowing about these discrepancies can save you headaches when building a machine. Chunks will process all events it can within one chunk before starting on the events in another making it so that each chunk executes at different times. Ticking areas have priority in this and will always be executed before any other chunks allowing you to determine which cross-chunk event will happen first. (E.g, two pistons extending into the same tile) This order is predictable and changes every 20 ticks, so if you know what order the chunks are in for the 1st tick you will also know the order for the next 19 but not anything after. Chunks also have their own independent pending tick queue and will only process pending ticks within the borders of its own chunk.