

IISE Transactions L^AT_EX Template

John Doe ^a and Jane Roe ^b

^a Department, University, City, Country

^b Department, University, City, Country

Abstract



Keywords: *IISE Transactions*; L^AT_EX; Manuscript format; Taylor & Francis.

Contents

1	Documentation conventions	13
1.1	Glossary	13
2	Introduction	14
2.1	Destiny	14
2.2	Response	14
2.3	Operation	15
2.4	Arguments	15
2.4.1	Character	15
2.4.2	Boolean	15
2.4.3	Double	16
2.4.4	String	16
2.4.5	Array	16
2.4.6	File	17
2.4.7	Server type	18
2.4.8	Position	18
2.4.9	Block	19
2.4.10	Item	22
2.4.11	Entity	22
2.4.12	Container	24
3	Server manager petition	26
3.1	Start server operation	26
3.1.1	Maps	28
3.1.2	Plugins	29
3.1.3	Server version	30
3.1.4	Config files	30
3.2	Server started notification	30
3.3	Error notification	31
3.4	Get coverage operation	31

3.4.1	Get coverage request	31
3.4.2	Get coverage response	31
4	Server petition	33
4.1	Server petition group	33
4.2	Server petition operation	34
4.3	Base operations	34
4.3.1	Server stop operation	35
4.3.2	Server stopped notification	35
4.3.3	Server started notification	35
4.3.4	Whitelist player operation	36
4.3.5	OP player operation	36
4.3.6	Set block operation	37
4.3.7	Get block operation	37
4.3.8	Get block response	37
4.3.9	Get player position operation	38
4.3.10	Get player position response	38
4.3.11	Give item to player operation	39
4.3.12	Run command operation	39
4.3.13	Get players operation	39
4.3.14	Get players response	40
4.3.15	Synchronize operation	40
4.3.16	Synchronize response	40
4.3.17	Tp player operation	40
4.3.18	Get player pitch operation	41
4.3.19	Get player pitch response	41
4.3.20	Get player yaw operation	42
4.3.21	Get player yaw response	42
4.3.22	Get player inventory operation	43
4.3.23	Get player inventory response	43
4.3.24	Get entities operation	43
4.3.25	Get entities response	44

4.4	Performance operations	44
4.5	WorldGuard operations	44
4.6	Residence operations	45
5	Clients manager petition	46
5.1	Start client operation	46
5.2	Client started response operation	46
6	Client petition	48
6.1	Stop client operation	48
6.2	Send message operation	48
6.3	Chat message	48
6.4	Run command operation	49
6.5	Break block operation	49
6.6	Equip item in hand operation	50
6.7	Move at operation	50
6.8	Look at operation	51
6.9	Synchronize operation	51
6.10	Synchronize response	51
6.11	Hit operation	51
6.12	Use operation	52
7	Revision history	53
A	Blocks	54
A.1	Unused material modifiers	54
A.2	Material modifiers	58
A.2.1	Age	58
A.2.2	Attachment	58
A.2.3	Axis	59
A.2.4	Berries	60
A.2.5	Bites	61
A.2.6	Candles	61

A.2.7	Charges	62
A.2.8	Conditional	62
A.2.9	Delay	62
A.2.10	Down	63
A.2.11	North, South, East and West	63
A.2.12	Up	65
A.2.13	Eggs	66
A.2.14	Extended	66
A.2.15	Eye	66
A.2.16	Face	67
A.2.17	Facing	67
A.2.18	Half	75
A.2.19	Hanging	78
A.2.20	Hinge	79
A.2.21	Honey level	79
A.2.22	Inverted	79
A.2.23	Layers	80
A.2.24	Leaves	80
A.2.25	Level	80
A.2.26	Lit	81
A.2.27	Locked	83
A.2.28	Mode	83
A.2.29	Note	83
A.2.30	Open	83
A.2.31	Orientation	85
A.2.32	Part	85
A.2.33	Pickles	86
A.2.34	Powered	86
A.2.35	Rotation	88
A.2.36	Shape - Rails	89
A.2.37	Shape - Stairs	90

A.2.38	Type	94
A.2.39	Vertical direction	96
A.2.40	Waterlogged	96
A.3	Material name attached modifiers	106
A.3.1	Color	106
A.3.2	Wood type	106
A.3.3	Liquid recipient	107
A.3.4	Flower	107
A.3.5	Piston head	109
A.3.6	Stripped	109
A.3.7	Infested	109
A.3.8	Dead	109
A.3.9	Heads	109
A.3.10	Heads	110
A.3.11	Sizeable	110
A.4	Material modifiers aggregation	110
A.4.1	Direction aggregation	110
A.4.2	Axis aggregation	112
A.4.3	Age aggregation	112
A.4.4	Grouped materials aggregation	113
A.4.5	Stages aggregation	113
A.4.6	Parts aggregation	113
A.4.7	Material aggregation	114
A.4.8	Liquid aggregation	114
A.5	Material modifiers concatenation	115
References		117

Figures

2.1	Packet structure	14
2.2	True packet with the LSB at 1	15
2.3	True packet with all bits at 1	15
2.4	Structure of a String	16
2.5	Example of a string array	17
2.6	File structure	18
2.7	Position structure	19
2.8	Structure of a Block	20
2.9	Structure of a Block	21
2.10	Structure of an Item	22
2.11	Structure of an Entity	23
2.12	Structure of a DroppedItem	24
2.13	Structure of a Container	25
3.1	Server manager petition structure	26
3.2	Start server petition structure	27
3.3	Start server response structure	28
3.4	Start server error response structure	28
3.5	Usual plugin structure	29
3.6	File plugin structure	30
3.7	Server started notification structure	31
3.8	Error notification structure	31
3.9	Get coverage operation structure	31
3.10	Get coverage response structure	32
4.1	Server petition structure	33
4.2	Implemented group response structure	34
4.3	Stop server operation structure	35
4.4	Server stopped response structure	35
4.5	Server started response structure	36
4.6	Whitelist player operation structure	36
4.7	OP player operation structure	36

4.8	Set block operation structure	37
4.9	Get block operation structure	37
4.10	Get block operation structure	38
4.11	Get player position operation structure	38
4.12	Get player position response structure	38
4.13	Give item to player operation structure	39
4.14	Run command operation structure	39
4.15	Get players operation structure	40
4.16	Get players response structure	40
4.17	Synchronize operation structure	40
4.18	Synchronize response structure	40
4.19	Tp player operation structure	41
4.20	Get player pitch operation structure	41
4.21	Get player pitch response structure	42
4.22	Get player yaw operation structure	42
4.23	Get player yaw response structure	42
4.24	Get player inventory operation structure	43
4.25	Get player inventory response structure	43
4.26	Get entities operation structure	44
4.27	Get entities response structure	44
5.1	Clients manager petition structure	46
5.2	Start client petition structure	46
5.3	Client started petition response structure	47
6.1	Client petition structure	48
6.2	Stop client petition structure	48
6.3	Send message petition structure	48
6.4	Client message structure	49
6.5	Run command petition structure	49
6.6	Run command petition structure	50
6.7	Run command petition structure	50
6.8	Move at petition structure	50

6.9	Move at petition structure	51
6.10	Synchronize petition structure	51
6.11	Synchronize petition response structure	51
6.12	Hit petition structure	52
6.13	Use petition structure	52
A.1a	Prefix modifier concatenation	115
A.1b	Modifier concatenation	115
A.1c	Direction modifier concatenation	115
A.1d	Direction modifier concatenation 2	116
A.1e	Direction modifier concatenation 3	116
A.1f	Integer modifier concatenation	116
A.1g	Integer modifier concatenation 2	116

Tables

2.1	DST bits meaning	14
2.2	Block enum	22
2.3	Item enum	22
2.4	Entity enum	25
4.1	Extended types	34
7.1	Revision history	53
A.1	Unused Spigot BlockData's modifiers	55
A.2	Unused Spigot BlockData's modifiers on certain blocks	57
A.3	Ageable materials	58
A.4	Attachable materials	58
A.5	Orientable materials	60
A.6	Materials with berries	61
A.7	Cake	61
A.8	Materials with candles	62
A.9	Charged materials	62
A.10	Conditionable materials	62
A.11	Delayable materials	63
A.12	Materials with down option	63
A.13	Orientable materials	65
A.14	Materials with up option	66
A.15	Materials with eggs	66
A.16	Extendable materials	66
A.17	Materials with eye	67
A.18	Directional materials	67
A.19	Directional materials	75
A.20	Two-blocks materials	78
A.21	Hangable materials	78
A.22	Doors	79
A.23	Hives	79
A.24	Invertible blocks	80

A.25 Snow	80
A.26 Bamboo	80
A.27 Levelled materials	81
A.28 Lightable materials	82
A.29 Repeater	83
A.30 Materials with mode	83
A.31 Note block	83
A.32 Openable materials	84
A.33 Jigsaw orientations	85
A.34 Jigsaw	85
A.35 Openable materials	86
A.36 Materials with pickles	86
A.37 Powerabled materials	88
A.38 Relation between rotation and where is looking	88
A.39 Directional materials	89
A.40 Rail directions	90
A.41 Rails	90
A.42 Stairs	94
A.43 Type materials	96
A.44 Dripstone	96
A.45 Waterlogged materials	105
A.46 Colors	106
A.47 Wood types	107
A.48 Liquid types	107
A.49 Plantable materials	109
A.50 Piston types	109
A.51 Heads	110
A.52 Heads	110
A.53 Direction aggregation	112
A.54 Axis aggregation	112
A.55 Age aggregation	113

A.56 Grouped materials aggregation	113
A.57 Stages aggregation	113
A.58 Parts aggregation	114
A.59 Material aggregation	114
A.60 Liquid aggregation	114

1 Documentation conventions

...

abbreviations

1.1 Glossary

async Asynchronous; returned non-sequentially. 14

IEEE 754 IEEE Standard for Floating-Point Arithmetic (IEEE 754) is a standard for computing floating-points operations. For more details about it check Rajaraman (2016). 16

Least significant bit The Least significant bit is the bit with the lowest index number. 7, 15

Most significant bit The Most significant bit is the bit with the higher index number. 33

Multidimensional array Array of arrays. 16

NOP No OPeration. It represents a valid operation that means 'do nothing'. 15

2 Introduction

explicar los distintos protocolos que se hablaron a continuacion

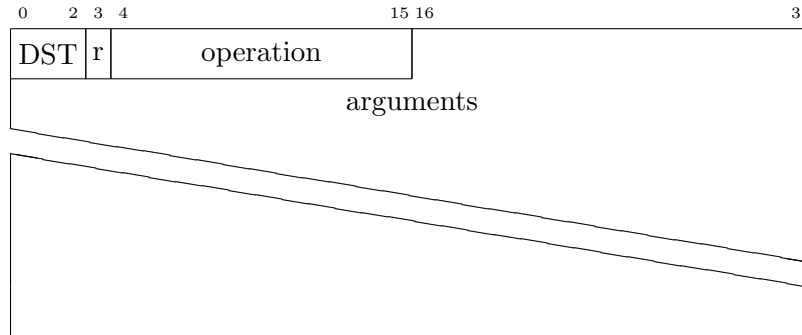


Figure 2.1: Packet structure

2.1 Destiny

explain

reference to the interconnected blocks

DST[2]	DST[1]	DST[0]	Destination
0	0	0	ServerManagerPetition
0	0	1	ServerPetition
0	1	0	ClientsManagerPetition
0	1	1	ClientPetition
1	X	X	<i>Reserved</i>

Table 2.1: DST bits meaning

2.2 Response

Some of the petitions have return objects. Those petitions will return to the sender (Tester-Connector) with the same code, but with a '1' on the Response parameter. In that case, the parameter Destiny now means 'Origin'.

Some petitions have async "returns" (for example: examples). Those will be sent using petitions without return's operations (so, petitions without a mirror petition with a '1' as Response), marked as responses (Response bit at '1').

2.3 Operation

The Operation parameter specifies the desired request. Those change according to the Destiny, so they will be discussed in more detail in their respective sections.

The only exception is the all-zeroes operation (0b000000000000) which represents a NOP request. That way, if you need to perform a long test, you won't be **explain the 'kicked by inactivity' concept** kicked by inactivity if you send this request every few minutes.

2.4 Arguments

The Arguments parameter specifies the arguments (if any) to the *Operation* request. Those change according to the Destiny, so the amount of arguments, and their types and order will be discussed in more detail in their respective sections.

Now there will be discussed the most common data types, so they will be independent of any programming language.

2.4.1 Character

Characters are sent as a 1-byte integer, representing its ASCII **ref?** value.

2.4.2 Boolean

Booleans are 1-bit element that represents *true* (0b1), or *false* (0b0).

For alignment **define?** reasons, booleans will be sent as 1-byte element. To avoid misunderstandings, let's define *false* as 0x00, and *true* as 'not **define?** *false*'. That way, this two packets are valid *true* elements:

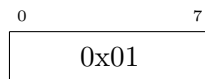


Figure 2.2: True packet with the LSB at 1

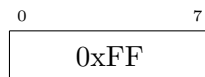


Figure 2.3: True packet with all bits at 1

2.4.3 Double

Doubles are 8-bytes floating-point numbers. They are represented following the IEEE 754¹.

2.4.4 String

Strings are arrays of characters. Refer to the respective subsections for more information.

2.4.5 Array

Arrays are a set of n elements of the same type.

The structure is a 2-byte **first (0..7) MSB, then (8..15) LSB** integer (representing the number of elements, n), followed by n elements of the same type. As a note here, by representing the size with a 2-byte integer the maximum number of elements per array is 65,535.

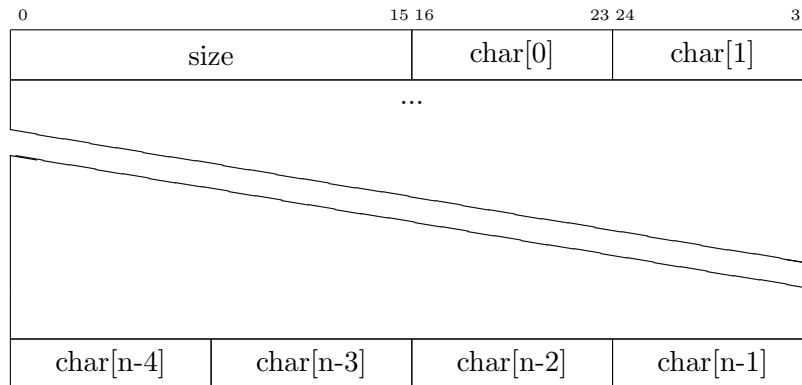


Figure 2.4: Structure of a String

Arrays can be multidimensional, holding n arrays of the same type. It's worth mentioning that they don't have to be arrays of the same length, as can be seen in Figure 2.5, Example of a string array.

¹This standard should be used by C, Java and Python. **cite?**

0		15 16		23 24		31	
2 [number of arrays]			5 [str[0]’s length]				
h		e		l		l	
o		6 [str[1]’s length]				w	
o		r		l		d	
!		next type					

Figure 2.5: Example of a string array

2.4.6 File

Similar to the Array, a File is a name (String), followed by a group of bytes.

The problem here is that if we stick with the Array structure, the maximum size of a file will be around 8kB. To solve this, the File structure implements some kind of 'extended array', that extends the 'size' parameter to 32 bits. That way, the file size restriction by protocol definition² is 4GB.

²Besides defining here what's allowed, remember that this packet will be inside a TCP payload **definition?**. This means that the maximum file size will be probably redefined by the machine's TCP firewalls.

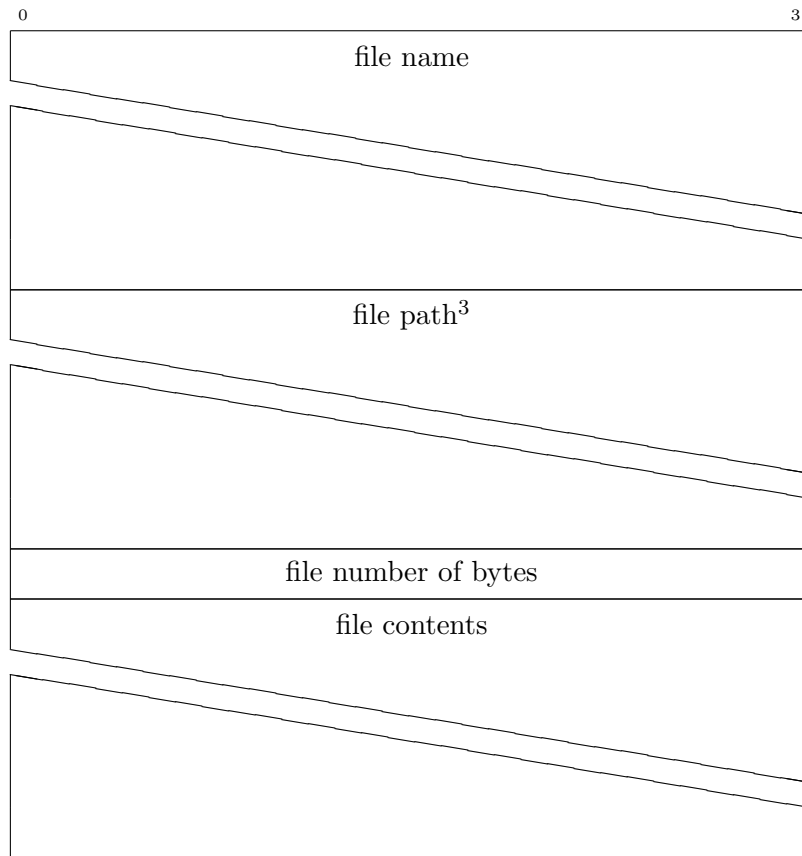


Figure 2.6: File structure

2.4.7 Server type

The Server type specifies the Minecraft server.

As a standard, we only support Spigot (*Spigot* (n.d.)) and Paper (*PaperMC* (n.d.)), but for scalability reasons this parameter is a String specifying the server type.

2.4.8 Position



³The path must be relative, and you can't go outside the Server directory (using '../'). Both " and './' means the root of the Server directory.

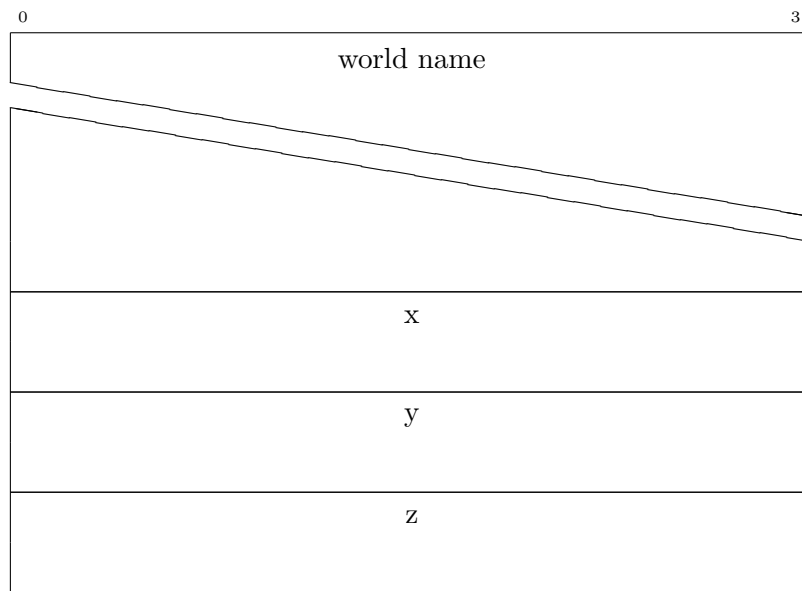


Figure 2.7: Position structure

2.4.9 Block

... 56 bytes

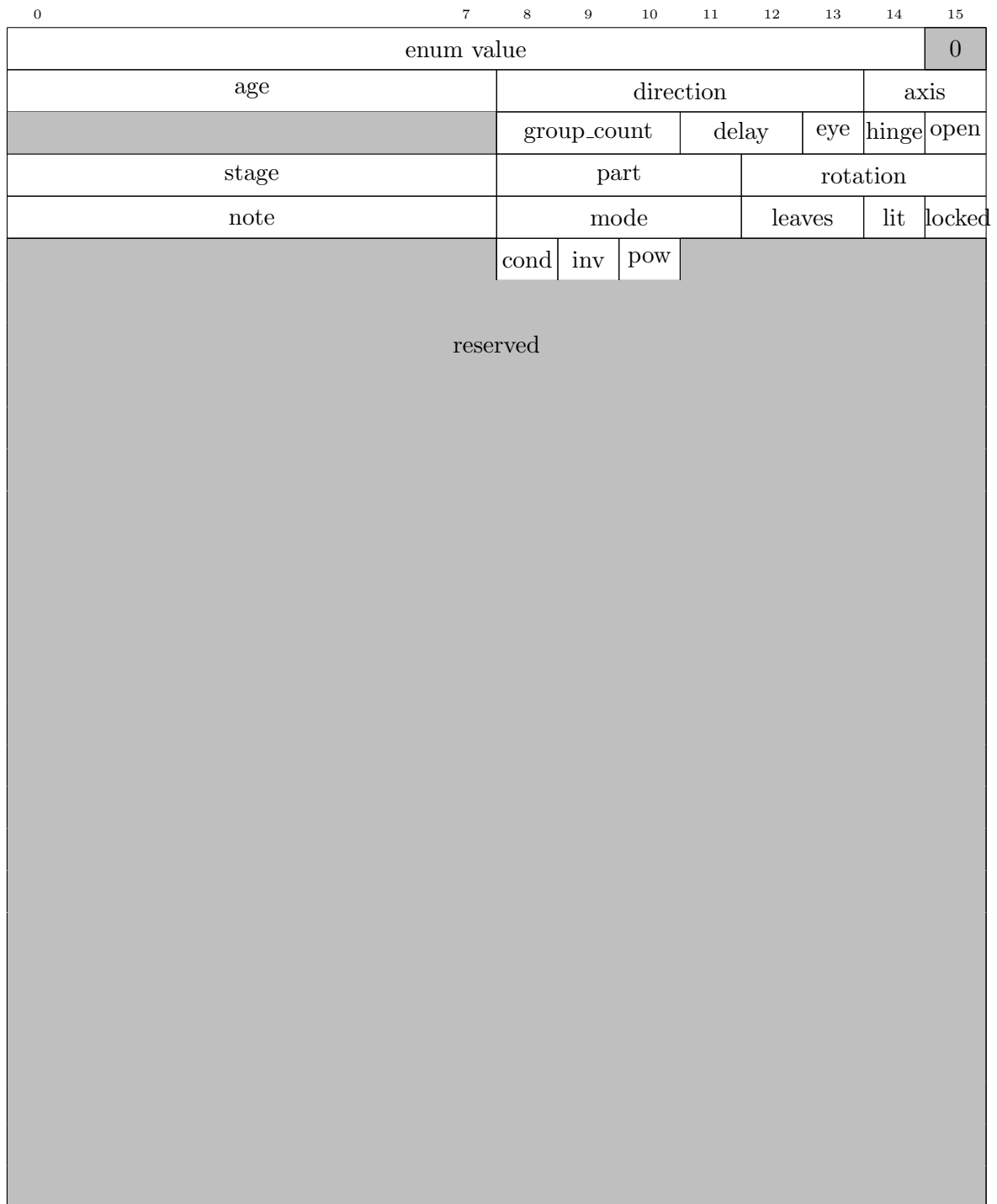


Figure 2.8: Structure of a Block

0	3	4	5	6	7	8	9	10	11	12	13	14	15	
enum value													0	
age					direction						axis			
color					group_count			delay		eye	hinge	open		
stage					part				rotation					
note					mode				leaves		lit	locked		
liquid		cond	inv	pow	strp	inst	dead	reserved						
							material color							
material ⁴														

Figure 2.9: Structure of a Block

⁴Some blocks (like slabs) are made of other materials.

unsigned 4-bytes integer. 2MSB forced at 00 (01, 10 and 11 reserved for Complex/Basic Blocks (if made)), others as Enum value

Enum value	Block name	First Minecraft version
0	AIR	1.8

Table 2.2: Block enum

2.4.10 Item

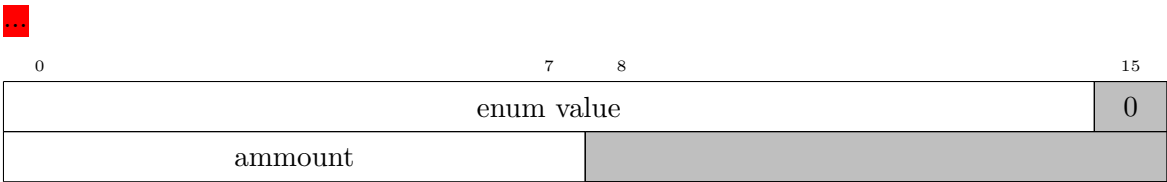


Figure 2.10: Structure of an Item

Enum value	Item name	First Minecraft version
0	AIR	1.8

Table 2.3: Item enum

2.4.11 Entity

...

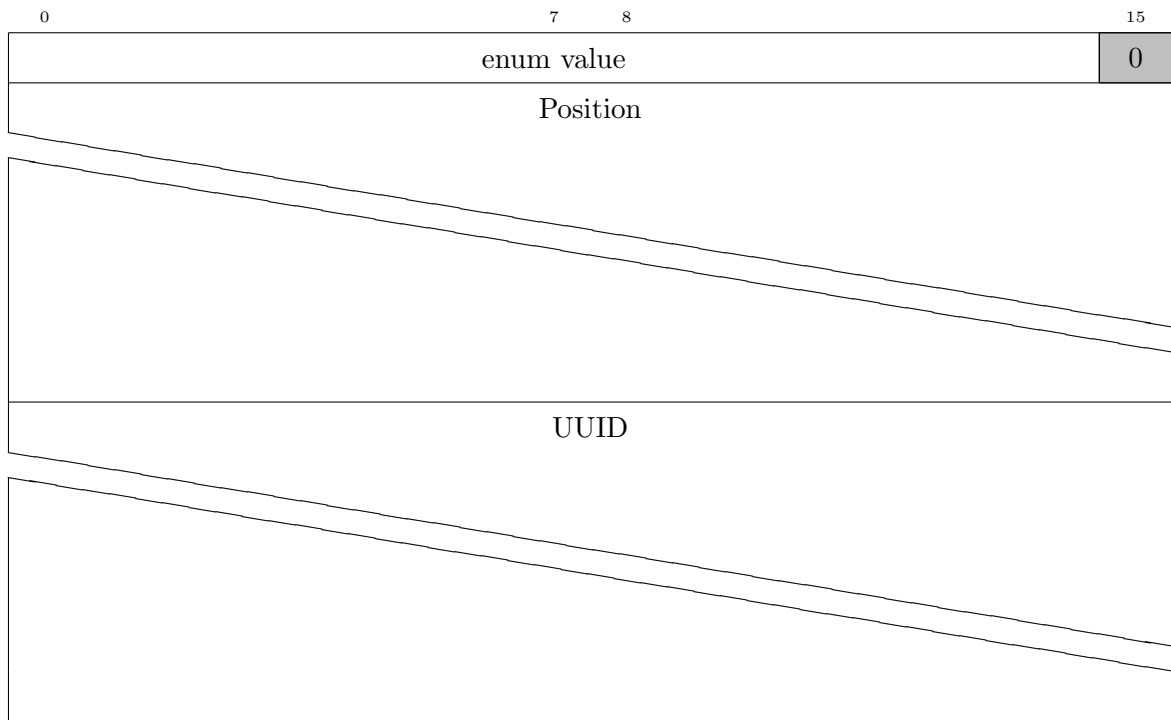


Figure 2.11: Structure of an Entity

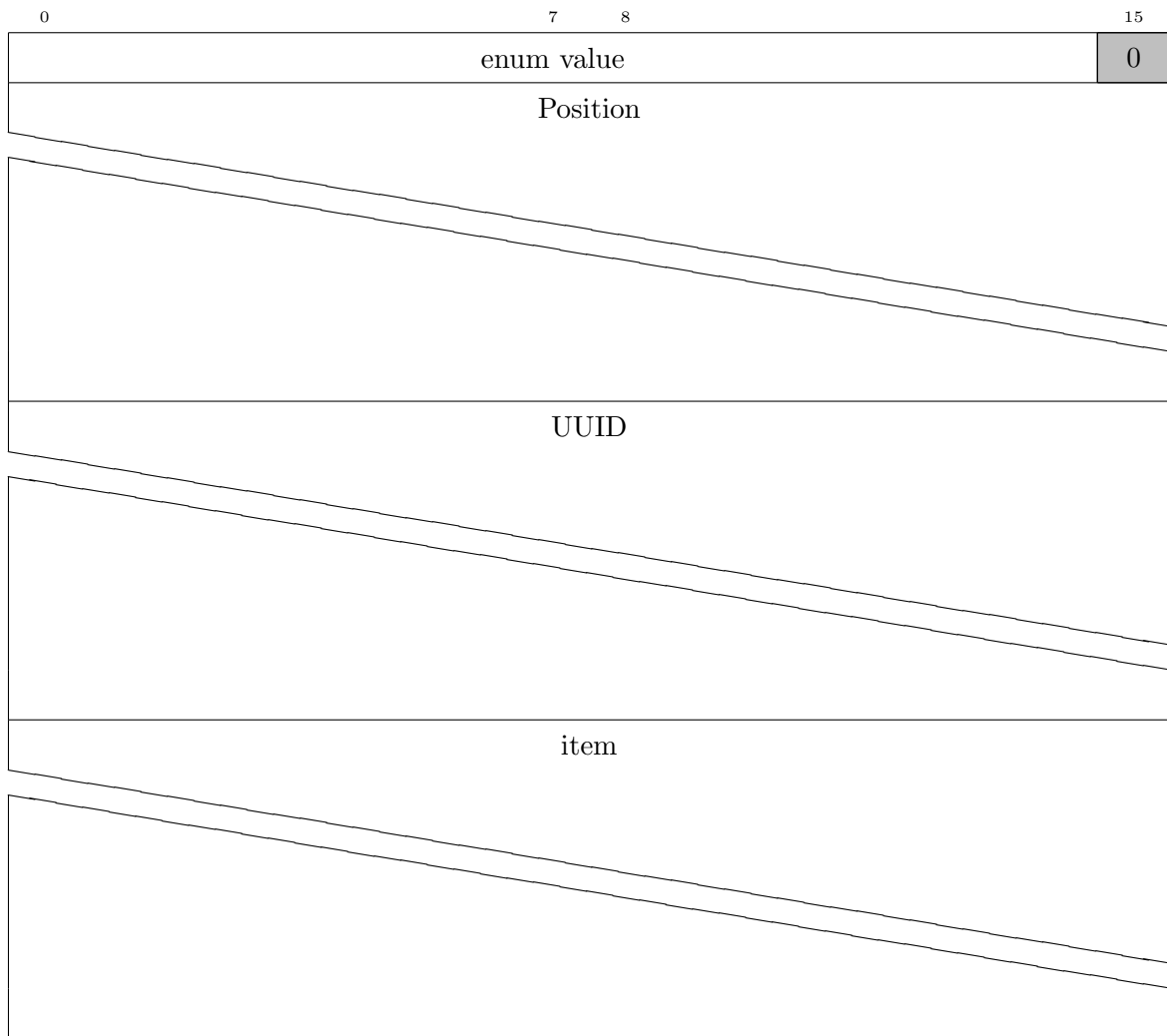


Figure 2.12: Structure of a `DroppedItem`

2.4.12 Container



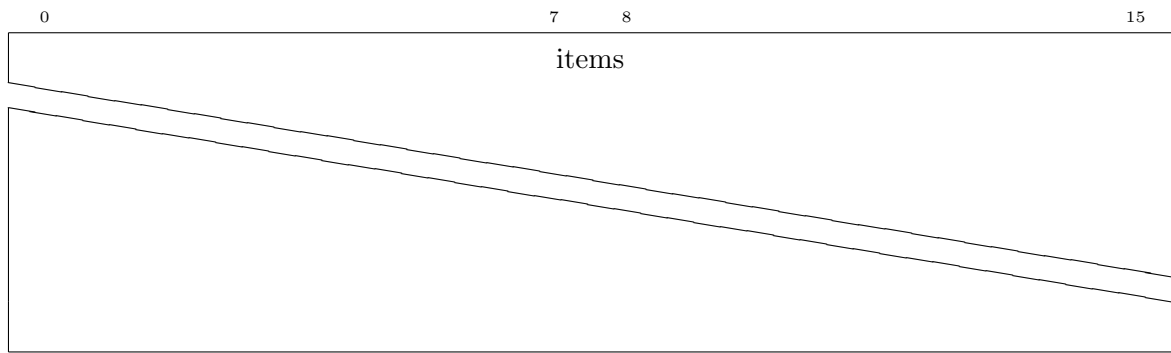


Figure 2.13: Structure of a Container

Enum value	Entity name	First Minecraft version
0	ZOMBIE	1.8

Table 2.4: Entity enum

3 Server manager petition

...

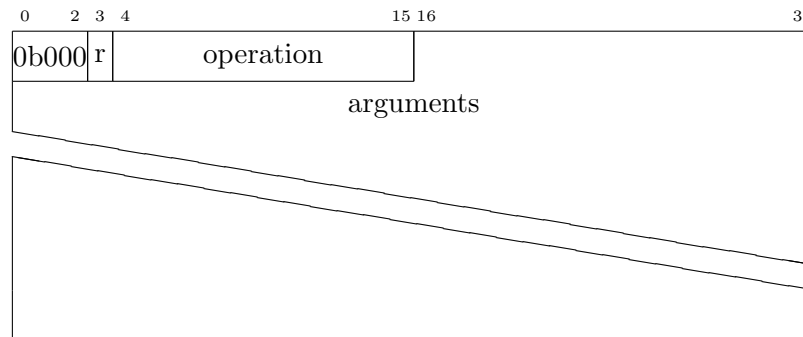


Figure 3.1: Server manager petition structure

Table of operations

You don't have to implement the NOP operation in this destiny block because the timeout happens inside the Server petition block. That is, if you don't call operations (or send NOPs) to the Server petition for a long time, the server will stop, and because the server stopped the Server manager will close the established connection.

3.1 Start server operation

...

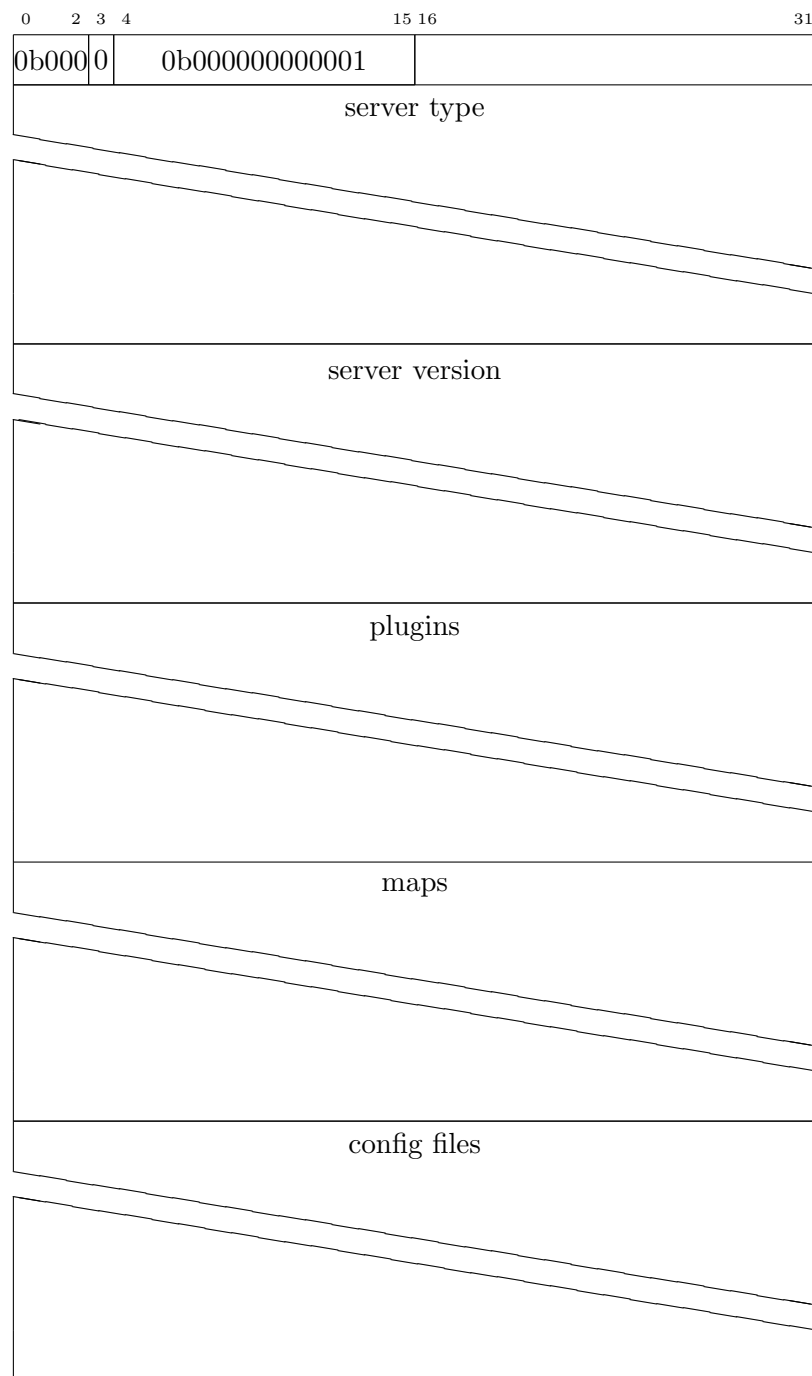


Figure 3.2: Start server petition structure

Once a 'start server' request is received the program should create a server with the specified arguments, and return its IP:Port (for example, '127.0.0.1:25565', a 15-characters string; see Figure 3.3, Start server response structure). The IP to send the Server Petitions is the same, but the next port (IP:<port+1>).

If it's not possible to create it (for example: one argument is invalid, the user sent a plugin when it's specified that only Usual Plugins are allowed **explain**, or there's no free servers of that type), then an empty IP is returned (see Figure 3.4, Start server error response structure).

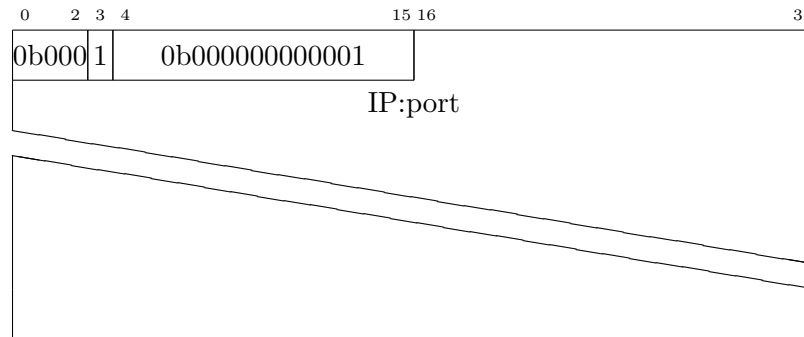


Figure 3.3: Start server response structure

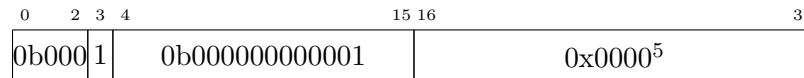


Figure 3.4: Start server error response structure

3.1.1 Maps

Array of maps (worlds; Map[]). To have more information about arrays check the subsection 2.4.5, Array.

About the Map type, Minecraft is divided on different worlds (*World - Minecraft Wiki* (n.d.)). By default there's only three, but with some plugins this number can increase.

In order to properly test some plugins, there may be needed some kind of known place. To avoid overusing the Set block operation **link** you can send using this argument your(s) world(s).

Map in more detail

⁵Being the argument an array, the first 2 bytes specifies its size. As we must return an empty array, the argument should be exactly 16 zeroes.

3.1.2 Plugins

Array of plugins (Plugin[]). To have more information check the subsection 2.4.5, Array.

About the Plugin type, there's three types of plugins:

1. Usual plugins

The Usual plugins are plugins that you expect everyone to have for being extremely common, like WorldGuard (*WorldGuard* (n.d.)), or to allow the user to test plugins with Premium plugins⁶ dependencies. This allows both security and performance.

Something to highlight is the fact that, as mentioned in the operation Allows non usual plugins [reference](#), some ServerManager will only allow plugins that are already in the machine.

As can be seen in the Figure 3.5, Usual plugin structure, the first argument (that specifies the Plugin type) is 0x00.

The plugin version is optional, and can't be specified in the parameter *name*. If no version is provided (an empty string) then the Server Manager will pick the plugin with the highest version that is compatible with the desired server version.

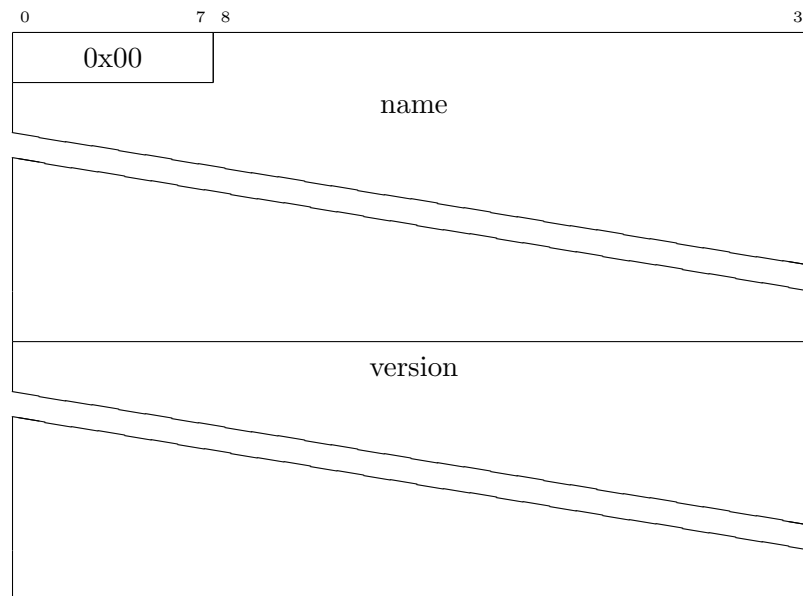


Figure 3.5: Usual plugin structure

⁶Premium plugins are paid plugins. For that reason, only the purchaser can download them (so you can't send a link to the plugin), and sending them through the internet via file upload may not be legal, so the plugin must be already downloaded in the machine.

2. Uploaded plugins

The Uploaded plugins are plugins available in some website, thus can be sent through an URL.

structure?

3. File plugins

File plugins are plugins that are non-usual and aren't uploaded in any website, so they must be sent as a file.

As can be seen in the Figure 3.6, File plugin structure, the first argument (that specifies the Plugin type) is 0x02.

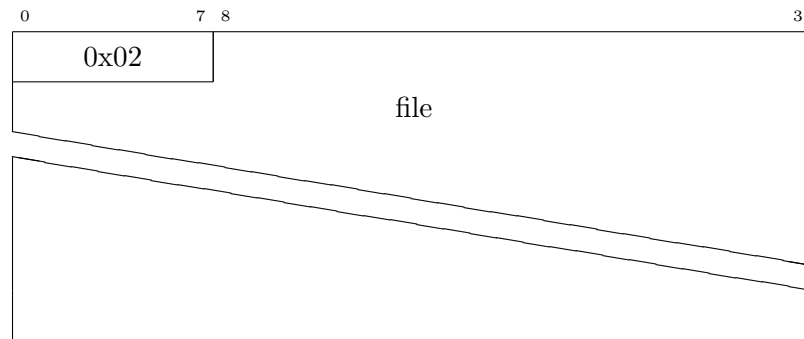


Figure 3.6: File plugin structure

mixed plugin types example?

3.1.3 Server version

String specifying the server type's version. For example, '1.12.2'.

3.1.4 Config files

...

3.2 Server started notification

After a Start server operation the server will start. Due to the unpredictable amount of time that the server takes to start up you'll receive a Server started notification once the server socket is available.

You may notice that there's another Server started notification under the Server petition section. That notification goes to the ServerManager ref?, while this goes to the Tester ref?. Also, the Server one have a token that is only shared between Server and the ServerManager, and the Tester doesn't have to know it too.

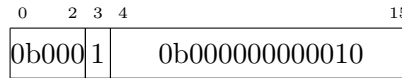


Figure 3.7: Server started notification structure

3.3 Error notification

...

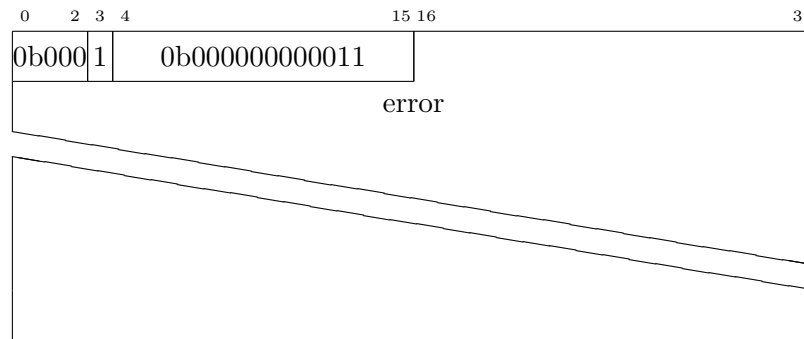


Figure 3.8: Error notification structure

3.4 Get coverage operation

... get JaCoCo binary file

3.4.1 Get coverage request

...

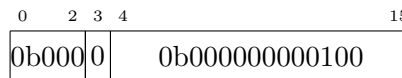


Figure 3.9: Get coverage operation structure

3.4.2 Get coverage response

...

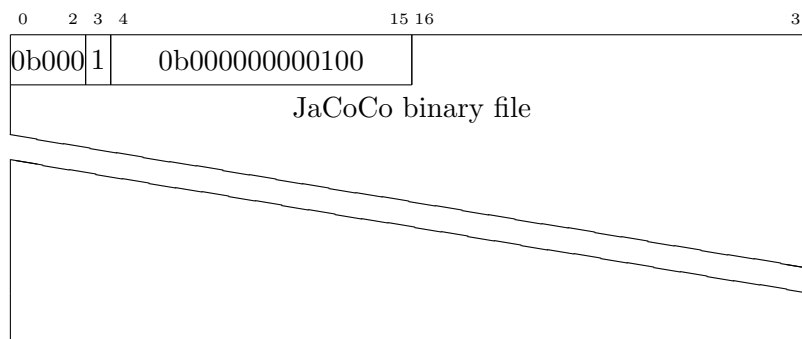


Figure 3.10: Get coverage response structure

4 Server petition

...

The server petitions are a bit different from the rest. The server petitions are designed in a way that everyone have some common operations, and then you can add some others optionally (and even non-standard ones). We'll define this 'set of operations' as groups.

For that reason, the operation field (defined on the Figure 2.1, Packet structure) becomes the group, and then the operation is defined on the next 2 bytes, as shown in the Figure 4.1, Server petition structure.

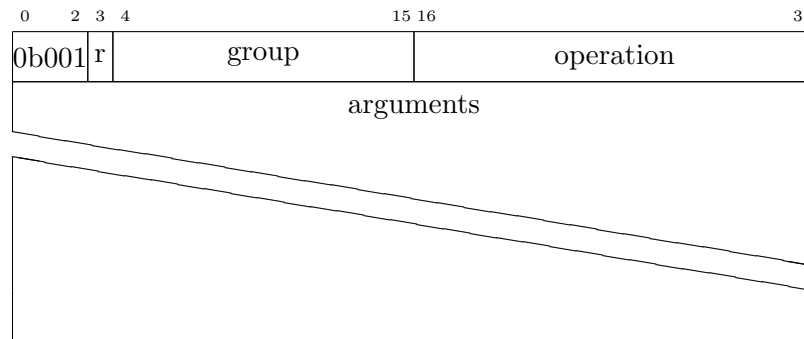


Figure 4.1: Server petition structure

4.1 Server petition group

The group tells which kind of petitions we're talking about.

The MSB **abbreviation?** tells if the group is one of the standards, thus must be followed by specification, or if it's non-standard, so the petition can be whatever the user want it to be. This is useful if you want to implement a petition not followed by the standard, or if the petition only makes sense in your personal environment.

The 0b00000000000001 group represents the 'base group'. This group implements some basic operations, and must be implemented. All the others are optional.

type[15]	type[14..4]	Extended type
0	0b000000000000	NOP ⁷
0	0b000000000001	Base operations
0	0b000000000010	System operations
0	0b000000000011	Performance operations
0	0b00000010000	WorldGuard operations
0	0b00000010001	Residence operations
1	XXXXXXXXXXXX	Reserved for internal use

Table 4.1: Extended types

If you’ve implemented an extended type and you believe that it makes sense to be part of the standard contact contact@watchwolf.dev to reserve one of the addresses.

4.2 Server petition operation

Like the parameter Operation, it specifies the desired request. For more information, refer to the subsection 2.3, Operation.

The only reserved operation is the all-zeroes operation (0x0000). It represents the question ‘is this extended petition implemented?’. The server must response (with the response bit at 1) with *true* (group implemented on this machine) or *false* (unknown/unimplemented group), as it can be seen in Figure 4.2, Implemented group response structure.

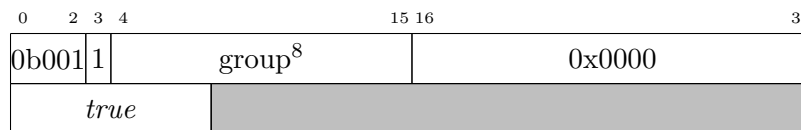


Figure 4.2: Implemented group response structure

4.3 Base operations

...

‘is implemented’ (all zeroes) optional

⁷As stated on the subsection 2.3, Operation, the all-zeroes operation represents a NOP request.

⁸except for groups 0b000000000000 and 0b000000000001

4.3.1 Server stop operation

...

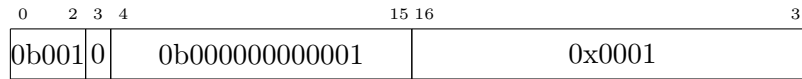


Figure 4.3: Stop server operation structure

4.3.2 Server stopped notification

... response to...

To have more information about the *server id* parameter check the Subsection 4.3.3, Server started notification.

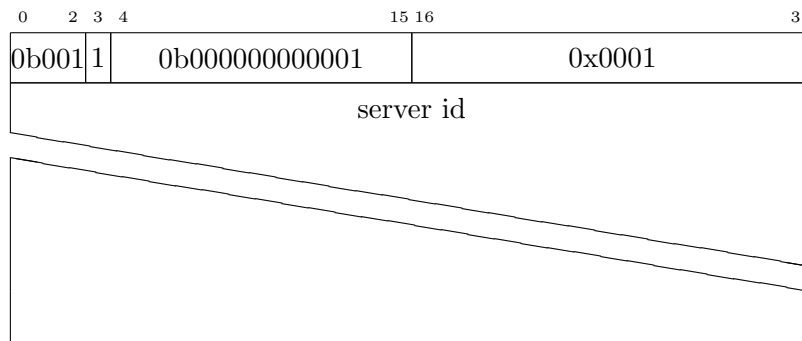


Figure 4.4: Server stopped response structure

4.3.3 Server started notification

This notification is sent to the Server Manager [ref?](#), as a response for the Start server operation, thus not really a response of a Server's operation.

As one IP can have multiple servers, a string that identifies the server must be sent with the response. This argument can be whatever you want (for example, <server ip>:<server port> will be unique), but must be shared between both the Server Manager and the Server. For security reasons [cite IP spoofing or similar](#) (because the Tester [ref?](#) also knows the server's IP and port) a hash function is encouraged to be used.

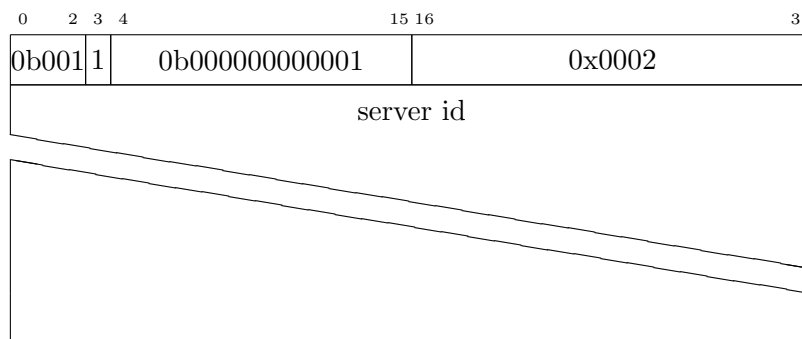


Figure 4.5: Server started response structure

4.3.4 Whitelist player operation

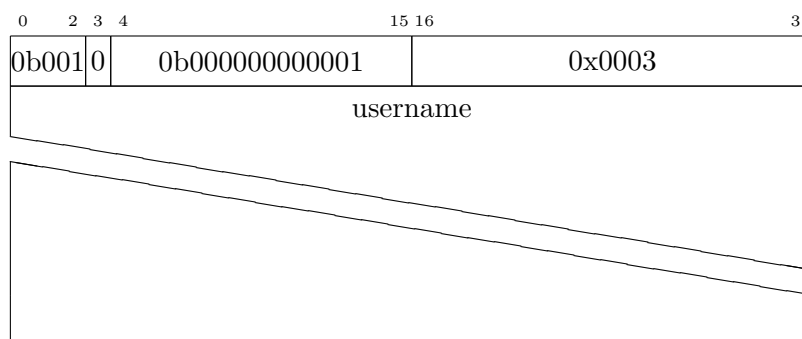


Figure 4.6: Whitelist player operation structure

4.3.5 OP player operation

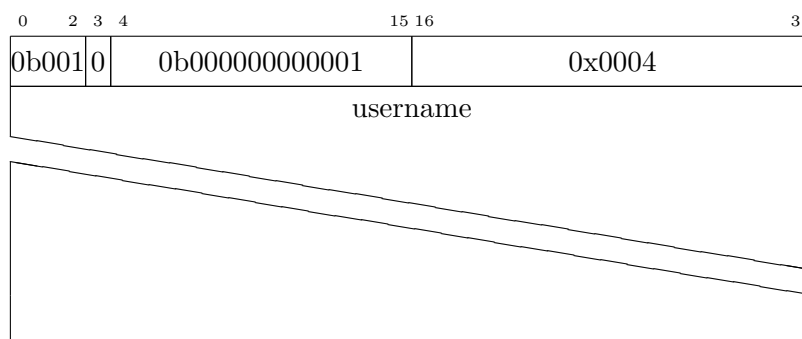


Figure 4.7: OP player operation structure

4.3.6 Set block operation

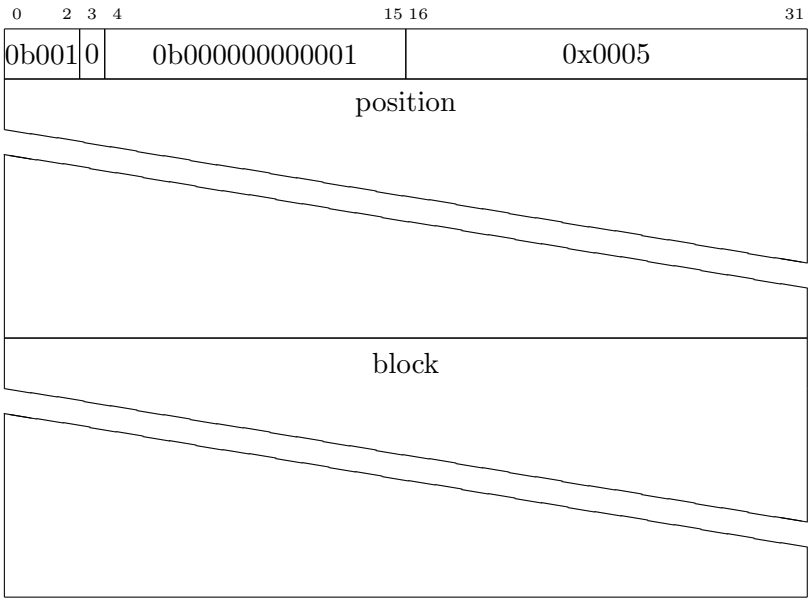


Figure 4.8: Set block operation structure

4.3.7 Get block operation

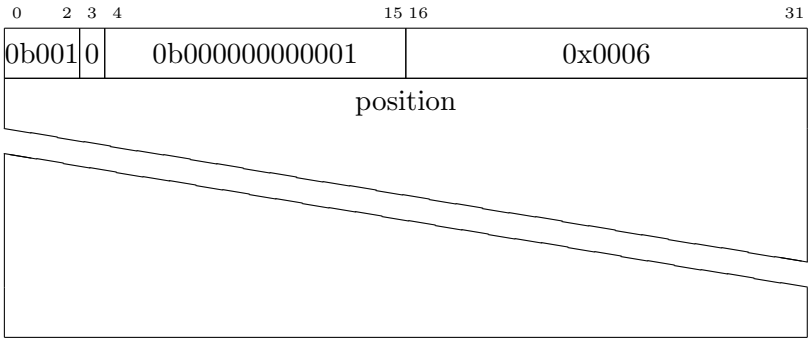


Figure 4.9: Get block operation structure

4.3.8 Get block response



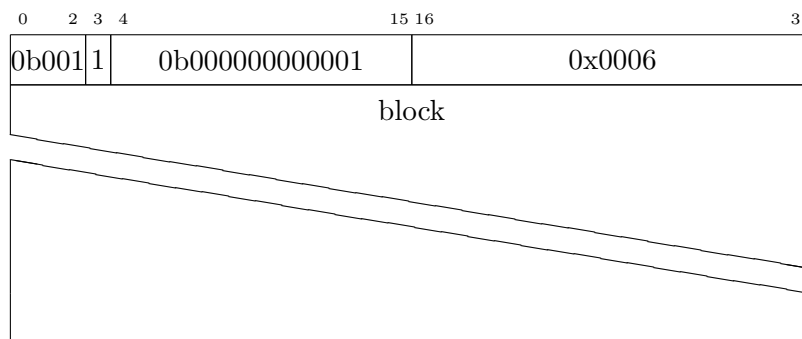


Figure 4.10: Get block operation structure

4.3.9 Get player position operation

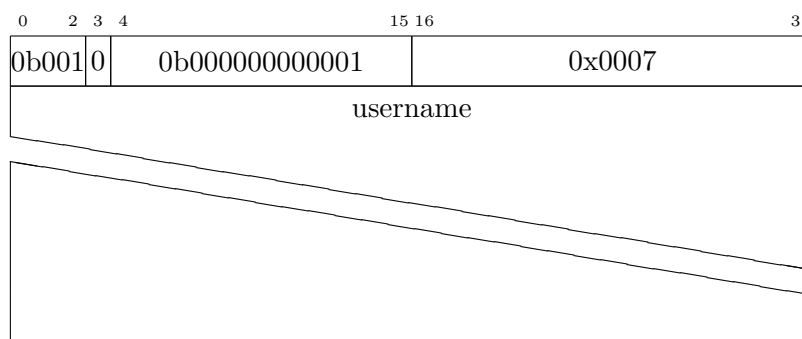


Figure 4.11: Get player position operation structure

4.3.10 Get player position response

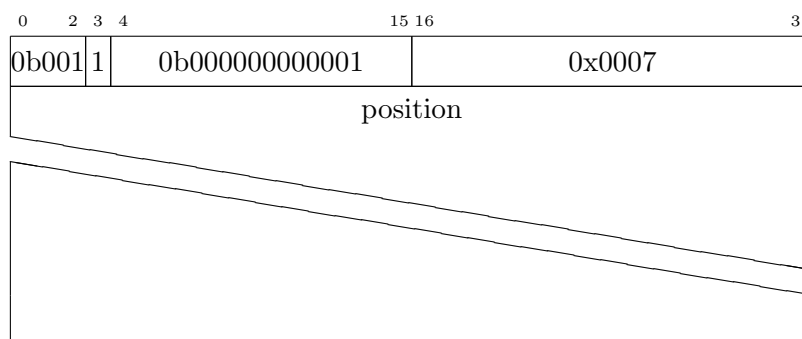


Figure 4.12: Get player position response structure

4.3.11 Give item to player operation

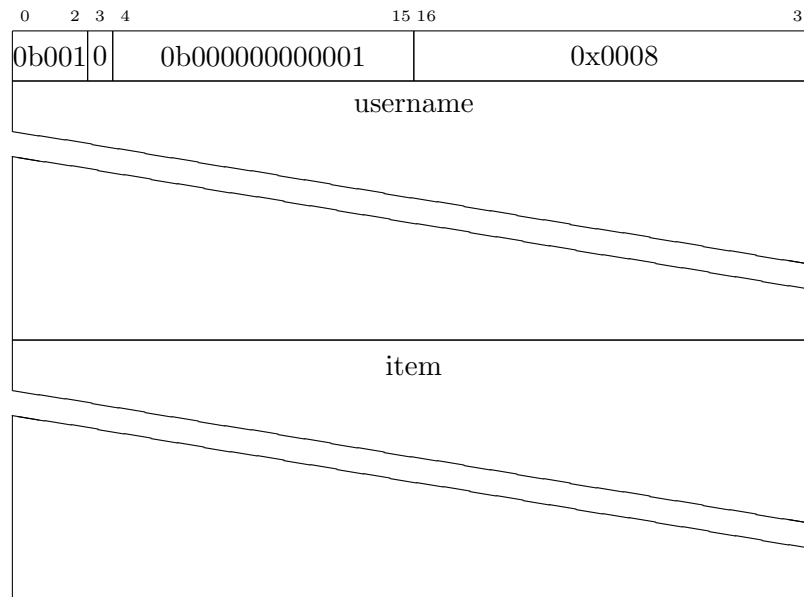


Figure 4.13: Give item to player operation structure

4.3.12 Run command operation

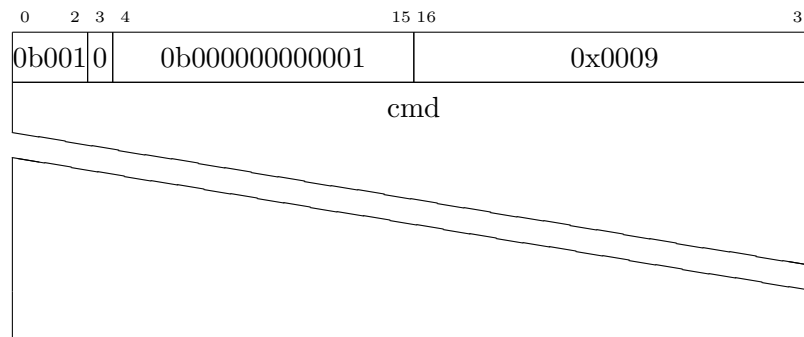


Figure 4.14: Run command operation structure

4.3.13 Get players operation



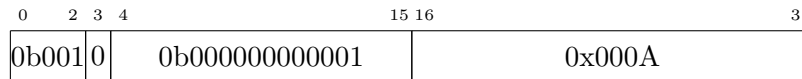


Figure 4.15: Get players operation structure

4.3.14 Get players response

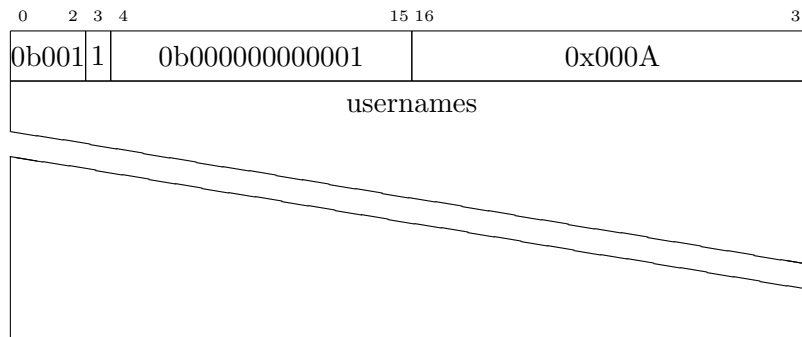


Figure 4.16: Get players response structure

4.3.15 Synchronize operation

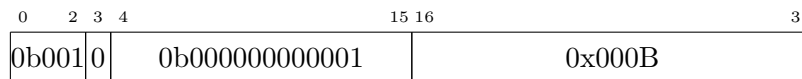


Figure 4.17: Synchronize operation structure

4.3.16 Synchronize response

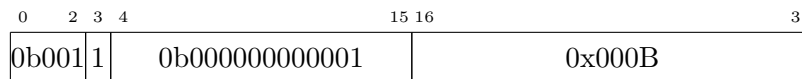


Figure 4.18: Synchronize response structure

4.3.17 Tp player operation



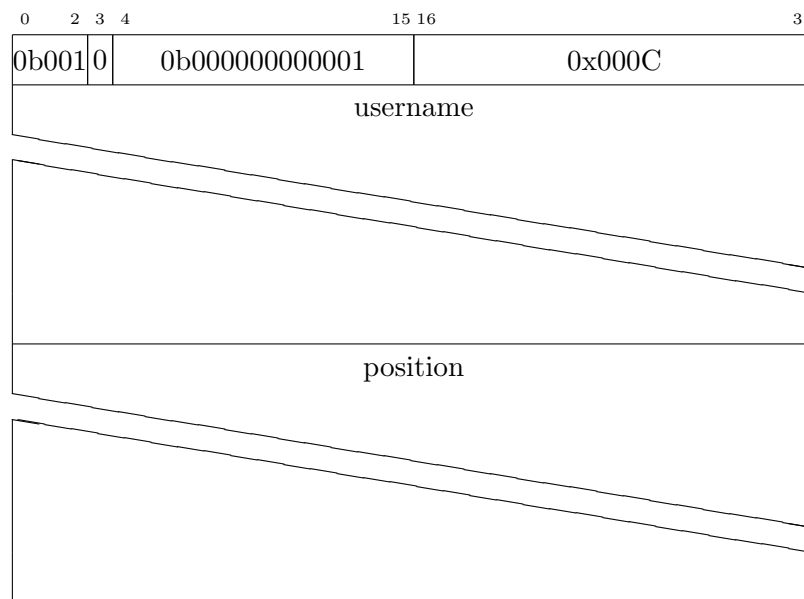


Figure 4.19: Tp player operation structure

4.3.18 Get player pitch operation

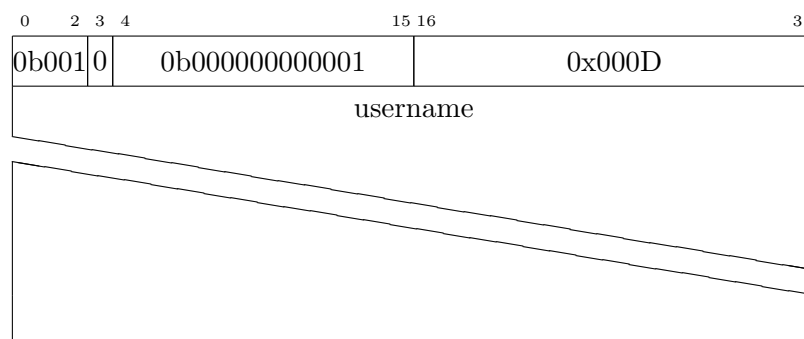


Figure 4.20: Get player pitch operation structure

4.3.19 Get player pitch response



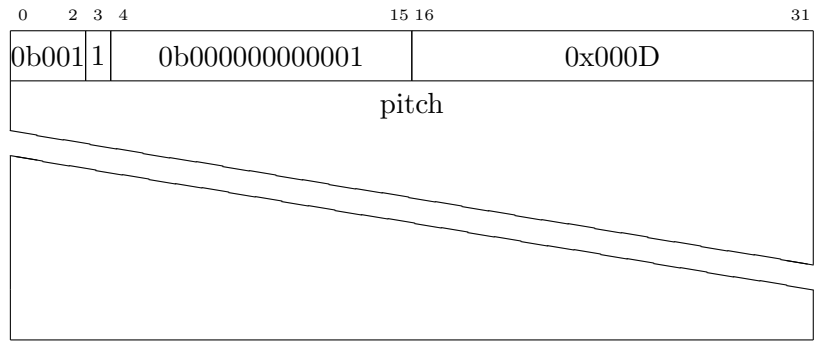


Figure 4.21: Get player pitch response structure

4.3.20 Get player yaw operation

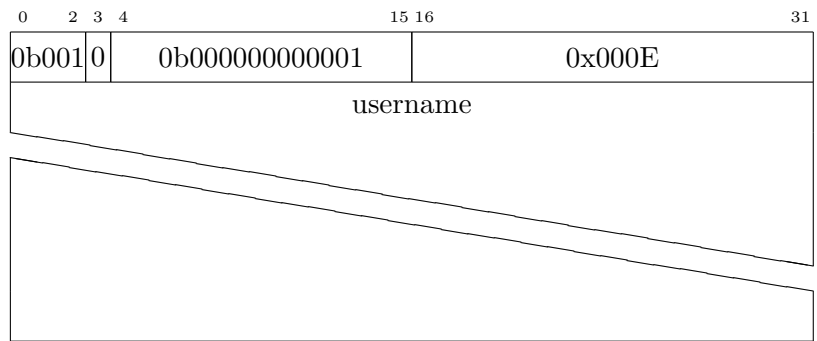


Figure 4.22: Get player yaw operation structure

4.3.21 Get player yaw response

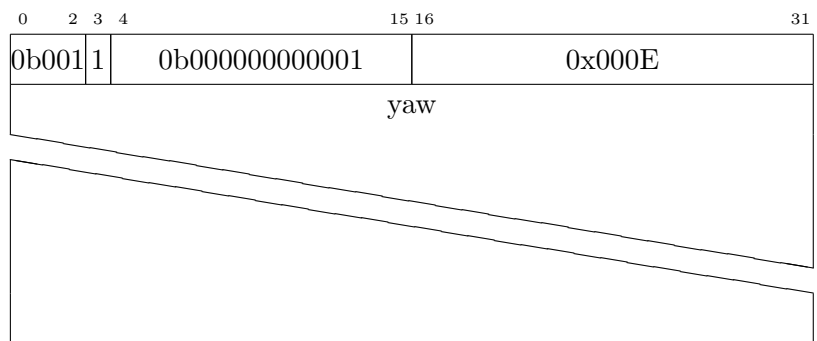


Figure 4.23: Get player yaw response structure

4.3.22 Get player inventory operation

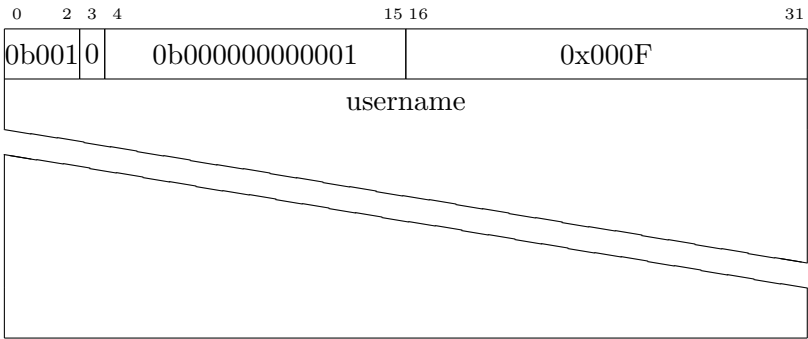


Figure 4.24: Get player inventory operation structure

4.3.23 Get player inventory response

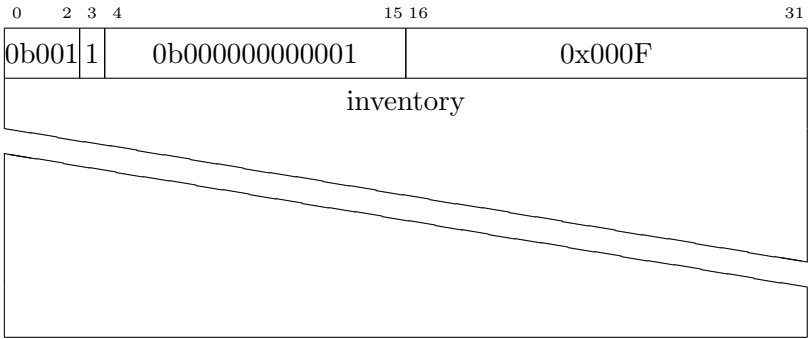


Figure 4.25: Get player inventory response structure

4.3.24 Get entities operation



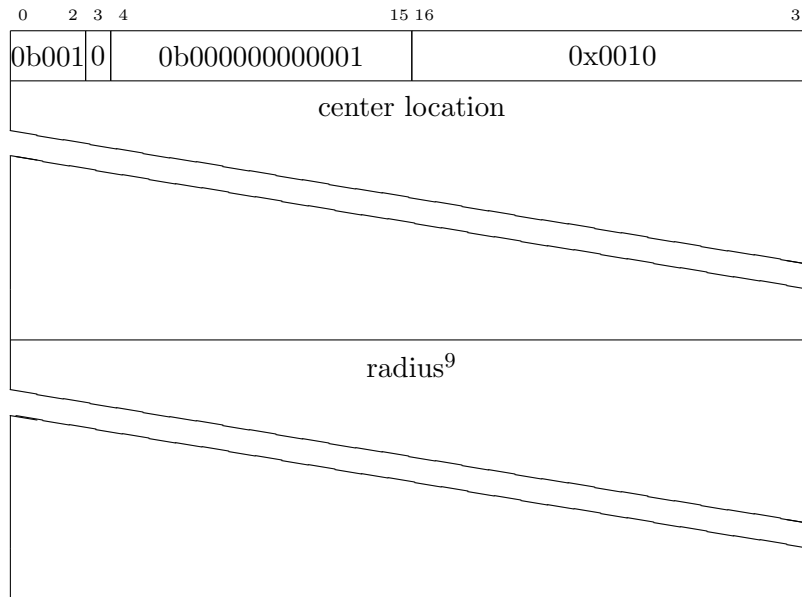


Figure 4.26: Get entities operation structure

4.3.25 Get entities response

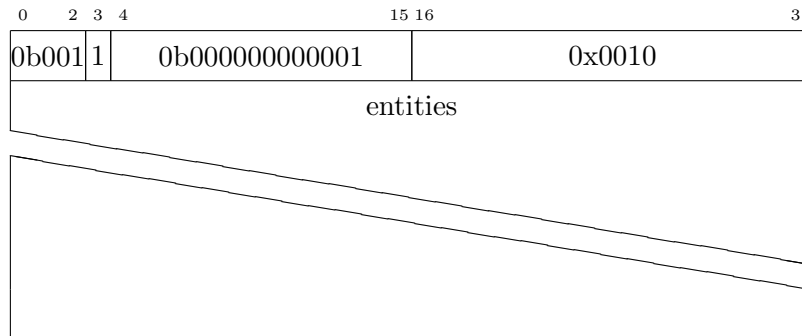


Figure 4.27: Get entities response structure

4.4 Performance operations



4.5 WorldGuard operations



⁹Large radius or locations in unloaded chunks may return unexpected data.

4.6 Residence operations



5 Clients manager petition

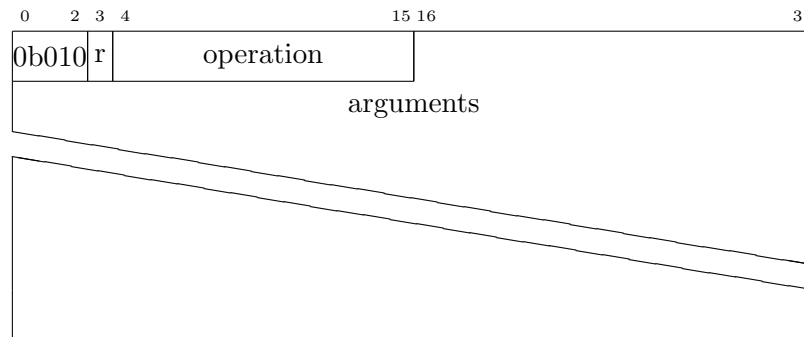


Figure 5.1: Clients manager petition structure

5.1 Start client operation

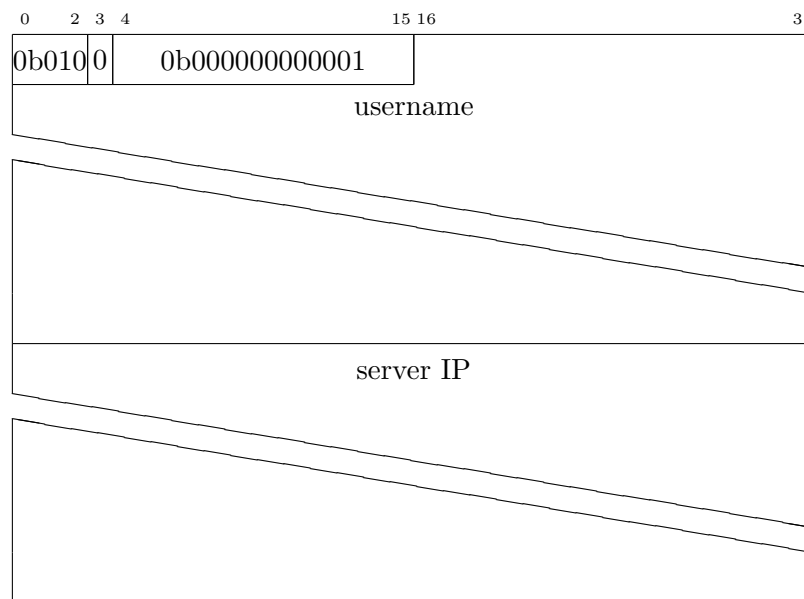


Figure 5.2: Start client petition structure

5.2 Client started response operation



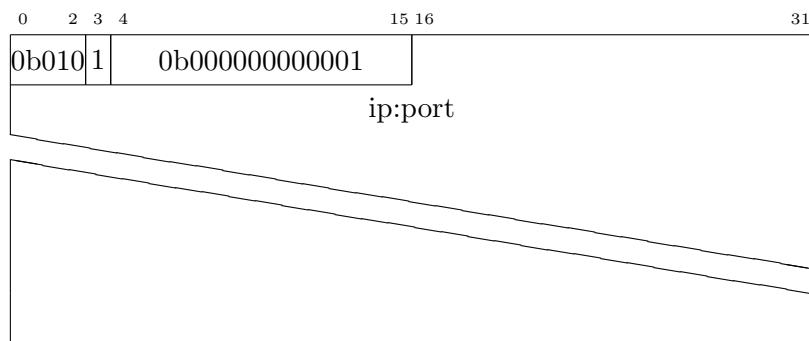


Figure 5.3: Client started petition response structure

6 Client petition

...

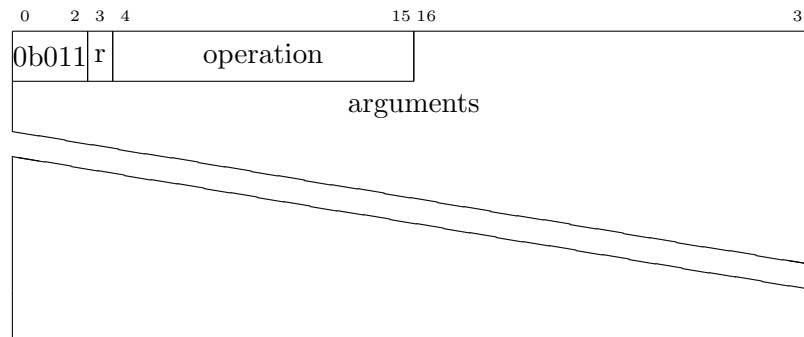


Figure 6.1: Client petition structure

6.1 Stop client operation

...

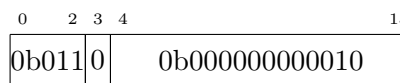


Figure 6.2: Stop client petition structure

6.2 Send message operation

... don't use this to run commands

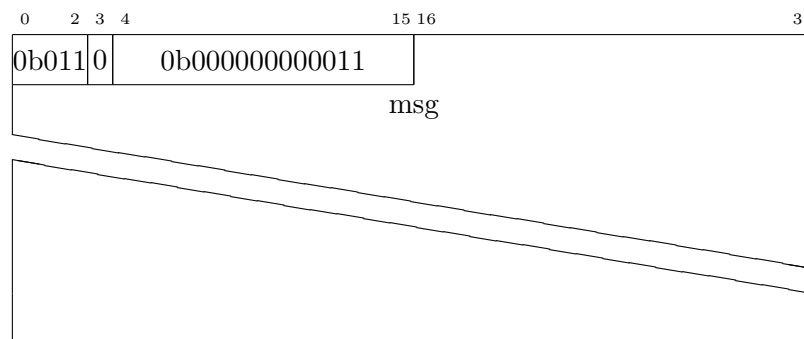


Figure 6.3: Send message petition structure

6.3 Chat message

... async

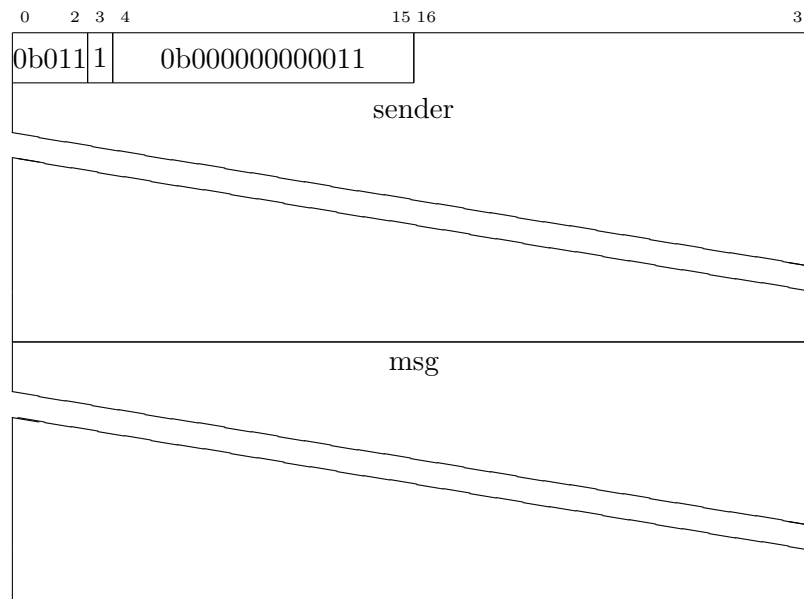


Figure 6.4: Client message structure

6.4 Run command operation

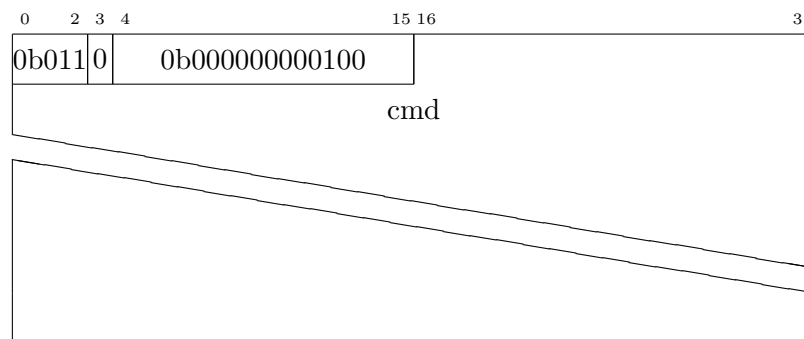


Figure 6.5: Run command petition structure

6.5 Break block operation



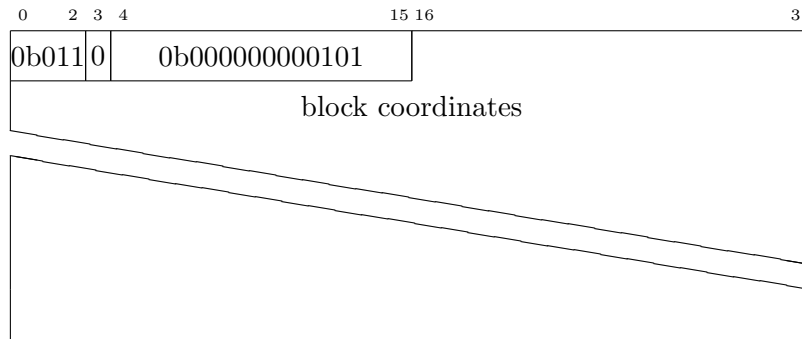


Figure 6.6: Run command petition structure

6.6 Equip item in hand operation

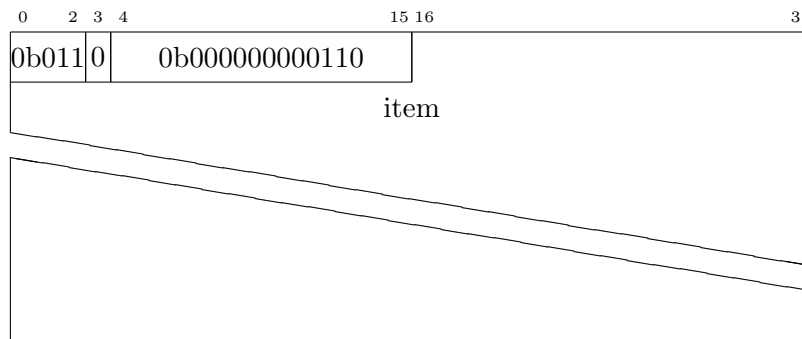


Figure 6.7: Run command petition structure

6.7 Move at operation

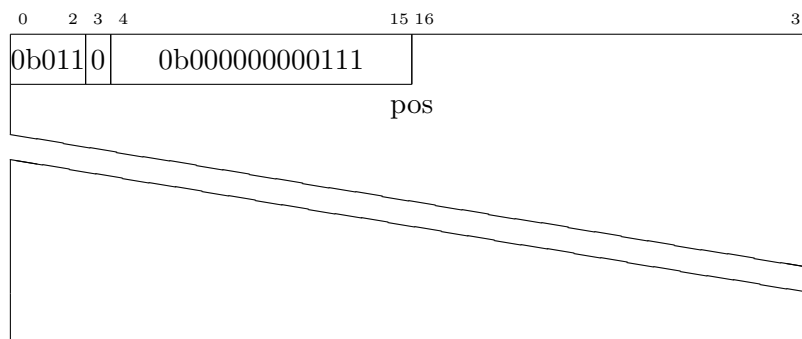


Figure 6.8: Move at petition structure

6.8 Look at operation

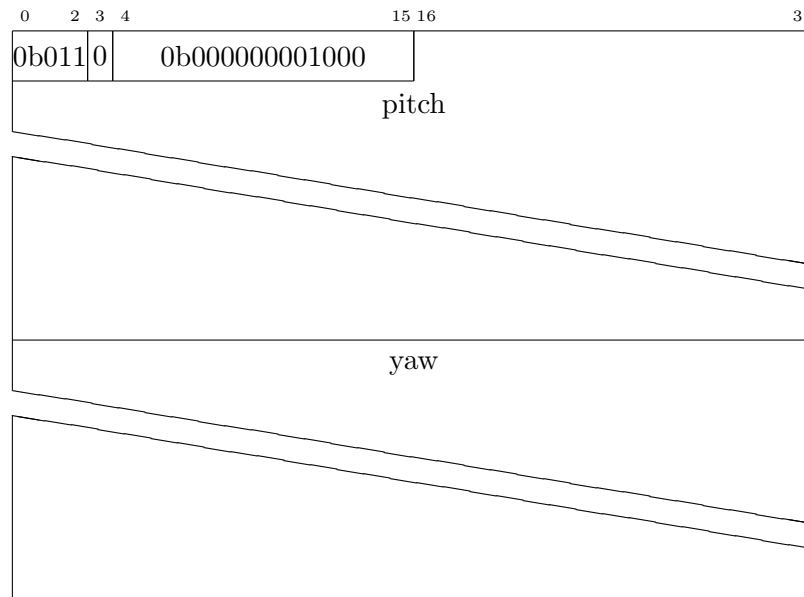


Figure 6.9: Move at petition structure

6.9 Synchronize operation

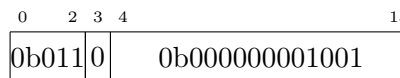


Figure 6.10: Synchronize petition structure

6.10 Synchronize response

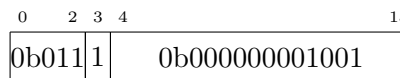


Figure 6.11: Synchronize petition response structure

6.11 Hit operation

... left click with item in hand

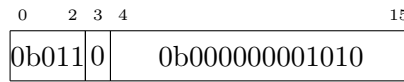


Figure 6.12: Hit petition structure

6.12 Use operation

... right click with item in hand

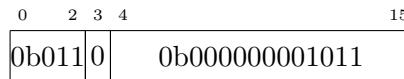


Figure 6.13: Use petition structure

7 Revision history

Date	Revision	Changes
date	1	Initial release.

Table 7.1: Revision history

A Blocks

To generate the blocks enum Spigot 1.19 was used. That means that all the block names *should* be the exact same as *Spigot - Enum Material - 1.19* (n.d.).

A.1 Unused material modifiers

There's some Spigot modifiers that beside existing it won't be imported because there aren't a distinguished block in their own. You can find those in Figure A.1, Unused Spigot BlockData's modifiers.

Modifier name	Reason for discarding
has_bottle_X	Inventory dependent
has_record	Inventory dependent
enabled	Adjacent redstone dependent
triggered	Adjacent redstone dependent
instrument	Bottom-block dependent
occupied	Entity dependent
persistent	Admin block
unstable	Admin block
distance	Block dependent
stage	Same block
short	Tick dependent
attached	Block dependent
disarmed	Block dependent
power	Block/event dependent
tilt	Entity dependent
can_summon	Admin block
shrieking	Entity dependent
bloom	Admin block
bottom	Bottom-block dependent
has_book	Inventory dependent
sculk_sensor_phase	Admin block

Modifier name	Reason for discarding
signal_fire	Bottom-block dependent
north=tall	Top-block dependent
south=tall	Top-block dependent
east=tall	Top-block dependent
west=tall	Top-block dependent
hatch	Unable to concatenate
thickness	Block dependent
snowy	Block dependent
in_wall	Same block
moisture	Block dependent

Table A.1: Unused Spigot BlockData’s modifiers

In addition to this, some modifiers applied to certain blocks doesn’t change the block itself. Those are mentioned in Figure A.2, Unused Spigot BlockData’s modifiers on certain blocks.

Block name	Modifier name
CAVE_VINES	age
CACTUS	age
FIRE	age
KELP	age
SUGAR_CANE	age
MANGROVE_PROPAGULE	age
TWISTING_VINES	age
WEeping_VINES	age
ANDESITE_WALL	up
BLACKSTONE_WALL	up
BRICK_WALL	up
COBBLED_DEEPSLATE_WALL	up
COBBLESTONE_WALL	up

Block name	Modifier name
DEEPSLATE_BRICK_WALL	up
DEEPSLATE_TILE_WALL	up
DIORITE_WALL	up
END_STONE_BRICK_WALL	up
GRANITE_WALL	up
MOSSY_COBBLESTONE_WALL	up
MOSSY_STONE_BRICK_WALL	up
MUD_BRICK_WALL	up
NETHER_BRICK_WALL	up
POLISHED_BLACKSTONE_BRICK_WALL	up
POLISHED_BLACKSTONE_WALL	up
POLISHED_DEEPSLATE_WALL	up
PRISMARINE_WALL	up
RED_NETHER_BRICK_WALL	up
RED_SANDSTONE_WALL	up
SANDSTONE_WALL	up
STONE_BRICK_WALL	up
ACACIA_DOOR	powered
ACACIA_FENCE_GATE	powered
ACACIA_TRAPDOOR	powered
ACTIVATOR_RAIL	powered
BELL	powered
BIRCH_DOOR	powered
BIRCH_FENCE_GATE	powered
BIRCH_TRAPDOOR	powered
CRIMSON_DOOR	powered
CRIMSON_FENCE_GATE	powered
CRIMSON_TRAPDOOR	powered
DARK_OAK_DOOR	powered
DARK_OAK_FENCE_GATE	powered

Block name	Modifier name
DARK_OAK_TRAPDOOR	powered
IRON_DOOR	powered
IRON_TRAPDOOR	powered
JUNGLE_DOOR	powered
JUNGLE_FENCE_GATE	powered
JUNGLE_TRAPDOOR	powered
LECTERN	powered
MANGROVE_DOOR	powered
MANGROVE_FENCE_GATE	powered
MANGROVE_TRAPDOOR	powered
NOTE_BLOCK	powered
OAK_DOOR	powered
OAK_FENCE_GATE	powered
OAK_TRAPDOOR	powered
POWERED_RAIL	powered
SPRUCE_DOOR	powered
SPRUCE_FENCE_GATE	powered
SPRUCE_TRAPDOOR	powered
TRIPWIRE	powered
WARPED_DOOR	powered
WARPED_FENCE_GATE	powered
WARPED_TRAPDOOR	powered
SMOKER	lit
FURNACE	lit
CHEST	type
TRAPPED_CHEST	type

Table A.2: Unused Spigot BlockData's modifiers on certain blocks

A.2 Material modifiers

A.2.1 Age

Represents the different growth stages that a crop-like block can go through.

Defaults to 0.

Material	Age range
BEETROOTS	0-3
BAMBOO	0-1
CARROTS	0-7
CHORUS_FLOWER	0/5 ¹⁰
COCOA	0-2
FROSTED_ICE	0-3
MELON_STEM	0-7
NETHER_WART	0-3
POTATOES	0-7
PUMPKIN_STEM	0-7
SWEET_BERRY_BUSH	0-3
WHEAT	0-7

Table A.3: Ageable materials

A.2.2 Attachment

Denotes how the bell is attached to its block.

Defaults to floor.

Material	Options
BELL	ceiling/double_wall/floor/single_wall

Table A.4: Attachable materials

¹⁰The block is the same from age 0 to 4, and it changes in age 5. That's why age=5 is considered as age=1, and age=0-4 as age=0, as you may notice in Figure A.1, Modifier concatenation.

A.2.3 Axis

Represents the axis along whilst this block is oriented.

Except for NETHER_PORTAL (which defaults to x), it defaults to y.

Material	Age range
NETHER_PORTAL	x/z
ACACIA_LOG	x/y/z
ACACIA_WOOD	x/y/z
BASALT	x/y/z
BIRCH_LOG	x/y/z
BIRCH_WOOD	x/y/z
BONE_BLOCK	x/y/z
CHAIN	x/y/z
CRIMSON_HYPHAE	x/y/z
CRIMSON_STEM	x/y/z
DARK_OAK_LOG	x/y/z
DARK_OAK_WOOD	x/y/z
DEEPSLATE	x/y/z
HAY_BLOCK	x/y/z
INFESTED_DEEPSLATE	x/y/z
JUNGLE_LOG	x/y/z
JUNGLE_WOOD	x/y/z
MANGROVE_LOG	x/y/z
MANGROVE_WOOD	x/y/z
MUDDY_MANGROVE_ROOTS	x/y/z
OAK_LOG	x/y/z
OAK_WOOD	x/y/z
OCHRE_FROGLIGHT	x/y/z
PEARLESCENT_FROGLIGHT	x/y/z
POLISHED_BASALT	x/y/z
PURPUR_PILLAR	x/y/z

Material	Age range
QUARTZ_PILLAR	x/y/z
SPRUCE_LOG	x/y/z
SPRUCE_WOOD	x/y/z
STRIPPED_ACACIA_LOG	x/y/z
STRIPPED_ACACIA_WOOD	x/y/z
STRIPPED_BIRCH_LOG	x/y/z
STRIPPED_BIRCH_WOOD	x/y/z
STRIPPED_CRIMSON_HYPHAE	x/y/z
STRIPPED_CRIMSON_STEM	x/y/z
STRIPPED_DARK_OAK_LOG	x/y/z
STRIPPED_DARK_OAK_WOOD	x/y/z
STRIPPED_JUNGLE_LOG	x/y/z
STRIPPED_JUNGLE_WOOD	x/y/z
STRIPPED_MANGROVE_LOG	x/y/z
STRIPPED_MANGROVE_WOOD	x/y/z
STRIPPED_OAK_LOG	x/y/z
STRIPPED_OAK_WOOD	x/y/z
STRIPPED_SPRUCE_LOG	x/y/z
STRIPPED_SPRUCE_WOOD	x/y/z
STRIPPED_WARPED_HYPHAE	x/y/z
STRIPPED_WARPED_STEM	x/y/z
VERDANT_FROGLIGHT	x/y/z
WARPED_HYPHAE	x/y/z
WARPED_STEM	x/y/z

Table A.5: Orientable materials

A.2.4 Berries

Indicates whether the block has berries.

Defaults to false.

Material	Values
CAVE_VINES	true/false
CAVE_VINES_PLANT	true/false

Table A.6: Materials with berries

A.2.5 Bites

Represents the amount of bites which have been taken from this slice of cake.

Defaults to 0.

Material	Values
CAKE	0-6

Table A.7: Cake

A.2.6 Candles

Represents the number of candles which are present.

Defaults to 1.

combine with cake if $\neq 0$

Material	Values
BLACK_CANDLE	1-4
BLUE_CANDLE	1-4
BROWN_CANDLE	1-4
CANDLE	1-4
CYAN_CANDLE	1-4
GRAY_CANDLE	1-4
GREEN_CANDLE	1-4
LIGHT_BLUE_CANDLE	1-4
LIGHT_GRAY_CANDLE	1-4
LIME_CANDLE	1-4
MAGENTA_CANDLE	1-4
ORANGE_CANDLE	1-4

Material	Values
PINK_CANDLE	1-4
PURPLE_CANDLE	1-4
RED_CANDLE	1-4
WHITE_CANDLE	1-4
YELLOW_CANDLE	1-4

Table A.8: Materials with candles

A.2.7 Charges

Represents the amount of times the anchor may still be used.

Defaults to 0.

Material	Values
RESPAWN_ANCHOR	0-4

Table A.9: Charged materials

A.2.8 Conditional

Denotes whether this command block is conditional or not.

Defaults to false.

Material	Values
CHAIN_COMMAND_BLOCK	true/false
COMMAND_BLOCK	true/false
REPEATING_COMMAND_BLOCK	true/false

Table A.10: Conditionable materials

A.2.9 Delay

Propagation delay of a repeater.

Defaults to 1.

Material	Values
REPEATER	1-4

Table A.11: Delayable materials

A.2.10 Down

Set which faces of the block textures are displayed on.

Except for BROWN_MUSHROOM_BLOCK, MUSHROOM_STEM and RED_MUSHROOM_BLOCK (which defaults to true), it defaults to false.

Material	Values
CHORUS_PLANT	true/false
GLOW_LICHEN	true/false
SCULK_VEIN	true/false
BROWN_MUSHROOM_BLOCK	true/false
MUSHROOM_STEM	true/false
RED_MUSHROOM_BLOCK	true/false

Table A.12: Materials with down option

A.2.11 North, South, East and West

Set which faces of the block textures are displayed on.

As the *tall* option is unused (check Table A.1, Unused Spigot BlockData's modifiers), *none* and *low* will be considered as *false* and *true*, respectively.

Material	Options (default on bold)
ACACIA_FENCE	true/ false
BIRCH_FENCE	true/ false
BLACK_STAINED_GLASS_PANE	true/ false
BLUE_STAINED_GLASS_PANE	true/ false
BROWN_STAINED_GLASS_PANE	true/ false
CHORUS_PLANT	true/ false
CRIMSON_FENCE	true/ false

Material	Options (default on bold)
CYAN_STAINED_GLASS_PANE	true/ false
DARK_OAK_FENCE	true/ false
FIRE	true/ false
GLASS_PANE	true/ false
GLOW_LICHEN	true/ false
GRAY_STAINED_GLASS_PANE	true/ false
GREEN_STAINED_GLASS_PANE	true/ false
IRON_BARS	true/ false
JUNGLE_FENCE	true/ false
LIGHT_BLUE_STAINED_GLASS_PANE	true/ false
LIGHT_GRAY_STAINED_GLASS_PANE	true/ false
LIME_STAINED_GLASS_PANE	true/ false
MAGENTA_STAINED_GLASS_PANE	true/ false
MANGROVE_FENCE	true/ false
NETHER_BRICK_FENCE	true/ false
OAK_FENCE	true/ false
ORANGE_STAINED_GLASS_PANE	true/ false
PINK_STAINED_GLASS_PANE	true/ false
PURPLE_STAINED_GLASS_PANE	true/ false
RED_STAINED_GLASS_PANE	true/ false
SCULK_VEIN	true/ false
SPRUCE_FENCE	true/ false
TRIPWIRE	true/ false
VINE	true/ false
WARPED_FENCE	true/ false
WHITE_STAINED_GLASS_PANE	true/ false
YELLOW_STAINED_GLASS_PANE	true/ false
BROWN_MUSHROOM_BLOCK	true /false
MUSHROOM_STEM	true /false
RED_MUSHROOM_BLOCK	true /false

Material	Options (default on bold)
REDSTONE_WIRE	none /up/slide
ANDESITE_WALL	none /low/tall
BLACKSTONE_WALL	none /low/tall
BRICK_WALL	none /low/tall
COBBLED_DEEPSLATE_WALL	none /low/tall
COBBLESTONE_WALL	none /low/tall
DEEPSLATE_BRICK_WALL	none /low/tall
DEEPSLATE_TILE_WALL	none /low/tall
DIORITE_WALL	none /low/tall
END_STONE_BRICK_WALL	none /low/tall
GRANITE_WALL	none /low/tall
MOSSY_COBBLESTONE_WALL	none /low/tall
MOSSY_STONE_BRICK_WALL	none /low/tall
MUD_BRICK_WALL	none /low/tall
NETHER_BRICK_WALL	none /low/tall
POLISHED_BLACKSTONE_BRICK_WALL	none /low/tall
POLISHED_BLACKSTONE_WALL	none /low/tall
POLISHED_DEEPSLATE_WALL	none /low/tall
PRISMARINE_WALL	none /low/tall
RED_NETHER_BRICK_WALL	none /low/tall
RED_SANDSTONE_WALL	none /low/tall
SANDSTONE_WALL	none /low/tall
STONE_BRICK_WALL	none /low/tall

Table A.13: Orientable materials

A.2.12 Up

Set which faces of the block textures are displayed on.

Except for CHORUS_PLANT, FIRE, GLOW_LICHEN, SCULK_VEIN and VINE (which defaults to false), it defaults to true.

Material	Options
CHORUS_PLANT	true/false
FIRE	true/false
GLOW_LICHEN	true/false
SCULK_VEIN	true/false
VINE	true/false
BROWN_MUSHROOM_BLOCK	true/false
MUSHROOM_STEM	true/false
RED_MUSHROOM_BLOCK	true/false

Table A.14: Materials with up option

A.2.13 Eggs

Number of eggs which appear in the block.

Defaults to 1.

Material	Values
TURTLE_EGG	1-4

Table A.15: Materials with eggs

A.2.14 Extended

Denotes whether the piston head is currently extended or not.

Defaults to false.

Material	Values
PISTON	true/false
STICKY_PISTON	true/false

Table A.16: Extendable materials

A.2.15 Eye

Defaults to false.

Material	Values
END_PORTAL_FRAME	true/false

Table A.17: Materials with eye

A.2.16 Face

Represents the face to which a lever or button is stuck.

WALL_SIGN

Defaults to wall.

Material	Directions
ACACIA_BUTTON	wall/floor/ceiling
BIRCH_BUTTON	wall/floor/ceiling
CRIMSON_BUTTON	wall/floor/ceiling
DARK_OAK_BUTTON	wall/floor/ceiling
GRINDSTONE	wall/floor/ceiling
JUNGLE_BUTTON	wall/floor/ceiling
LEVER	wall/floor/ceiling
MANGROVE_BUTTON	wall/floor/ceiling
OAK_BUTTON	wall/floor/ceiling
POLISHED_BLACKSTONE_BUTTON	wall/floor/ceiling
SPRUCE_BUTTON	wall/floor/ceiling
STONE_BUTTON	wall/floor/ceiling
WARPED_BUTTON	wall/floor/ceiling

Table A.18: Directional materials

A.2.17 Facing

Represents the face towards which the block is pointing.

Material	Options (default on bold)
HOPPER	down /north/south/east/west

Material	Options (default on bold)
OBSERVER	up/down/north/ south /east/west
BARREL	up/down/ north /south/east/west
CHAIN_COMMAND_BLOCK	up/down/ north /south/east/west
COMMAND_BLOCK	up/down/ north /south/east/west
DISPENSER	up/down/ north /south/east/west
DROPPER	up/down/ north /south/east/west
PISTON	up/down/ north /south/east/west
PISTON_HEAD	up/down/ north /south/east/west
REPEATING_COMMAND_BLOCK	up/down/ north /south/east/west
STICKY_PISTON	up/down/ north /south/east/west
ACACIA_BUTTON	north /south/east/west
ACACIA_DOOR	north /south/east/west
ACACIA_FENCE_GATE	north /south/east/west
ACACIA_STAIRS	north /south/east/west
ACACIA_TRAPDOOR	north /south/east/west
ACACIA_WALL_SIGN	north /south/east/west
ANDESITE_STAIRS	north /south/east/west
ANVIL	north /south/east/west
ATTACHED_MELON_STEM	north /south/east/west
ATTACHED_PUMPKIN_STEM	north /south/east/west
BEEHIVE	north /south/east/west
BEE_NEST	north /south/east/west
BELL	north /south/east/west
BIG_DRIPLEAF	north /south/east/west
BIG_DRIPLEAF_STEM	north /south/east/west
BIRCH_BUTTON	north /south/east/west
BIRCH_DOOR	north /south/east/west
BIRCH_FENCE_GATE	north /south/east/west
BIRCH_STAIRS	north /south/east/west
BIRCH_TRAPDOOR	north /south/east/west

Material	Options (default on bold)
BIRCH_WALL_SIGN	north /south/east/west
BLACKSTONE_STAIRS	north /south/east/west
BLACK_BED	north /south/east/west
BLACK_GLAZED_TERRACOTTA	north /south/east/west
BLACK_WALL_BANNER	north /south/east/west
BLAST_FURNACE	north /south/east/west
BLUE_BED	north /south/east/west
BLUE_GLAZED_TERRACOTTA	north /south/east/west
BLUE_WALL_BANNER	north /south/east/west
BRAIN_CORAL_WALL_FAN	north /south/east/west
BRICK_STAIRS	north /south/east/west
BROWN_BED	north /south/east/west
BROWN_GLAZED_TERRACOTTA	north /south/east/west
BROWN_WALL_BANNER	north /south/east/west
BUBBLE_CORAL_WALL_FAN	north /south/east/west
CAMPFIRE	north /south/east/west
CARVED_PUMPKIN	north /south/east/west
CHEST	north /south/east/west
CHIPPED_ANVIL	north /south/east/west
COBBLED_DEEPSLATE_STAIRS	north /south/east/west
COBBLESTONE_STAIRS	north /south/east/west
COCOA	north /south/east/west
COMPARATOR	north /south/east/west
CREEPER_WALL_HEAD	north /south/east/west
CRIMSON_BUTTON	north /south/east/west
CRIMSON_DOOR	north /south/east/west
CRIMSON_FENCE_GATE	north /south/east/west
CRIMSON_STAIRS	north /south/east/west
CRIMSON_TRAPDOOR	north /south/east/west
CRIMSON_WALL_SIGN	north /south/east/west

Material	Options (default on bold)
CUT_COPPER_STAIRS	north /south/east/west
CYAN_BED	north /south/east/west
CYAN_GLAZED_TERRACOTTA	north /south/east/west
CYAN_WALL_BANNER	north /south/east/west
DAMAGED_ANVIL	north /south/east/west
DARK_OAK_BUTTON	north /south/east/west
DARK_OAK_DOOR	north /south/east/west
DARK_OAK_FENCE_GATE	north /south/east/west
DARK_OAK_STAIRS	north /south/east/west
DARK_OAK_TRAPDOOR	north /south/east/west
DARK_OAK_WALL_SIGN	north /south/east/west
DARK_PRISMARINE_STAIRS	north /south/east/west
DEAD_BRAIN_CORAL_WALL_FAN	north /south/east/west
DEAD_BUBBLE_CORAL_WALL_FAN	north /south/east/west
DEAD_FIRE_CORAL_WALL_FAN	north /south/east/west
DEAD_HORN_CORAL_WALL_FAN	north /south/east/west
DEAD_TUBE_CORAL_WALL_FAN	north /south/east/west
DEEPSLATE_BRICK_STAIRS	north /south/east/west
DEEPSLATE_TILE_STAIRS	north /south/east/west
DIORITE_STAIRS	north /south/east/west
DRAGON_WALL_HEAD	north /south/east/west
ENDER_CHEST	north /south/east/west
END_PORTAL_FRAME	north /south/east/west
END_STONE_BRICK_STAIRS	north /south/east/west
EXPOSED_CUT_COPPER_STAIRS	north /south/east/west
FIRE_CORAL_WALL_FAN	north /south/east/west
FURNACE	north /south/east/west
GRANITE_STAIRS	north /south/east/west
GRAY_BED	north /south/east/west
GRAY_GLAZED_TERRACOTTA	north /south/east/west

Material	Options (default on bold)
GRAY_WALL_BANNER	north /south/east/west
GREEN_BED	north /south/east/west
GREEN_GLAZED_TERRACOTTA	north /south/east/west
GREEN_WALL_BANNER	north /south/east/west
GRINDSTONE	north /south/east/west
HORN_CORAL_WALL_FAN	north /south/east/west
IRON_DOOR	north /south/east/west
IRON_TRAPDOOR	north /south/east/west
JACK_O_LANTERN	north /south/east/west
JUNGLE_BUTTON	north /south/east/west
JUNGLE_DOOR	north /south/east/west
JUNGLE_FENCE_GATE	north /south/east/west
JUNGLE_STAIRS	north /south/east/west
JUNGLE_TRAPDOOR	north /south/east/west
JUNGLE_WALL_SIGN	north /south/east/west
LADDER	north /south/east/west
LECTERN	north /south/east/west
LEVER	north /south/east/west
LIGHT_BLUE_BED	north /south/east/west
LIGHT_BLUE_GLAZED_TERRACOTTA	north /south/east/west
LIGHT_BLUE_WALL_BANNER	north /south/east/west
LIGHT_GRAY_BED	north /south/east/west
LIGHT_GRAY_GLAZED_TERRACOTTA	north /south/east/west
LIGHT_GRAY_WALL_BANNER	north /south/east/west
LIME_BED	north /south/east/west
LIME_GLAZED_TERRACOTTA	north /south/east/west
LIME_WALL_BANNER	north /south/east/west
LOOM	north /south/east/west
MAGENTA_BED	north /south/east/west
MAGENTA_GLAZED_TERRACOTTA	north /south/east/west

Material	Options (default on bold)
MAGENTA_WALL_BANNER	north /south/east/west
MANGROVE_BUTTON	north /south/east/west
MANGROVE_DOOR	north /south/east/west
MANGROVE_FENCE_GATE	north /south/east/west
MANGROVE_STAIRS	north /south/east/west
MANGROVE_TRAPDOOR	north /south/east/west
MANGROVE_WALL_SIGN	north /south/east/west
MOSSY_COBBLESTONE_STAIRS	north /south/east/west
MOSSY_STONE_BRICK_STAIRS	north /south/east/west
MUD_BRICK_STAIRS	north /south/east/west
NETHER_BRICK_STAIRS	north /south/east/west
OAK_BUTTON	north /south/east/west
OAK_DOOR	north /south/east/west
OAK_FENCE_GATE	north /south/east/west
OAK_STAIRS	north /south/east/west
OAK_TRAPDOOR	north /south/east/west
OAK_WALL_SIGN	north /south/east/west
ORANGE_BED	north /south/east/west
ORANGE_GLAZED_TERRACOTTA	north /south/east/west
ORANGE_WALL_BANNER	north /south/east/west
OXIDIZED_CUT_COPPER_STAIRS	north /south/east/west
PINK_BED	north /south/east/west
PINK_GLAZED_TERRACOTTA	north /south/east/west
PINK_WALL_BANNER	north /south/east/west
PLAYER_WALL_HEAD	north /south/east/west
POLISHED_ANDESITE_STAIRS	north /south/east/west
POLISHED_BLACKSTONE_BRICK_STAIRS	north /south/east/west
POLISHED_BLACKSTONE_BUTTON	north /south/east/west
POLISHED_BLACKSTONE_STAIRS	north /south/east/west
POLISHED_DEEPSLATE_STAIRS	north /south/east/west

Material	Options (default on bold)
POLISHED_DIORITE_STAIRS	north /south/east/west
POLISHED_GRANITE_STAIRS	north /south/east/west
PRISMARINE_BRICK_STAIRS	north /south/east/west
PRISMARINE_STAIRS	north /south/east/west
PURPLE_BED	north /south/east/west
PURPLE_GLAZED_TERRACOTTA	north /south/east/west
PURPLE_WALL_BANNER	north /south/east/west
PURPUR_STAIRS	north /south/east/west
QUARTZ_STAIRS	north /south/east/west
REDSTONE_WALL_TORCH	north /south/east/west
RED_BED	north /south/east/west
RED_GLAZED_TERRACOTTA	north /south/east/west
RED_NETHER_BRICK_STAIRS	north /south/east/west
RED_SANDSTONE_STAIRS	north /south/east/west
RED_WALL_BANNER	north /south/east/west
REPEATER	north /south/east/west
SANDSTONE_STAIRS	north /south/east/west
SKELETON_WALL_SKULL	north /south/east/west
SMALL_DRIPLEAF	north /south/east/west
SMOKER	north /south/east/west
SMOOTH_QUARTZ_STAIRS	north /south/east/west
SMOOTH_RED_SANDSTONE_STAIRS	north /south/east/west
SMOOTH_SANDSTONE_STAIRS	north /south/east/west
SOUL_CAMPFIRE	north /south/east/west
SOUL_WALL_TORCH	north /south/east/west
SPRUCE_BUTTON	north /south/east/west
SPRUCE_DOOR	north /south/east/west
SPRUCE_FENCE_GATE	north /south/east/west
SPRUCE_STAIRS	north /south/east/west
SPRUCE_TRAPDOOR	north /south/east/west

Material	Options (default on bold)
SPRUCE_WALL_SIGN	north /south/east/west
STONECUTTER	north /south/east/west
STONE_BRICK_STAIRS	north /south/east/west
STONE_BUTTON	north /south/east/west
STONE_STAIRS	north /south/east/west
TRAPPED_CHEST	north /south/east/west
TRIPWIRE_HOOK	north /south/east/west
TUBE_CORAL_WALL_FAN	north /south/east/west
WALL_TORCH	north /south/east/west
WARPED_BUTTON	north /south/east/west
WARPED_DOOR	north /south/east/west
WARPED_FENCE_GATE	north /south/east/west
WARPED_STAIRS	north /south/east/west
WARPED_TRAPDOOR	north /south/east/west
WARPED_WALL_SIGN	north /south/east/west
WAXED_CUT_COPPER_STAIRS	north /south/east/west
WAXED_EXPOSED_CUT_COPPER_STAIRS	north /south/east/west
WAXED_OXIDIZED_CUT_COPPER_STAIRS	north /south/east/west
WAXED_WEATHERED_CUT_COPPER_STAIRS	north /south/east/west
WEATHERED_CUT_COPPER_STAIRS	north /south/east/west
WHITE_BED	north /south/east/west
WHITE_GLAZED_TERRACOTTA	north /south/east/west
WHITE_WALL_BANNER	north /south/east/west
WITHER_SKELETON_WALL_SKULL	north /south/east/west
YELLOW_BED	north /south/east/west
YELLOW_GLAZED_TERRACOTTA	north /south/east/west
YELLOW_WALL_BANNER	north /south/east/west
ZOMBIE_WALL_HEAD	north /south/east/west
AMETHYST_CLUSTER	up /down/north/south/east/west
BLACK_SHULKER_BOX	up /down/north/south/east/west

Material	Options (default on bold)
BLUE_SHULKER_BOX	up /down/north/south/east/west
BROWN_SHULKER_BOX	up /down/north/south/east/west
CYAN_SHULKER_BOX	up /down/north/south/east/west
END_ROD	up /down/north/south/east/west
GRAY_SHULKER_BOX	up /down/north/south/east/west
GREEN_SHULKER_BOX	up /down/north/south/east/west
LARGE_AMETHYST_BUD	up /down/north/south/east/west
LIGHTNING_ROD	up /down/north/south/east/west
LIGHT_BLUE_SHULKER_BOX	up /down/north/south/east/west
LIGHT_GRAY_SHULKER_BOX	up /down/north/south/east/west
LIME_SHULKER_BOX	up /down/north/south/east/west
MAGENTA_SHULKER_BOX	up /down/north/south/east/west
MEDIUM_AMETHYST_BUD	up /down/north/south/east/west
ORANGE_SHULKER_BOX	up /down/north/south/east/west
PINK_SHULKER_BOX	up /down/north/south/east/west
PURPLE_SHULKER_BOX	up /down/north/south/east/west
RED_SHULKER_BOX	up /down/north/south/east/west
SHULKER_BOX	up /down/north/south/east/west
SMALL_AMETHYST_BUD	up /down/north/south/east/west
WHITE_SHULKER_BOX	up /down/north/south/east/west
YELLOW_SHULKER_BOX	up /down/north/south/east/west

Table A.19: Directional materials

A.2.18 Half

Denotes which half of a two block tall material this block is.

Material	Options (default on bold)
ACACIA_STAIRS	bottom /top
ACACIA_TRAPDOOR	bottom /top

Material	Options (default on bold)
ANDESITE_STAIRS	bottom /top
BIRCH_STAIRS	bottom /top
BIRCH_TRAPDOOR	bottom /top
BLACKSTONE_STAIRS	bottom /top
BRICK_STAIRS	bottom /top
COBBLED_DEEPSLATE_STAIRS	bottom /top
COBBLESTONE_STAIRS	bottom /top
CRIMSON_STAIRS	bottom /top
CRIMSON_TRAPDOOR	bottom /top
CUT_COPPER_STAIRS	bottom /top
DARK_OAK_STAIRS	bottom /top
DARK_OAK_TRAPDOOR	bottom /top
DARK_PRISMARINE_STAIRS	bottom /top
DEEPSLATE_BRICK_STAIRS	bottom /top
DEEPSLATE_TILE_STAIRS	bottom /top
DIORITE_STAIRS	bottom /top
END_STONE_BRICK_STAIRS	bottom /top
EXPOSED_CUT_COPPER_STAIRS	bottom /top
GRANITE_STAIRS	bottom /top
IRON_TRAPDOOR	bottom /top
JUNGLE_STAIRS	bottom /top
JUNGLE_TRAPDOOR	bottom /top
MANGROVE_STAIRS	bottom /top
MANGROVE_TRAPDOOR	bottom /top
MOSSY_COBBLESTONE_STAIRS	bottom /top
MOSSY_STONE_BRICK_STAIRS	bottom /top
MUD_BRICK_STAIRS	bottom /top
NETHER_BRICK_STAIRS	bottom /top
OAK_STAIRS	bottom /top
OAK_TRAPDOOR	bottom /top

Material	Options (default on bold)
OXIDIZED_CUT_COPPER_STAIRS	bottom /top
POLISHED_ANDESITE_STAIRS	bottom /top
POLISHED_BLACKSTONE_BRICK_STAIRS	bottom /top
POLISHED_BLACKSTONE_STAIRS	bottom /top
POLISHED_DEEPSLATE_STAIRS	bottom /top
POLISHED_DIORITE_STAIRS	bottom /top
POLISHED_GRANITE_STAIRS	bottom /top
PRISMARINE_BRICK_STAIRS	bottom /top
PRISMARINE_STAIRS	bottom /top
PURPUR_STAIRS	bottom /top
QUARTZ_STAIRS	bottom /top
RED_NETHER_BRICK_STAIRS	bottom /top
RED_SANDSTONE_STAIRS	bottom /top
SANDSTONE_STAIRS	bottom /top
SMOOTH_QUARTZ_STAIRS	bottom /top
SMOOTH_RED_SANDSTONE_STAIRS	bottom /top
SMOOTH_SANDSTONE_STAIRS	bottom /top
SPRUCE_STAIRS	bottom /top
SPRUCE_TRAPDOOR	bottom /top
STONE_BRICK_STAIRS	bottom /top
STONE_STAIRS	bottom /top
WARPED_STAIRS	bottom /top
WARPED_TRAPDOOR	bottom /top
WAXED_CUT_COPPER_STAIRS	bottom /top
WAXED_EXPOSED_CUT_COPPER_STAIRS	bottom /top
WAXED_OXIDIZED_CUT_COPPER_STAIRS	bottom /top
WAXED_WEATHERED_CUT_COPPER_STAIRS	bottom /top
WEATHERED_CUT_COPPER_STAIRS	bottom /top
ACACIA_DOOR	lower /upper
BIRCH_DOOR	lower /upper

Material	Options (default on bold)
CRIMSON_DOOR	lower /upper
DARK_OAK_DOOR	lower /upper
IRON_DOOR	lower /upper
JUNGLE_DOOR	lower /upper
LARGE_FERN	lower /upper
LILAC	lower /upper
MANGROVE_DOOR	lower /upper
OAK_DOOR	lower /upper
PEONY	lower /upper
ROSE_BUSH	lower /upper
SMALL_DRIPLEAF	lower /upper
SPRUCE_DOOR	lower /upper
SUNFLOWER	lower /upper
TALL_GRASS	lower /upper
TALL_SEAGRASS	lower /upper
WARPED_DOOR	lower /upper

Table A.20: Two-blocks materials

A.2.19 Hanging

Denotes whether the block is hanging.

Defaults to false.

Material	Values
LANTERN	true/false
MANGROVE_PROPAGULE	true/false
SOUL_LANTERN	true/false

Table A.21: Hangable materials

A.2.20 Hinge

Indicates which hinge this door is attached to and will rotate around when opened.

Defaults to left.

Material	Options
ACACIA_DOOR	left/right
BIRCH_DOOR	left/right
CRIMSON_DOOR	left/right
DARK_OAK_DOOR	left/right
IRON_DOOR	left/right
JUNGLE_DOOR	left/right
MANGROVE_DOOR	left/right
OAK_DOOR	left/right
SPRUCE_DOOR	left/right
WARPED_DOOR	left/right

Table A.22: Doors

A.2.21 Honey level

Represents the amount of honey stored in the hive.

Defaults to 0.

Material	Values
BEEHIVE	0/5 ¹¹
BEE_NEST	0/5 ¹¹

Table A.23: Hives

A.2.22 Inverted

Denotes whether this daylight detector is in the inverted mode.

¹¹The block is the same from honey-level 0 to 4, and it changes in age 5. That's why age=5 is considered as age=1, and age=0-4 as age=0, as you may notice in Figure A.1, Modifier concatenation.

Defaults to false.

Material	Values
DAYLIGHT_DETECTOR	true/false

Table A.24: Invertible blocks

A.2.23 Layers

Represents the amount of layers of snow which are present in this block.

Defaults to 1.

Material	Values
SNOW	1-8

Table A.25: Snow

A.2.24 Leaves

Represents the size of the leaves of the bamboo block.

Defaults to none.

Material	Values
BAMBOO	none/small/large

Table A.26: Bamboo

A.2.25 Level

Represents the amount of fluid contained within this block, either by itself or inside a cauldron.

Defaults on 0 except for POWDER_SNOW_CAULDRON and WATER_CAULDRON (which defaults on 1).

Material	Values
COMPOSTER	0-8
LAVA	0-7
WATER	0-7
POWDER_SNOW_CAULDRON	1-3
WATER_CAULDRON	1-3

Table A.27: Levelled materials

A.2.26 Lit

Denotes whether this block is currently lit.

Except for CAMPFIRE, REDSTONE_TORCH, REDSTONE_WALL_TORCH and SOUL_CAMPFIRE (which defaults to true), it defaults to false.

Material	Options
BLACK_CANDLE	true/false
BLACK_CANDLE_CAKE	true/false
BLAST_FURNACE	true/false
BLUE_CANDLE	true/false
BLUE_CANDLE_CAKE	true/false
BROWN_CANDLE	true/false
BROWN_CANDLE_CAKE	true/false
CANDLE	true/false
CANDLE_CAKE	true/false
CYAN_CANDLE	true/false
CYAN_CANDLE_CAKE	true/false
DEEPSLATE_REDSTONE_ORE	true/false
GRAY_CANDLE	true/false
GRAY_CANDLE_CAKE	true/false
GREEN_CANDLE	true/false
GREEN_CANDLE_CAKE	true/false
LIGHT_BLUE_CANDLE	true/false

Material	Options
LIGHT_BLUE_CANDLE_CAKE	true/false
LIGHT_GRAY_CANDLE	true/false
LIGHT_GRAY_CANDLE_CAKE	true/false
LIME_CANDLE	true/false
LIME_CANDLE_CAKE	true/false
MAGENTA_CANDLE	true/false
MAGENTA_CANDLE_CAKE	true/false
ORANGE_CANDLE	true/false
ORANGE_CANDLE_CAKE	true/false
PINK_CANDLE	true/false
PINK_CANDLE_CAKE	true/false
PURPLE_CANDLE	true/false
PURPLE_CANDLE_CAKE	true/false
REDSTONE_LAMP	true/false
REDSTONE_ORE	true/false
RED_CANDLE	true/false
RED_CANDLE_CAKE	true/false
WHITE_CANDLE	true/false
WHITE_CANDLE_CAKE	true/false
YELLOW_CANDLE	true/false
YELLOW_CANDLE_CAKE	true/false
CAMPFIRE	true/false
REDSTONE_TORCH	true/false
REDSTONE_WALL_TORCH	true/false
SOUL_CAMPFIRE	true/false

Table A.28: Lightable materials

A.2.27 Locked

Denotes whether the repeater is in the locked state or not.

Defaults to false.

Material	Values
REPEATER	true/false

Table A.29: Repeater

A.2.28 Mode

Indicates what mode the block will operate in.

Material	Options (default on bold)
COMPARATOR	compare /subtract
STRUCTURE_BLOCK	load /corner/save

Table A.30: Materials with mode

A.2.29 Note

Specified tuned pitch that the instrument will be played in.

Defaults to 0.

Material	Values
NOTE_BLOCK	0-24

Table A.31: Note block

A.2.30 Open

Denotes whether this block is currently opened.

Defaults to false.

Material	Values
ACACIA_DOOR	true/false
ACACIA_FENCE_GATE	true/false

Material	Values
ACACIA_TRAPDOOR	true/false
BARREL	true/false
BIRCH_DOOR	true/false
BIRCH_FENCE_GATE	true/false
BIRCH_TRAPDOOR	true/false
CRIMSON_DOOR	true/false
CRIMSON_FENCE_GATE	true/false
CRIMSON_TRAPDOOR	true/false
DARK_OAK_DOOR	true/false
DARK_OAK_FENCE_GATE	true/false
DARK_OAK_TRAPDOOR	true/false
IRON_DOOR	true/false
IRON_TRAPDOOR	true/false
JUNGLE_DOOR	true/false
JUNGLE_FENCE_GATE	true/false
JUNGLE_TRAPDOOR	true/false
MANGROVE_DOOR	true/false
MANGROVE_FENCE_GATE	true/false
MANGROVE_TRAPDOOR	true/false
OAK_DOOR	true/false
OAK_FENCE_GATE	true/false
OAK_TRAPDOOR	true/false
SPRUCE_DOOR	true/false
SPRUCE_FENCE_GATE	true/false
SPRUCE_TRAPDOOR	true/false
WARPED_DOOR	true/false
WARPED_FENCE_GATE	true/false
WARPED_TRAPDOOR	true/false

Table A.32: Openable materials

A.2.31 Orientation

Direction the block is facing.

Defaults to north_up, and can take any of the values shown in Table A.33, Jigsaw orientations.

Orientation
north_up
south_up
east_up
west_up
up_north
up_south
up_east
up_west
down_north
down_south
down_east
down_west

Table A.33: Jigsaw orientations

Material
JIGSAW

Table A.34: Jigsaw

A.2.32 Part

Denotes which half of the bed this block corresponds to.

Defaults to foot.

Material	Values
BLACK_BED	foot/head

Material	Values
BLUE_BED	foot/head
BROWN_BED	foot/head
CYAN_BED	foot/head
GRAY_BED	foot/head
GREEN_BED	foot/head
LIGHT_BLUE_BED	foot/head
LIGHT_GRAY_BED	foot/head
LIME_BED	foot/head
MAGENTA_BED	foot/head
ORANGE_BED	foot/head
PINK_BED	foot/head
PURPLE_BED	foot/head
RED_BED	foot/head
WHITE_BED	foot/head
YELLOW_BED	foot/head

Table A.35: Openable materials

A.2.33 Pickles

Indicates the number of pickles in this block.

Defaults to 1.

Material	Values
SEA_PICKLE	1-4

Table A.36: Materials with pickles

A.2.34 Powered

Indicates whether this block is in the powered state or not (emitting current).

Defaults to false.

Material	Powered value
ACACIA_BUTTON	true/false
ACACIA_PRESSURE_PLATE	true/false
BIRCH_BUTTON	true/false
BIRCH_PRESSURE_PLATE	true/false
COMPARATOR	true/false
CRIMSON_BUTTON	true/false
CRIMSON_PRESSURE_PLATE	true/false
DARK_OAK_BUTTON	true/false
DARK_OAK_PRESSURE_PLATE	true/false
DETECTOR_RAIL	true/false
JUNGLE_BUTTON	true/false
JUNGLE_PRESSURE_PLATE	true/false
LEVER	true/false
LIGHTNING_ROD	true/false
MANGROVE_BUTTON	true/false
MANGROVE_PRESSURE_PLATE	true/false
OAK_BUTTON	true/false
OAK_PRESSURE_PLATE	true/false
OBSERVER	true/false
POLISHED_BLACKSTONE_BUTTON	true/false
POLISHED_BLACKSTONE_PRESSURE_PLATE	true/false
REPEATER	true/false
SPRUCE_BUTTON	true/false
SPRUCE_PRESSURE_PLATE	true/false
STONE_BUTTON	true/false
STONE_PRESSURE_PLATE	true/false
TRIPWIRE_HOOK	true/false
WARPED_BUTTON	true/false
WARPED_PRESSURE_PLATE	true/false

Material	Powered value
----------	---------------

Table A.37: Powerabled materials

A.2.35 Rotation

Denotes where the block is looking.

Defaults to 0 and goes up to 15.

Rotation value	Direction
0	South
4	West
8	North
12	East

Table A.38: Relation between rotation and where is looking

Material
ACACIA_SIGN
BIRCH_SIGN
BLACK_BANNER
BLUE_BANNER
BROWN_BANNER
CREEPER_HEAD
CRIMSON_SIGN
CYAN_BANNER
DARK_OAK_SIGN
DRAGON_HEAD
GRAY_BANNER
GREEN_BANNER
JUNGLE_SIGN
LIGHT_BLUE_BANNER
LIGHT_GRAY_BANNER

Material
LIME_BANNER
MAGENTA_BANNER
MANGROVE_SIGN
OAK_SIGN
ORANGE_BANNER
PINK_BANNER
PLAYER_HEAD
PURPLE_BANNER
RED_BANNER
SKELETON_SKULL
SPRUCE_SIGN
WARPED_SIGN
WHITE_BANNER
WITHER_SKELETON_SKULL
YELLOW_BANNER
ZOMBIE_HEAD

Table A.39: Directional materials

A.2.36 Shape - Rails

Represents the current layout of a minecart rail.

Defaults to north_south, and it can take any value of those mentioned in Table A.40, Rail directions.

Shape
north_south
east_west
north_east
north_west
south_east

Shape
south_west
ascending_north
ascending_south
ascending_east
ascending_west

Table A.40: Rail directions

Material
ACTIVATOR_RAIL
DETECTOR_RAIL
POWERED_RAIL
RAIL

Table A.41: Rails

A.2.37 Shape - Stairs

Represents the texture and bounding box shape of these stairs.

Defaults to straight.

Material	Shape
ACACIA_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
ANDESITE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
BIRCH_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
BLACKSTONE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right

Material	Shape
COBBLED_DEEPSLATE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
COBBLESTONE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
CRIMSON_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
CUT_COPPER_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
DARK_OAK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
DARK_PRISMARINE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
DEEPSLATE_BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
DEEPSLATE_TILE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
DIORITE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
END_STONE_BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
EXPOSED_CUT_COPPER_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
GRANITE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
JUNGLE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
MANGROVE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
MOSSY_COBBLESTONE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right

Material	Shape
MOSSY_STONE_BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
MUD_BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
NETHER_BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
OAK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
OXIDIZED_CUT_COPPER_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
POLISHED_ANDESITE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
POLISHED_BLACKSTONE_BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
POLISHED_BLACKSTONE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
POLISHED_DEEPSLATE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
POLISHED_DIORITE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
POLISHED_GRANITE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
PRISMARINE_BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
PRISMARINE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
PURPUR_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
QUARTZ_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right

Material	Shape
RED_NETHER_BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
RED_SANDSTONE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
SANDSTONE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
SMOOTH_QUARTZ_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
SMOOTH_RED_SANDSTONE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
SMOOTH_SANDSTONE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
SPRUCE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
STONE_BRICK_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
STONE_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
WARPED_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
WAXED_CUT_COPPER_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
WAXED_EXPOSED_CUT_COPPER_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
WAXED_OXIDIZED_CUT_COPPER_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
WAXED_WEATHERED_CUT_COPPER_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right
WEATHERED_CUT_COPPER_STAIRS	straight/inner_right/inner_left/ outer_right/inner_right

Material	Shape
----------	-------

Table A.42: Stairs

A.2.38 Type

Represents the type of piston which that block corresponds to, or represents what state the slab is in.

Material	Options (default on bold)
ACACIA_SLAB	bottom /top/double
ANDESITE_SLAB	bottom /top/double
BIRCH_SLAB	bottom /top/double
BLACKSTONE_SLAB	bottom /top/double
BRICK_SLAB	bottom /top/double
COBBLED_DEEPSLATE_SLAB	bottom /top/double
COBBLESTONE_SLAB	bottom /top/double
CRIMSON_SLAB	bottom /top/double
CUT_COPPER_SLAB	bottom /top/double
CUT_RED_SANDSTONE_SLAB	bottom /top/double
CUT_SANDSTONE_SLAB	bottom /top/double
DARK_OAK_SLAB	bottom /top/double
DARK_PRISMARINE_SLAB	bottom /top/double
DEEPSLATE_BRICK_SLAB	bottom /top/double
DEEPSLATE_TILE_SLAB	bottom /top/double
DIORITE_SLAB	bottom /top/double
END_STONE_BRICK_SLAB	bottom /top/double
EXPOSED_CUT_COPPER_SLAB	bottom /top/double
GRANITE_SLAB	bottom /top/double
JUNGLE_SLAB	bottom /top/double
MANGROVE_SLAB	bottom /top/double
MOSSY_COBBLESTONE_SLAB	bottom /top/double

Material	Options (default on bold)
MOSSY_STONE_BRICK_SLAB	bottom /top/double
MUD_BRICK_SLAB	bottom /top/double
NETHER_BRICK_SLAB	bottom /top/double
OAK_SLAB	bottom /top/double
OXIDIZED_CUT_COPPER_SLAB	bottom /top/double
PETRIFIED_OAK_SLAB	bottom /top/double
POLISHED_ANDESITE_SLAB	bottom /top/double
POLISHED_BLACKSTONE_BRICK_SLAB	bottom /top/double
POLISHED_BLACKSTONE_SLAB	bottom /top/double
POLISHED_DEEPSLATE_SLAB	bottom /top/double
POLISHED_DIORITE_SLAB	bottom /top/double
POLISHED_GRANITE_SLAB	bottom /top/double
PRISMARINE_BRICK_SLAB	bottom /top/double
PRISMARINE_SLAB	bottom /top/double
PURPUR_SLAB	bottom /top/double
QUARTZ_SLAB	bottom /top/double
RED_NETHER_BRICK_SLAB	bottom /top/double
RED_SANDSTONE_SLAB	bottom /top/double
SANDSTONE_SLAB	bottom /top/double
SMOOTH_QUARTZ_SLAB	bottom /top/double
SMOOTH_RED_SANDSTONE_SLAB	bottom /top/double
SMOOTH_SANDSTONE_SLAB	bottom /top/double
SMOOTH_STONE_SLAB	bottom /top/double
SPRUCE_SLAB	bottom /top/double
STONE_BRICK_SLAB	bottom /top/double
STONE_SLAB	bottom /top/double
WARPED_SLAB	bottom /top/double
WAXED_CUT_COPPER_SLAB	bottom /top/double
WAXED_EXPOSED_CUT_COPPER_SLAB	bottom /top/double
WAXED_OXIDIZED_CUT_COPPER_SLAB	bottom /top/double

Material	Options (default on bold)
WAXED_WEATHERED_CUT_COPPER_SLAB	bottom /top/double
WEATHERED_CUT_COPPER_SLAB	bottom /top/double
PISTON_HEAD	normal /sticky

Table A.43: Type materials

A.2.39 Vertical direction

Represents the dripstone orientation.

Defaults to up.

Material	Values
POINTED_DRIPSTONE	up/down

Table A.44: Dripstone

A.2.40 Waterlogged

Denotes whether this block has fluid in it.

Besides underwater blocks¹² (which defaults to true), it defaults to false. All the possible options are true or false.

Material	Aquatic block ¹³
ACACIA_FENCE	✗
ACACIA_LEAVES	✗

¹²BRAIN_CORAL, BRAIN_CORAL_FAN, BRAIN_CORAL_WALL_FAN, BUBBLE_CORAL, BUBBLE_CORAL_FAN, BUBBLE_CORAL_WALL_FAN, CONDUIT, DEAD_BRAIN_CORAL, DEAD_BRAIN_CORAL_FAN, DEAD_BRAIN_CORAL_WALL_FAN, DEAD_BUBBLE_CORAL, DEAD_BUBBLE_CORAL_FAN, DEAD_BUBBLE_CORAL_WALL_FAN, DEAD_FIRE_CORAL, DEAD_FIRE_CORAL_FAN, DEAD_FIRE_CORAL_WALL_FAN, DEAD_HORN_CORAL, DEAD_HORN_CORAL_FAN, DEAD_HORN_CORAL_WALL_FAN, DEAD_TUBE_CORAL, DEAD_TUBE_CORAL_FAN, DEAD_TUBE_CORAL_WALL_FAN, FIRE_CORAL, FIRE_CORAL_FAN, FIRE_CORAL_WALL_FAN, HORN_CORAL, HORN_CORAL_FAN, HORN_CORAL_WALL_FAN, SEA_PICKLE, TUBE_CORAL, TUBE_CORAL_FAN and TUBE_CORAL_WALL_FAN

Material	Aquatic block ¹³
ACACIA_SIGN	✗
ACACIA_SLAB	✗
ACACIA_STAIRS	✗
ACACIA_TRAPDOOR	✗
ACACIA_WALL_SIGN	✗
ACTIVATOR_RAIL	✗
AMETHYST_CLUSTER	✗
ANDESITE_SLAB	✗
ANDESITE_STAIRS	✗
ANDESITE_WALL	✗
AZALEA_LEAVES	✗
BIG_DRIPLEAF	✗
BIG_DRIPLEAF_STEM	✗
BIRCH_FENCE	✗
BIRCH_LEAVES	✗
BIRCH_SIGN	✗
BIRCH_SLAB	✗
BIRCH_STAIRS	✗
BIRCH_TRAPDOOR	✗
BIRCH_WALL_SIGN	✗
BLACKSTONE_SLAB	✗
BLACKSTONE_STAIRS	✗
BLACKSTONE_WALL	✗
BLACK_CANDLE	✗
BLACK_STAINED_GLASS_PANE	✗
BLUE_CANDLE	✗
BLUE_STAINED_GLASS_PANE	✗
BRICK_SLAB	✗
BRICK_STAIRS	✗
BRICK_WALL	✗

Material	Aquatic block ¹³
BROWN_CANDLE	✗
BROWN_STAINED_GLASS_PANE	✗
CAMPFIRE	✗
CANDLE	✗
CHAIN	✗
CHEST	✗
COBBLED_DEEPSLATE_SLAB	✗
COBBLED_DEEPSLATE_STAIRS	✗
COBBLED_DEEPSLATE_WALL	✗
COBBLESTONE_SLAB	✗
COBBLESTONE_STAIRS	✗
COBBLESTONE_WALL	✗
CRIMSON_FENCE	✗
CRIMSON_SIGN	✗
CRIMSON_SLAB	✗
CRIMSON_STAIRS	✗
CRIMSON_TRAPDOOR	✗
CRIMSON_WALL_SIGN	✗
CUT_COPPER_SLAB	✗
CUT_COPPER_STAIRS	✗
CUT_RED_SANDSTONE_SLAB	✗
CUT_SANDSTONE_SLAB	✗
CYAN_CANDLE	✗
CYAN_STAINED_GLASS_PANE	✗
DARK_OAK_FENCE	✗
DARK_OAK_LEAVES	✗
DARK_OAK_SIGN	✗
DARK_OAK_SLAB	✗
DARK_OAK_STAIRS	✗
DARK_OAK_TRAPDOOR	✗

Material	Aquatic block ¹³
DARK_OAK_WALL_SIGN	✗
DARK_PRISMARINE_SLAB	✗
DARK_PRISMARINE_STAIRS	✗
DEEPSLATE_BRICK_SLAB	✗
DEEPSLATE_BRICK_STAIRS	✗
DEEPSLATE_BRICK_WALL	✗
DEEPSLATE_TILE_SLAB	✗
DEEPSLATE_TILE_STAIRS	✗
DEEPSLATE_TILE_WALL	✗
DETECTOR_RAIL	✗
DIORITE_SLAB	✗
DIORITE_STAIRS	✗
DIORITE_WALL	✗
ENDER_CHEST	✗
END_STONE_BRICK_SLAB	✗
END_STONE_BRICK_STAIRS	✗
END_STONE_BRICK_WALL	✗
EXPOSED_CUT_COPPER_SLAB	✗
EXPOSED_CUT_COPPER_STAIRS	✗
FLOWERING_AZALEA_LEAVES	✗
GLASS_PANE	✗
GLOW_LICHEN	✗
GRANITE_SLAB	✗
GRANITE_STAIRS	✗
GRANITE_WALL	✗
GRAY_CANDLE	✗
GRAY_STAINED_GLASS_PANE	✗
GREEN_CANDLE	✗
GREEN_STAINED_GLASS_PANE	✗
HANGING_ROOTS	✗

Material	Aquatic block ¹³
IRON_BARS	✗
IRON_TRAPDOOR	✗
JUNGLE_FENCE	✗
JUNGLE_LEAVES	✗
JUNGLE_SIGN	✗
JUNGLE_SLAB	✗
JUNGLE_STAIRS	✗
JUNGLE_TRAPDOOR	✗
JUNGLE_WALL_SIGN	✗
LADDER	✗
LANTERN	✗
LARGE_AMETHYST_BUD	✗
LIGHTNING_ROD	✗
LIGHT_BLUE_CANDLE	✗
LIGHT_BLUE_STAINED_GLASS_PANE	✗
LIGHT_GRAY_CANDLE	✗
LIGHT_GRAY_STAINED_GLASS_PANE	✗
LIME_CANDLE	✗
LIME_STAINED_GLASS_PANE	✗
MAGENTA_CANDLE	✗
MAGENTA_STAINED_GLASS_PANE	✗
MANGROVE_FENCE	✗
MANGROVE_LEAVES	✗
MANGROVE_PROPAGULE	✗
MANGROVE_ROOTS	✗
MANGROVE_SIGN	✗
MANGROVE_SLAB	✗
MANGROVE_STAIRS	✗
MANGROVE_TRAPDOOR	✗
MANGROVE_WALL_SIGN	✗

Material	Aquatic block ¹³
MEDIUM_AMETHYST_BUD	✗
MOSSY_COBBLESTONE_SLAB	✗
MOSSY_COBBLESTONE_STAIRS	✗
MOSSY_COBBLESTONE_WALL	✗
MOSSY_STONE_BRICK_SLAB	✗
MOSSY_STONE_BRICK_STAIRS	✗
MOSSY_STONE_BRICK_WALL	✗
MUD_BRICK_SLAB	✗
MUD_BRICK_STAIRS	✗
MUD_BRICK_WALL	✗
NETHER_BRICK_FENCE	✗
NETHER_BRICK_SLAB	✗
NETHER_BRICK_STAIRS	✗
NETHER_BRICK_WALL	✗
OAK_FENCE	✗
OAK_LEAVES	✗
OAK_SIGN	✗
OAK_SLAB	✗
OAK_STAIRS	✗
OAK_TRAPDOOR	✗
OAK_WALL_SIGN	✗
ORANGE_CANDLE	✗
ORANGE_STAINED_GLASS_PANE	✗
OXIDIZED_CUT_COPPER_SLAB	✗
OXIDIZED_CUT_COPPER_STAIRS	✗
PETRIFIED_OAK_SLAB	✗
PINK_CANDLE	✗
PINK_STAINED_GLASS_PANE	✗
POINTED_DRIPSTONE	✗
POLISHED_ANDESITE_SLAB	✗

Material	Aquatic block ¹³
POLISHED_ANDESITE_STAIRS	✗
POLISHED_BLACKSTONE_BRICK_SLAB	✗
POLISHED_BLACKSTONE_BRICK_STAIRS	✗
POLISHED_BLACKSTONE_BRICK_WALL	✗
POLISHED_BLACKSTONE_SLAB	✗
POLISHED_BLACKSTONE_STAIRS	✗
POLISHED_BLACKSTONE_WALL	✗
POLISHED_DEEPSLATE_SLAB	✗
POLISHED_DEEPSLATE_STAIRS	✗
POLISHED_DEEPSLATE_WALL	✗
POLISHED_DIORITE_SLAB	✗
POLISHED_DIORITE_STAIRS	✗
POLISHED_GRANITE_SLAB	✗
POLISHED_GRANITE_STAIRS	✗
POWERED_RAIL	✗
PRISMARINE_BRICK_SLAB	✗
PRISMARINE_BRICK_STAIRS	✗
PRISMARINE_SLAB	✗
PRISMARINE_STAIRS	✗
PRISMARINE_WALL	✗
PURPLE_CANDLE	✗
PURPLE_STAINED_GLASS_PANE	✗
PURPUR_SLAB	✗
PURPUR_STAIRS	✗
QUARTZ_SLAB	✗
QUARTZ_STAIRS	✗
RAIL	✗
RED_CANDLE	✗
RED_NETHER_BRICK_SLAB	✗
RED_NETHER_BRICK_STAIRS	✗

Material	Aquatic block ¹³
RED_NETHER_BRICK_WALL	✗
RED_SANDSTONE_SLAB	✗
RED_SANDSTONE_STAIRS	✗
RED_SANDSTONE_WALL	✗
RED_STAINED_GLASS_PANE	✗
SANDSTONE_SLAB	✗
SANDSTONE_STAIRS	✗
SANDSTONE_WALL	✗
SCAFFOLDING	✗
SCULK_SENSOR	✗
SCULK_SHRIEKER	✗
SCULK_VEIN	✗
SMALL_AMETHYST_BUD	✗
SMALL_DRIPLEAF	✗
SMOOTH_QUARTZ_SLAB	✗
SMOOTH_QUARTZ_STAIRS	✗
SMOOTH_RED_SANDSTONE_SLAB	✗
SMOOTH_RED_SANDSTONE_STAIRS	✗
SMOOTH_SANDSTONE_SLAB	✗
SMOOTH_SANDSTONE_STAIRS	✗
SMOOTH_STONE_SLAB	✗
SOUL_CAMPFIRE	✗
SOUL_LANTERN	✗
SPRUCE_FENCE	✗
SPRUCE_LEAVES	✗
SPRUCE_SIGN	✗
SPRUCE_SLAB	✗
SPRUCE_STAIRS	✗
SPRUCE_TRAPDOOR	✗
SPRUCE_WALL_SIGN	✗

Material	Aquatic block ¹³
STONE_BRICK_SLAB	✗
STONE_BRICK_STAIRS	✗
STONE_BRICK_WALL	✗
STONE_SLAB	✗
STONE_STAIRS	✗
TRAPPED_CHEST	✗
WARPED_FENCE	✗
WARPED_SIGN	✗
WARPED_SLAB	✗
WARPED_STAIRS	✗
WARPED_TRAPDOOR	✗
WARPED_WALL_SIGN	✗
WAXED_CUT_COPPER_SLAB	✗
WAXED_CUT_COPPER_STAIRS	✗
WAXED_EXPOSED_CUT_COPPER_SLAB	✗
WAXED_EXPOSED_CUT_COPPER_STAIRS	✗
WAXED_OXIDIZED_CUT_COPPER_SLAB	✗
WAXED_OXIDIZED_CUT_COPPER_STAIRS	✗
WAXED_WEATHERED_CUT_COPPER_SLAB	✗
WAXED_WEATHERED_CUT_COPPER_STAIRS	✗
WEATHERED_CUT_COPPER_SLAB	✗
WEATHERED_CUT_COPPER_STAIRS	✗
WHITE_CANDLE	✗
WHITE_STAINED_GLASS_PANE	✗
YELLOW_CANDLE	✗
YELLOW_STAINED_GLASS_PANE	✗
BRAIN_CORAL	✓
BRAIN_CORAL_FAN	✓
BRAIN_CORAL_WALL_FAN	✓
BUBBLE_CORAL	✓

Material	Aquatic block ¹³
BUBBLE_CORAL_FAN	✓
BUBBLE_CORAL_WALL_FAN	✓
CONDUIT	✓
DEAD_BRAIN_CORAL	✓
DEAD_BRAIN_CORAL_FAN	✓
DEAD_BRAIN_CORAL_WALL_FAN	✓
DEAD_BUBBLE_CORAL	✓
DEAD_BUBBLE_CORAL_FAN	✓
DEAD_BUBBLE_CORAL_WALL_FAN	✓
DEAD_FIRE_CORAL	✓
DEAD_FIRE_CORAL_FAN	✓
DEAD_FIRE_CORAL_WALL_FAN	✓
DEAD_HORN_CORAL	✓
DEAD_HORN_CORAL_FAN	✓
DEAD_HORN_CORAL_WALL_FAN	✓
DEAD_TUBE_CORAL	✓
DEAD_TUBE_CORAL_FAN	✓
DEAD_TUBE_CORAL_WALL_FAN	✓
FIRE_CORAL	✓
FIRE_CORAL_FAN	✓
FIRE_CORAL_WALL_FAN	✓
HORN_CORAL	✓
HORN_CORAL_FAN	✓
HORN_CORAL_WALL_FAN	✓
SEA_PICKLE	✓
TUBE_CORAL	✓
TUBE_CORAL_FAN	✓
TUBE_CORAL_WALL_FAN	✓

Table A.45: Waterlogged materials

A.3 Material name attached modifiers

Some materials have modifiers already attached to the material name.

A.3.1 Color

... wool/glass/bed/candle/banner/GLAZED_TERRACOTTA

Index	Color
0	none
1	black
2	blue
3	brown
4	cyan
5	gray
6	green
7	light_blue
8	light_gray
9	lime
10	magenta
11	orange
12	pink
13	purple
14	red
15	white
16	yellow

Table A.46: Colors

A.3.2 Wood type

...

¹³If it's an underwater block (defaults to true).

Index	Wood
0	acacia
1	birch
2	crimson
3	dark_oak
4	jungle
5	mangrove
6	oak
7	spruce
8	warped

Table A.47: Wood types

saplings

A.3.3 Liquid recipient

... cauldron

Index	Liquid
0	none
1	water
2	lava
3	powder_snow

Table A.48: Liquid types

A.3.4 Flower

... pot

Index	Type
0	none
1	acacia_sapling

Index	Type
2	allium
3	azalea_bush
4	azure_bluet
5	bamboo
6	birch_sapling
7	blue_orchid
8	brown_mushroom
9	cactus
10	cornflower
11	crimson_fungus
12	crimson_roots
13	dandelion
14	dark_oak_sapling
15	dead_bush
16	fern
17	flowering_azalea_bush
18	jungle_sapling
19	lily_of_the_valley
20	mangrove_propagule
21	oak_sapling
22	orange_tulip
23	oxeye_daisy
24	pink_tulip
25	poppy
26	red_mushroom
27	red_tulip
28	spruce_sapling
29	warped_fungus
30	warped_roots
31	white_tulip

Index	Type
32	wither_rose

Table A.49: Plantable materials

A.3.5 Piston head

... si head meecans extended

Index	Type
0	piston
1	extended_piston
2	piston_head

Table A.50: Piston types

A.3.6 Stripped

... boolean; log/wood

A.3.7 Infested

... silverfish in block; boolean; stones

A.3.8 Dead

... coral outside water; boolean; coral

A.3.9 Heads

...

Material	Values
ZOMBIE	0
PLAYER	1
CREEPER	2
DRAGON	3
SKELETON	4
WITHER_SKELETON	5
ZOMBIE	0

Table A.51: Heads

A.3.10 Heads

...

Material	Values
ZOMBIE	0
PLAYER	1
CREEPER	2
DRAGON	3
SKELETON	4
WITHER_SKELETON	5

Table A.52: Heads

A.3.11 Sizeable

...; AMETHYST_BUD & DRIPLEAF

A.4 Material modifiers aggregation

some modifiers are similar, so let's add them together

A.4.1 Direction aggregation

modifier, followed by the condition to set the bit to 1

Property	U	D	N	S	E	W
up	true					
down		true				
north			true			
south				true		
east					true	
west						true
face	ceiling	floor				
attachment	ceiling	floor				
half	top or upper	bottom or lower				
facing	up	down	north	south	east	west
vertical-direction	up	down				
type	top or double	bottom or double				
orientation	up_X	down_X	X_north or north_up	X_south or south_up	X_east or east_up	X_west or west_up

Property	U	D	N	S	E	W
shape	ascending_X		ascending_north or north_X	ascending_south or south_X or north_south	ascending_east or X_east or east_west	ascending_west or X_west
hanging	true					

Table A.53: Direction aggregation

A.4.2 Axis aggregation

modifier up to 2b

Property	MSB	LSB
axis	Y or Z	X or Z
attachment	double_wall	single_wall

Table A.54: Axis aggregation

A.4.3 Age aggregation

modifier up to 8b

Property
age
berries

Property
honey_level

Table A.55: Age aggregation

A.4.4 Grouped materials aggregation

modifier up to 3b

Property
candles
eggs
pickles

Table A.56: Grouped materials aggregation

A.4.5 Stages aggregation

modifier up to 8b

Property
charges
level
bites
layers

Table A.57: Stages aggregation

A.4.6 Parts aggregation

modifier; up to 4b

Property
part

Property
type
piston_head
stair_shape
heads

Table A.58: Parts aggregation

A.4.7 Material aggregation

modifier; up to 16b iron and gold pressure plates have their name as 'heavy/light weighted pressure plate' MOSS_CARPET

Property	Value
wood_type	0x8000 <i>wood value</i>
iron	0xC000
gold	0xC001
material	<i>material value</i>

Table A.59: Material aggregation

A.4.8 Liquid aggregation

modifier; up to 4b

Property	value
liquid	<i>liquid value</i>
waterlogged	1 ¹⁴

Table A.60: Liquid aggregation

¹⁴1 is the liquid value of water.

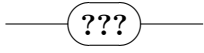


Figure A.1a: Prefix modifier concatenation

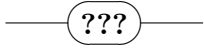


Figure A.1b: Modifier concatenation

A.5 Material modifiers concatenation

... (how to join modifiers)

If a material doesn't have the attribute that the diagram is checking it will assume that the attribute value is the default one (0 or false, in most of the cases), resulting in ignoring that property.

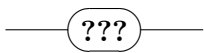


Figure A.1c: Direction modifier concatenation

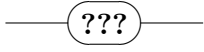


Figure A.1d: Direction modifier concatenation 2

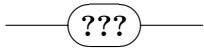


Figure A.1e: Direction modifier concatenation 3

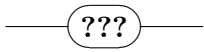


Figure A.1f: Integer modifier concatenation

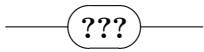


Figure A.1g: Integer modifier concatenation 2

References

Papermc. (n.d.). Retrieved from <https://papermc.io/>

Rajaraman, V. (2016, January). Ieee standard for floating point numbers. *Resonance*. Retrieved from <https://www.ias.ac.in/article/fulltext/reso/021/01/0011-0030>

Spigot. (n.d.). Retrieved from <https://www.spigotmc.org/>

Spigot - enum material - 1.19. (n.d.). Retrieved 2022-08-05, from <https://hub.spigotmc.org/javadocs/spigot/org/bukkit/material/package-summary.html>

Worldguard. (n.d.). Retrieved from <https://dev.bukkit.org/projects/worldguard>

World - minecraft wiki. (n.d.). Retrieved from <https://minecraft.fandom.com/wiki/World>