BIONODE.IO

Tutorial

STREAMS

Streams are a first-class construct in Node.js for handling data.

PROCESS DATA IN CHUNKS

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fs.createReadStream(file)

request(url)

process.stdin()

PROCESS DATA IN CHUNKS

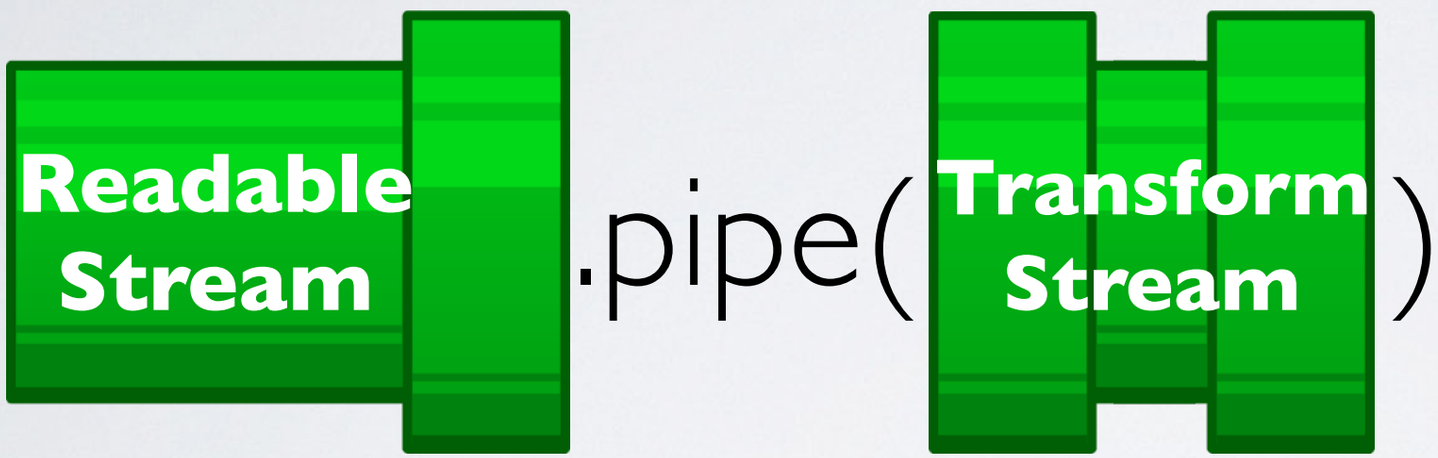
.pipe( )

fs.createReadStream(file)

request(url)

process.stdin()

PROCESS DATA IN CHUNKS



fs.createReadStream(file)

request(url)

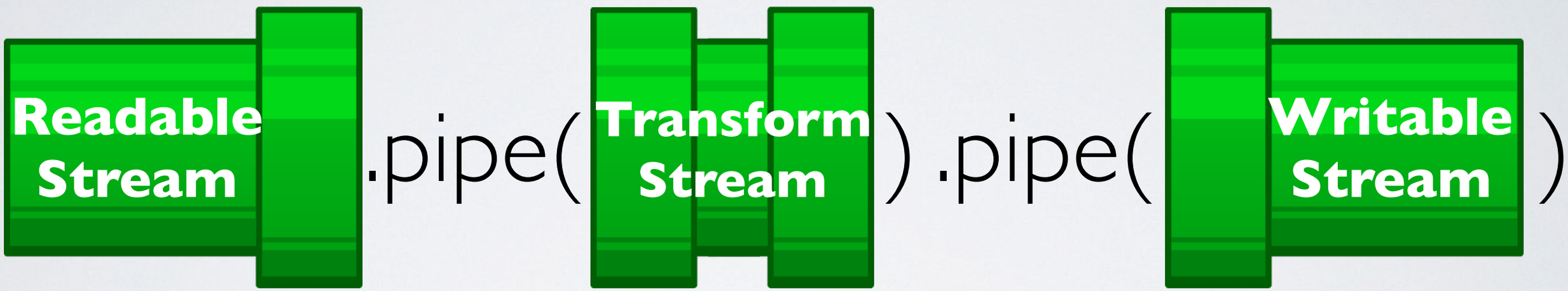
process.stdin()

JSONStream.parse()

filterFunction()

multithreadAnalysis()

PROCESS DATA IN CHUNKS



fs.createReadStream(file)

request(url)

process.stdin()

JSONStream.parse()

filterFunction()

multithreadAnalysis()

fs.createWriteStream(file)

process.stdout()

PROCESS DATA IN CHUNKS

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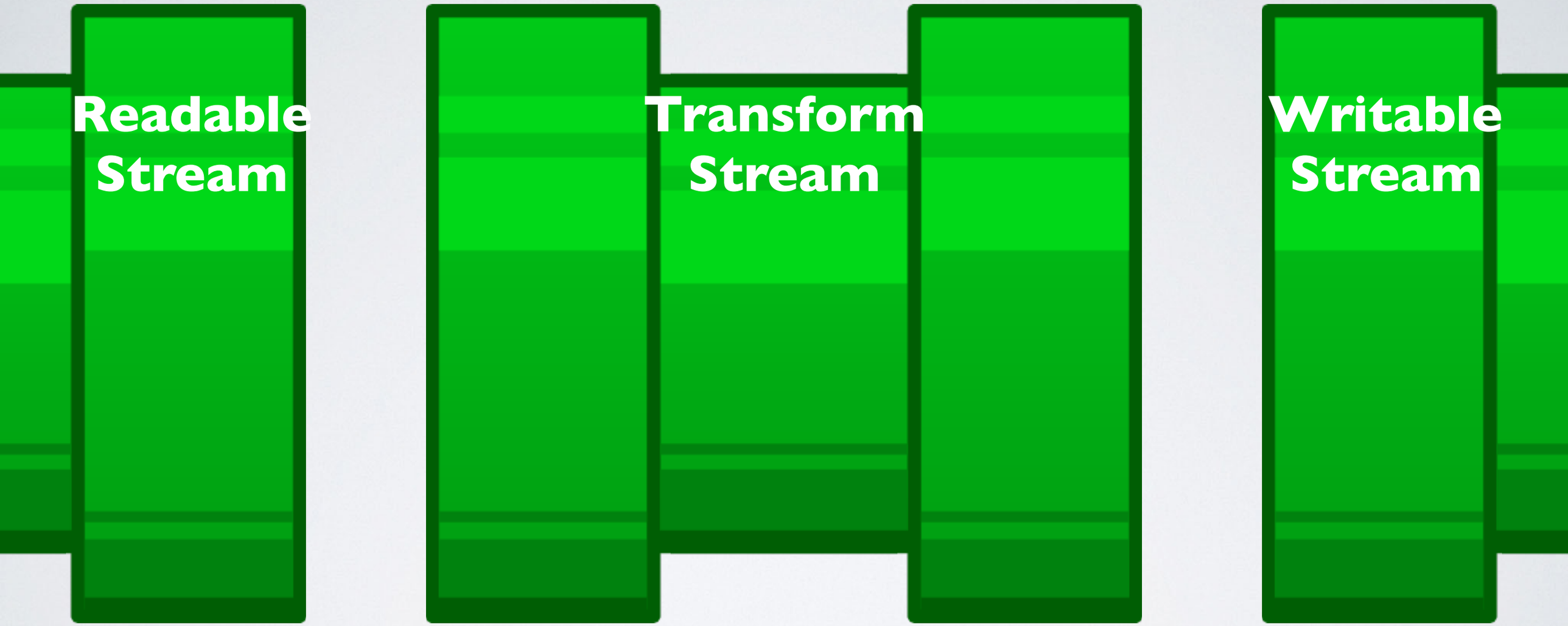
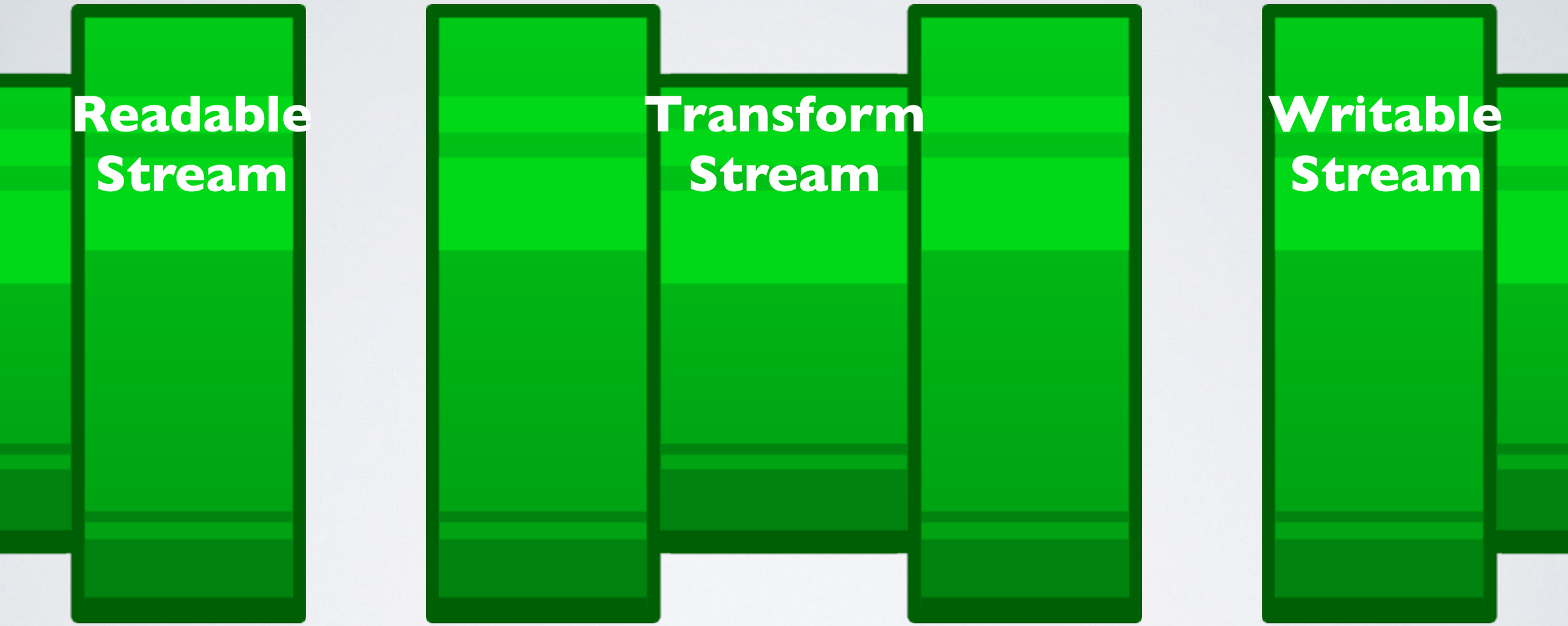

Readable Stream
Transform Stream
Writable Stream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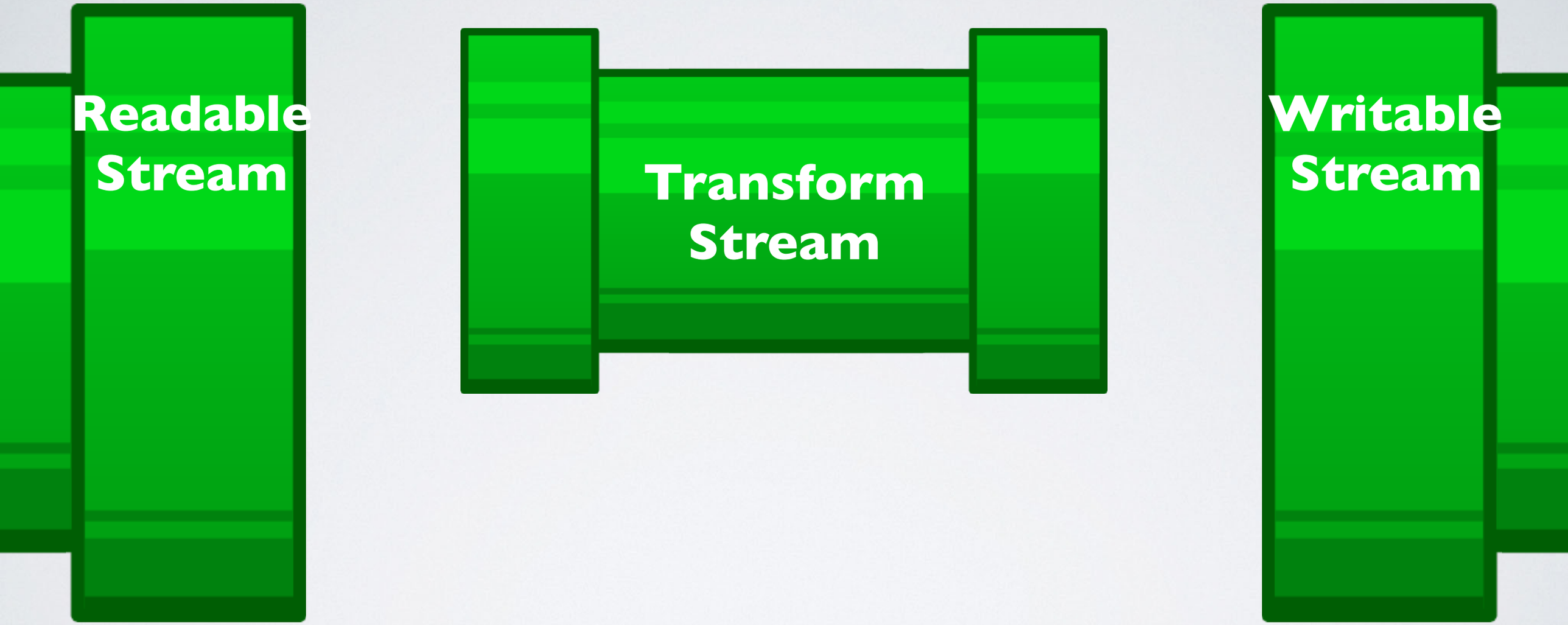
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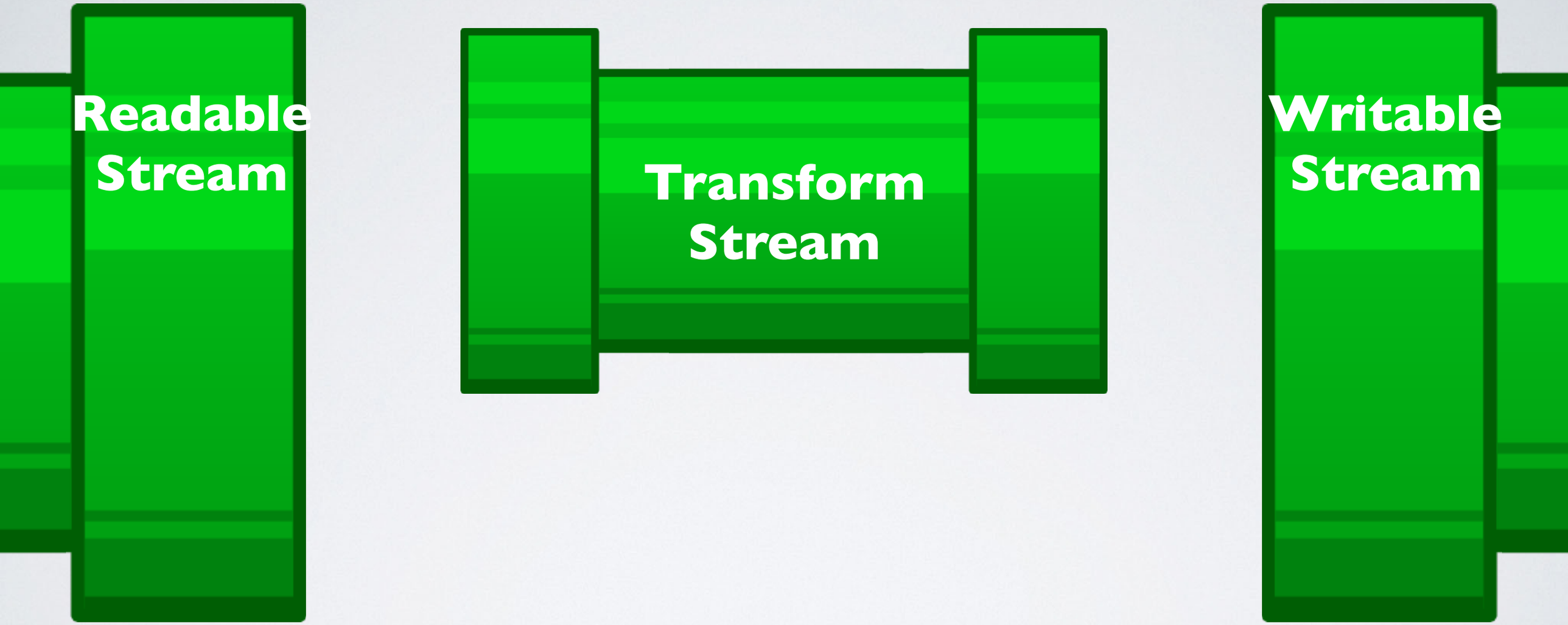
Writable Stream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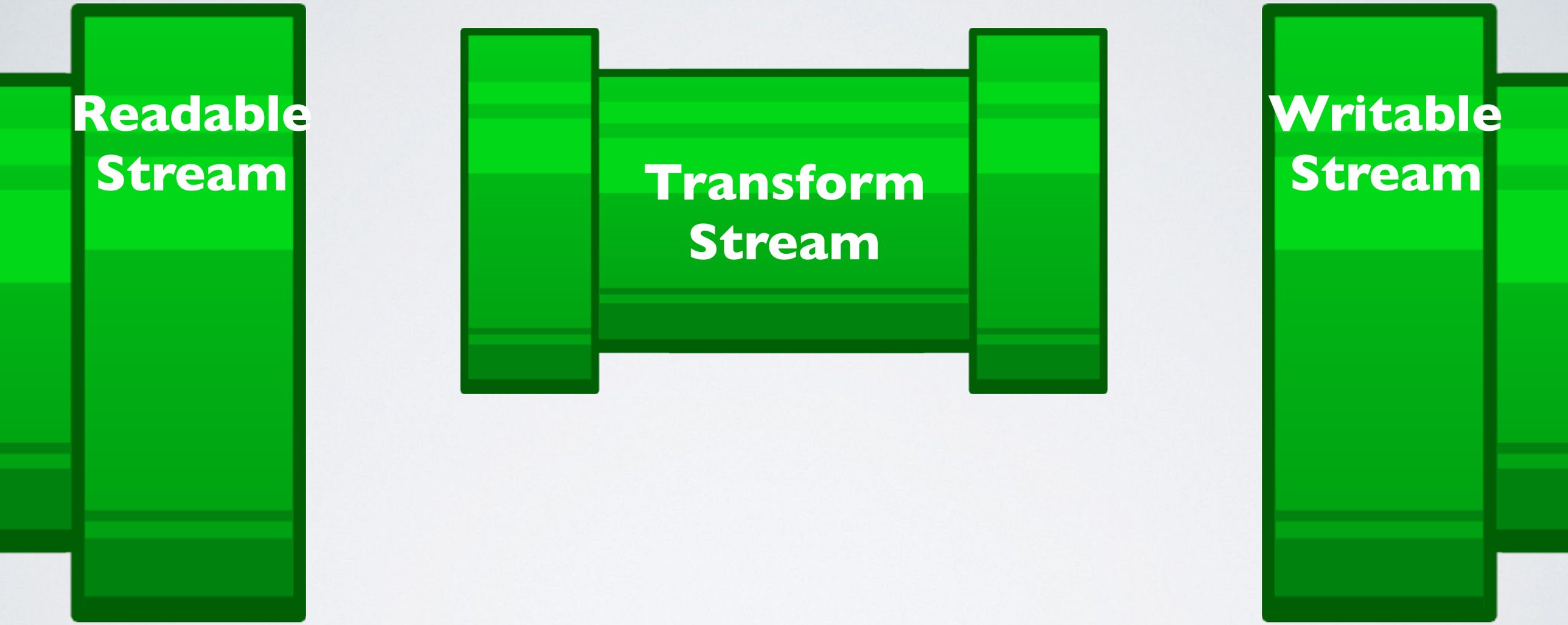
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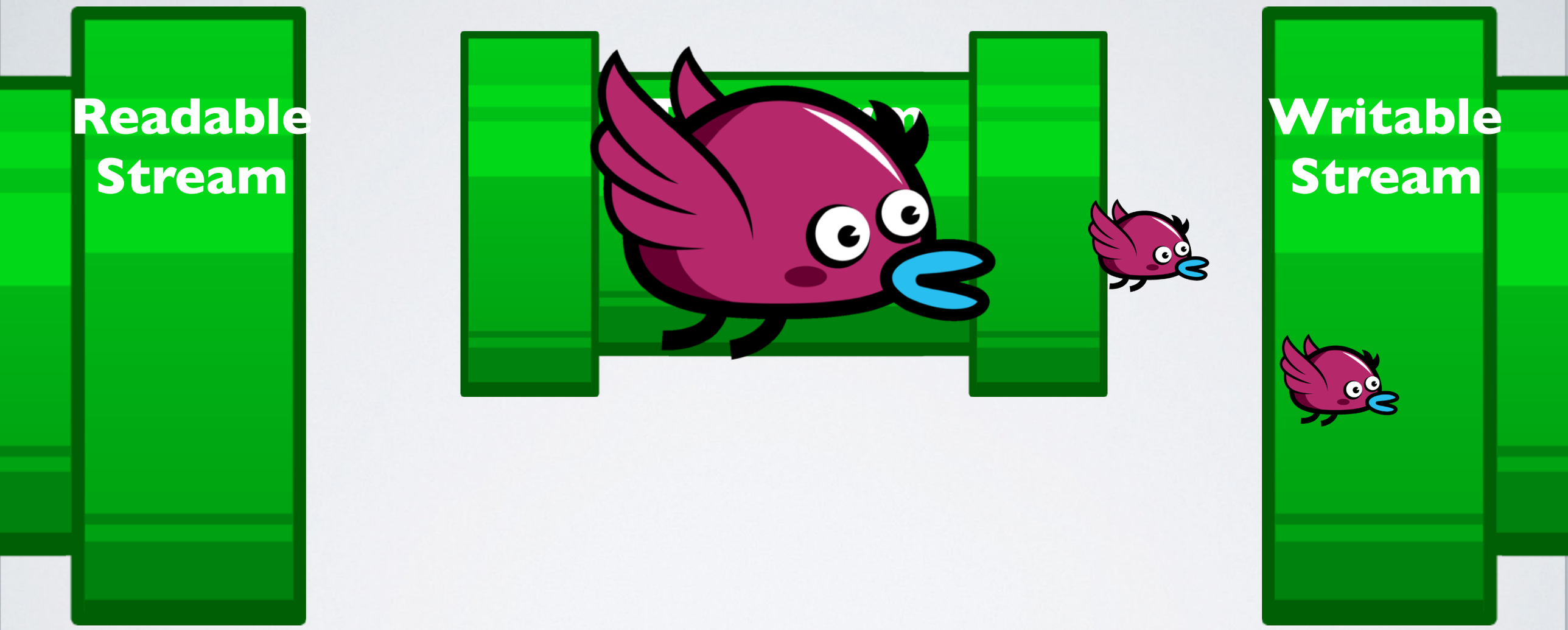
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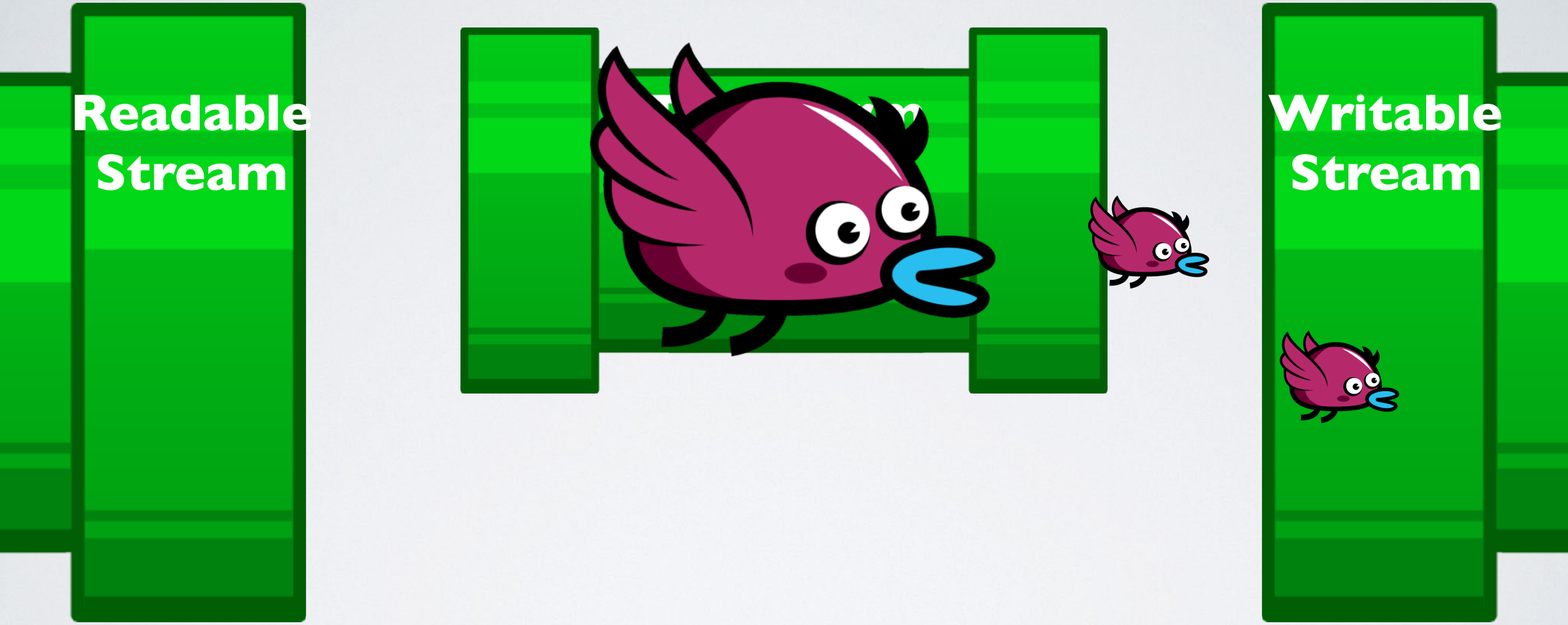
Writable Stream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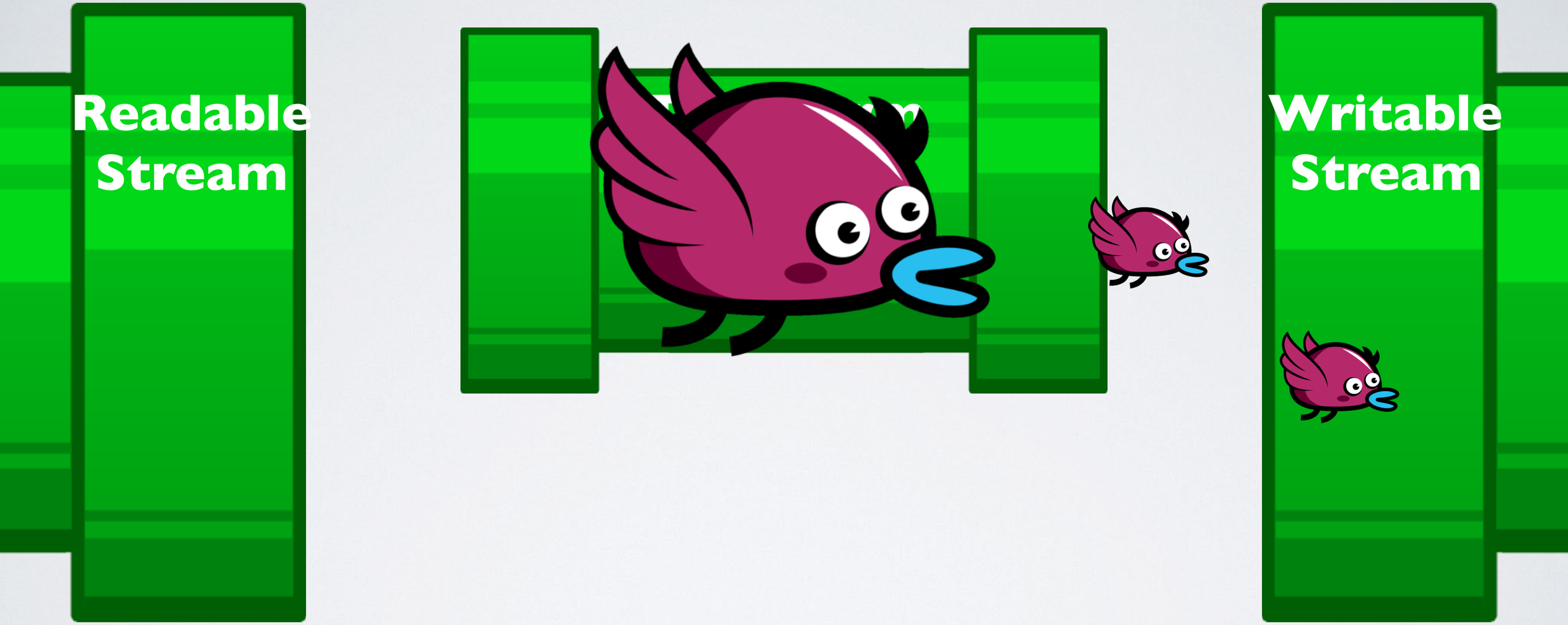
Writable Stream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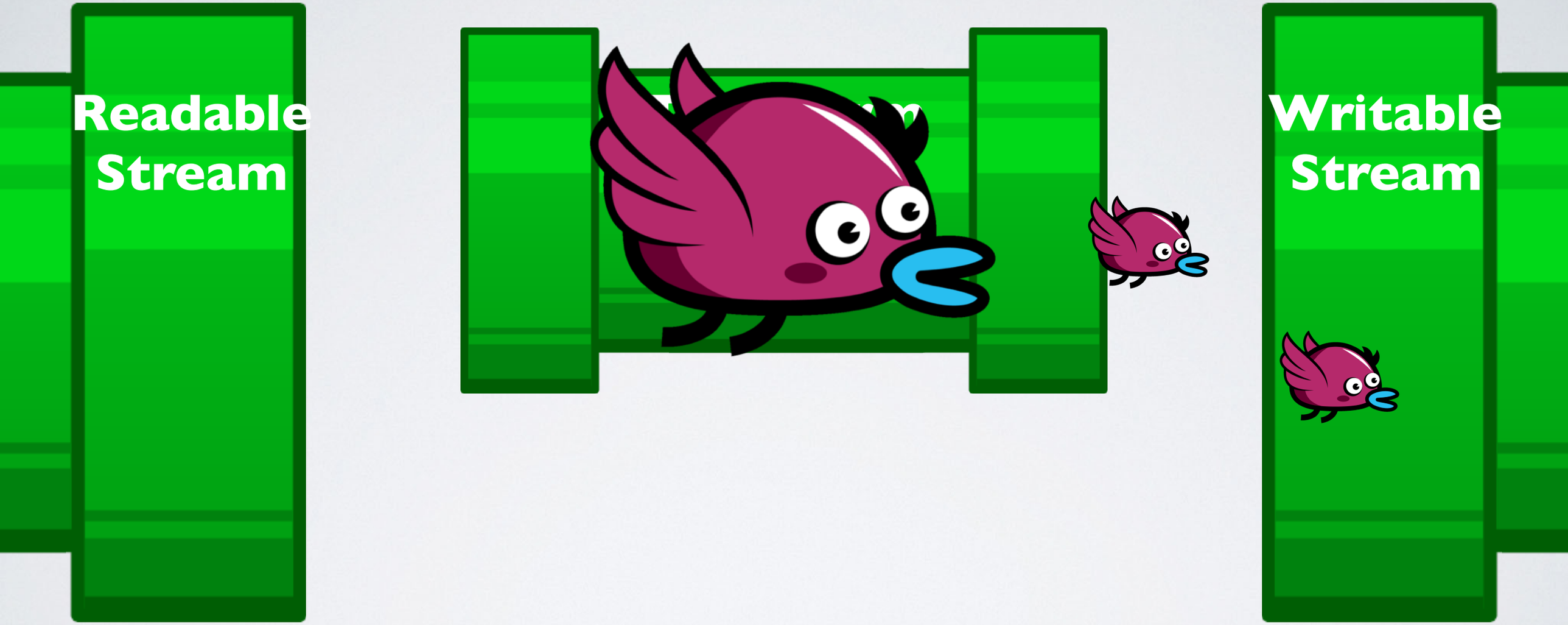
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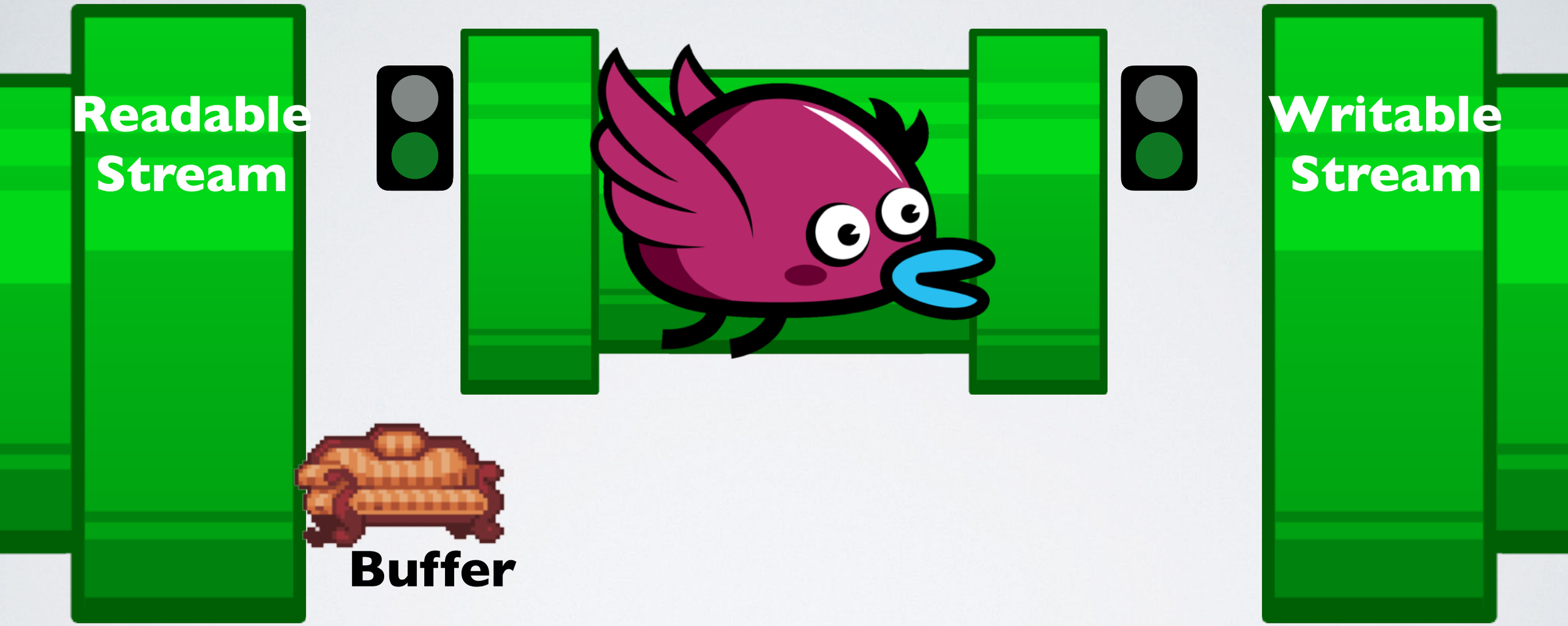
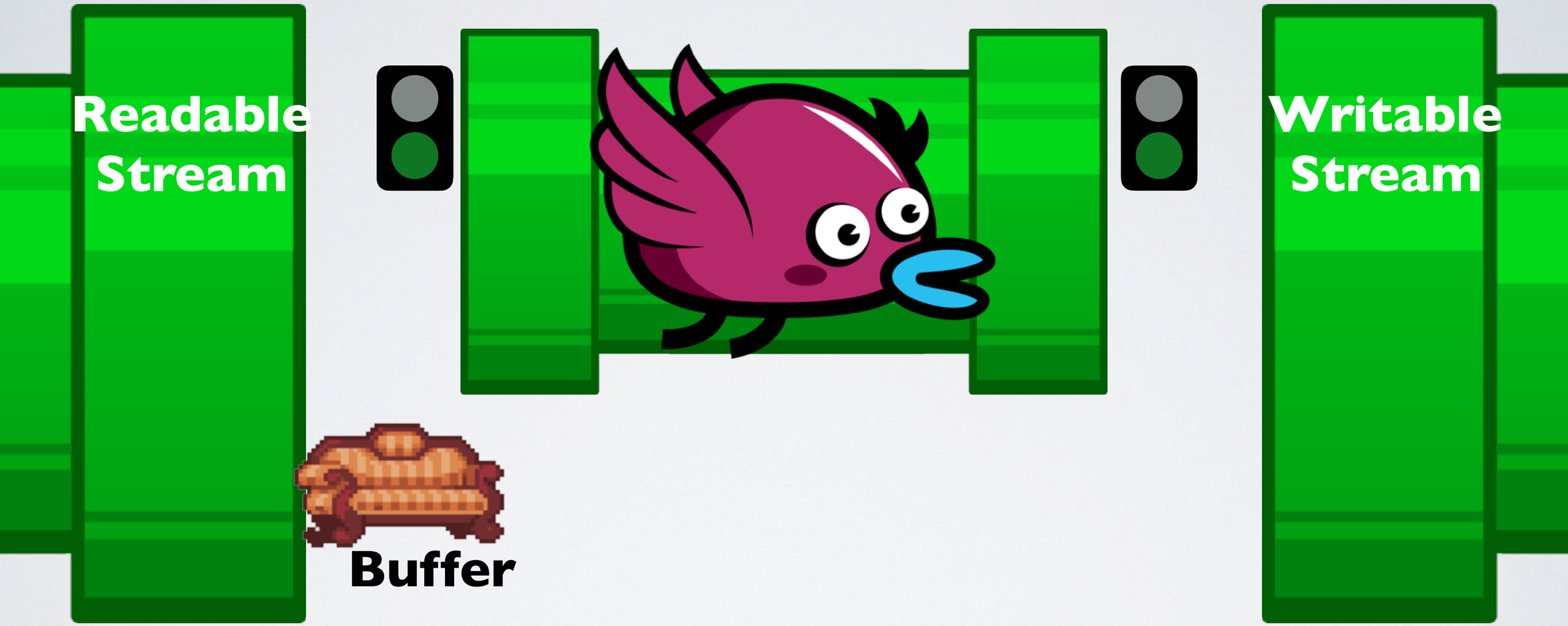

Readable Stream
Writable Stream
Buffer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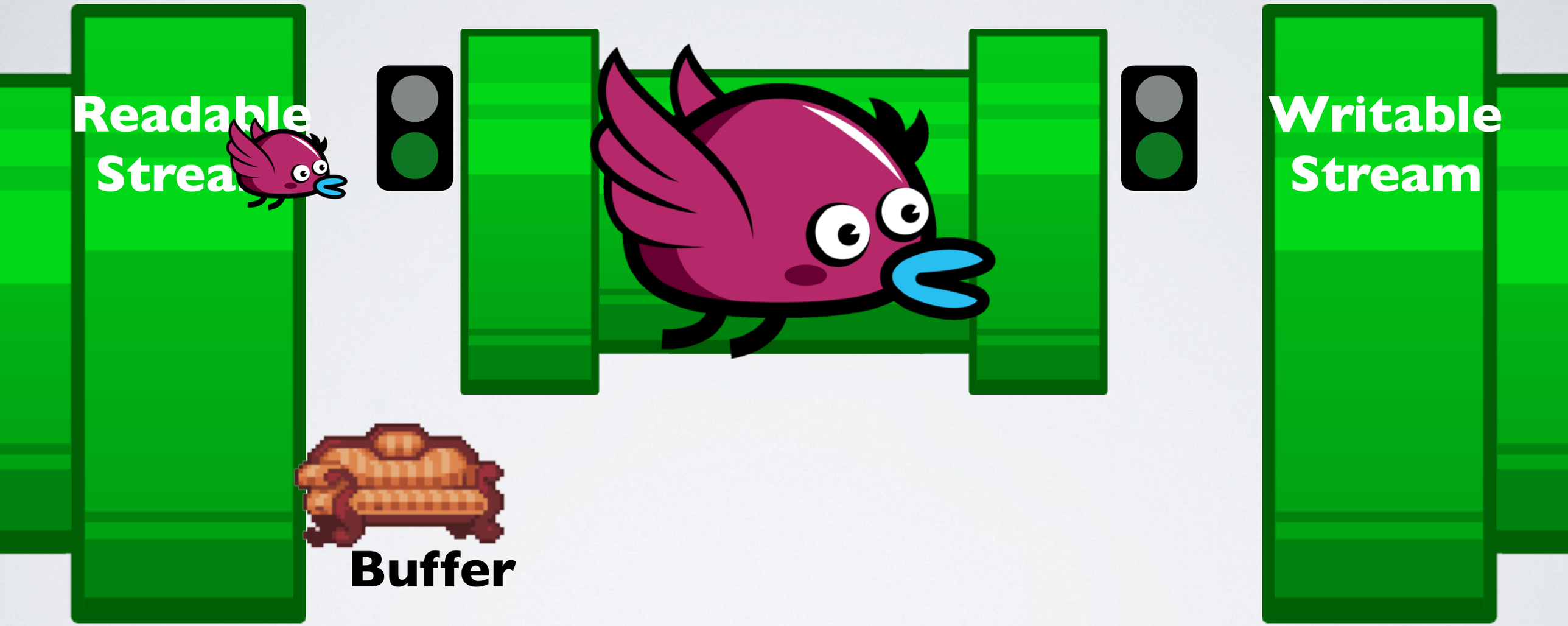
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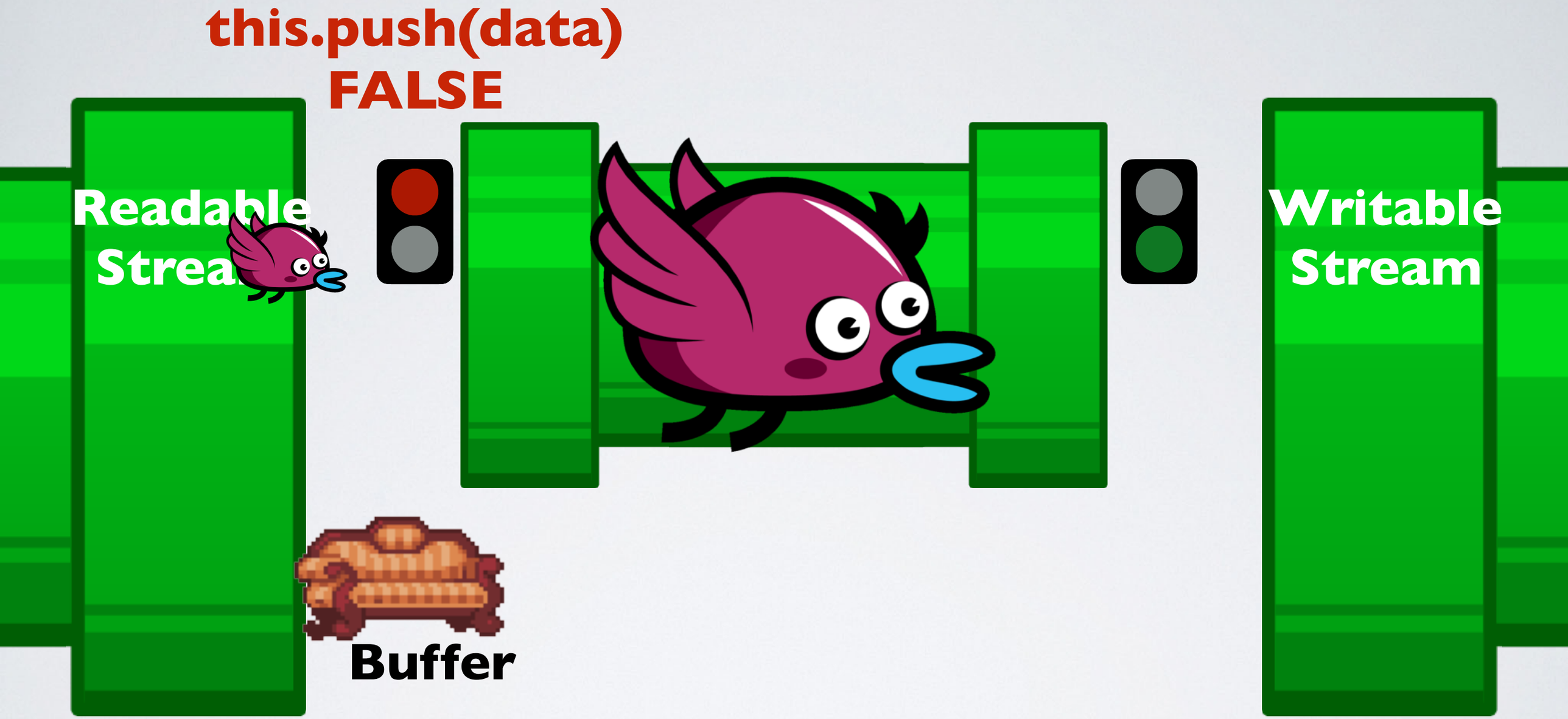
this.push(data)
FALSE
Readable
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Writable
Stream
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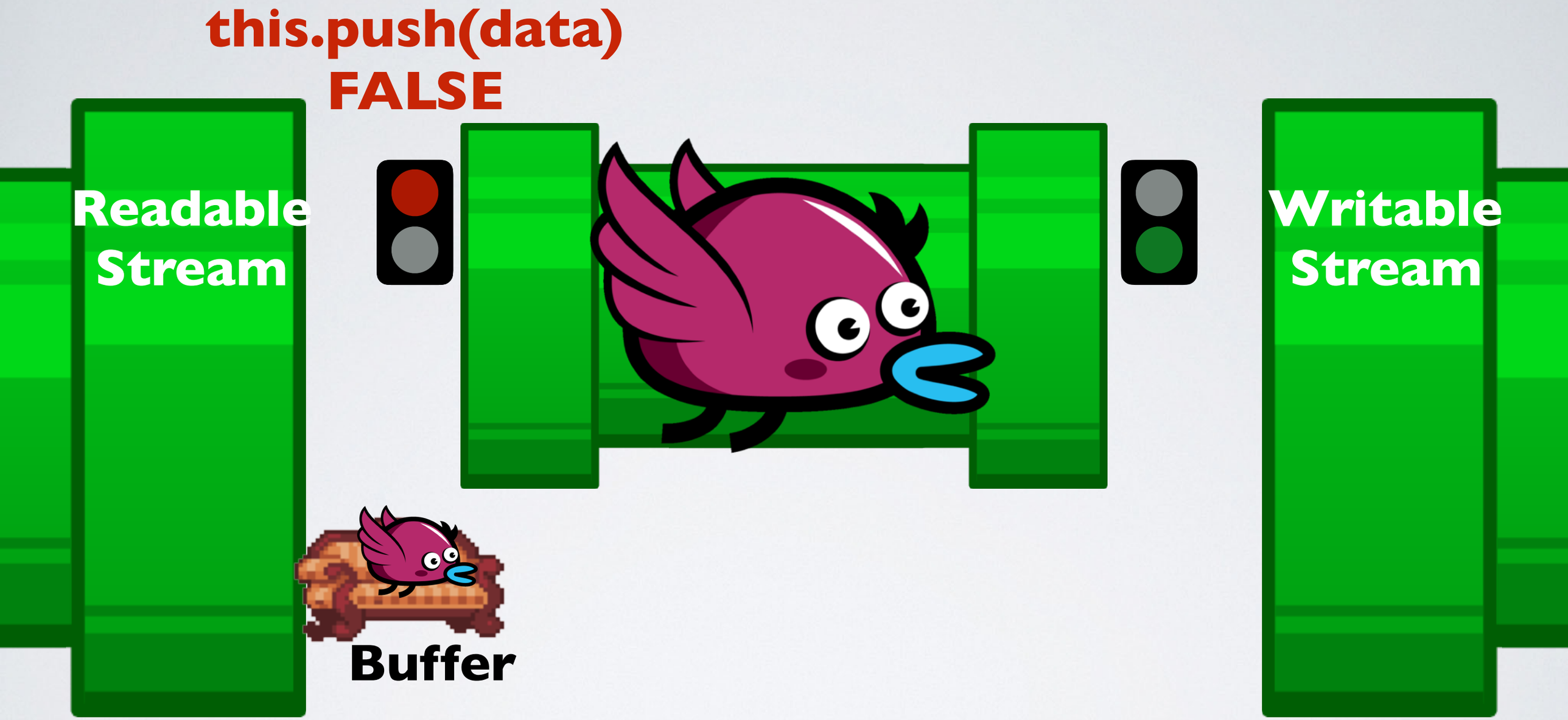
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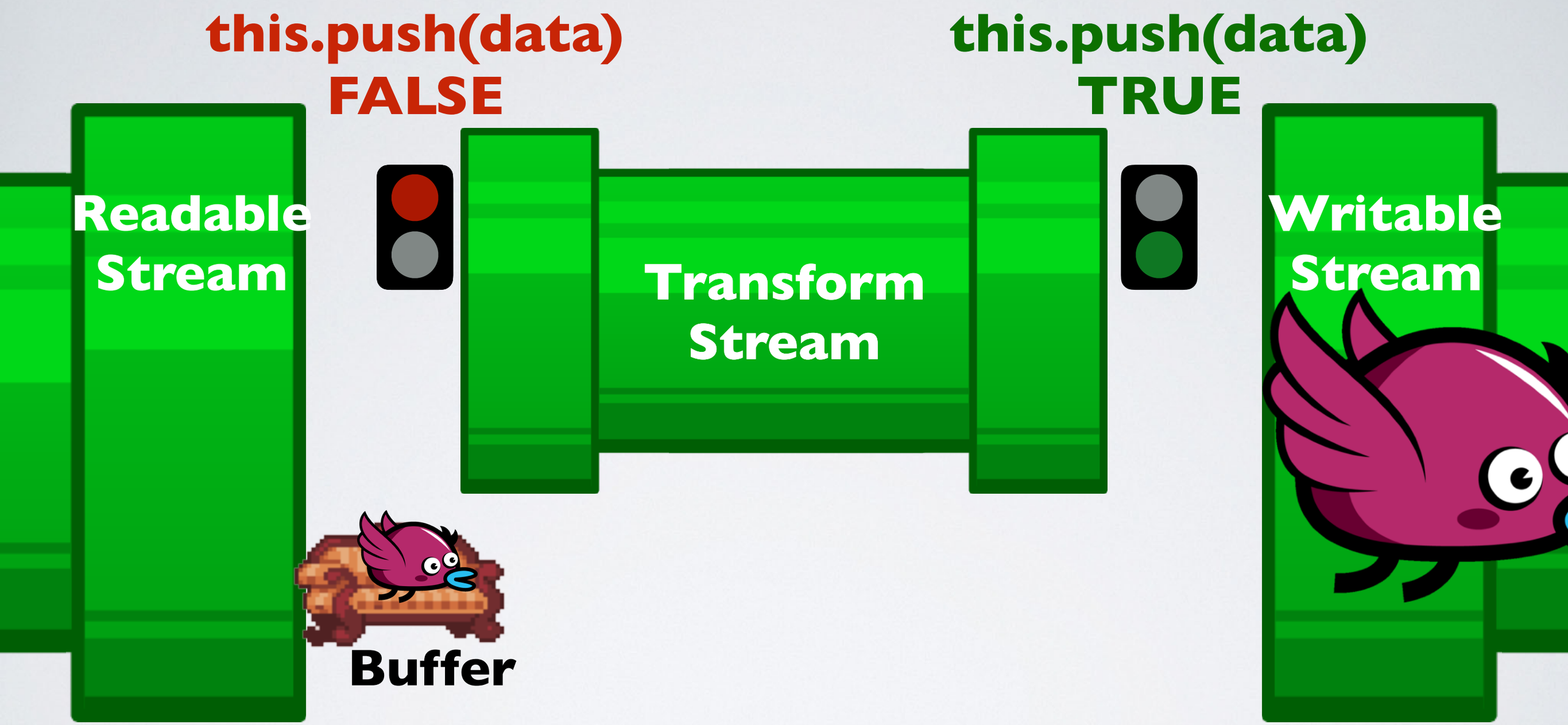
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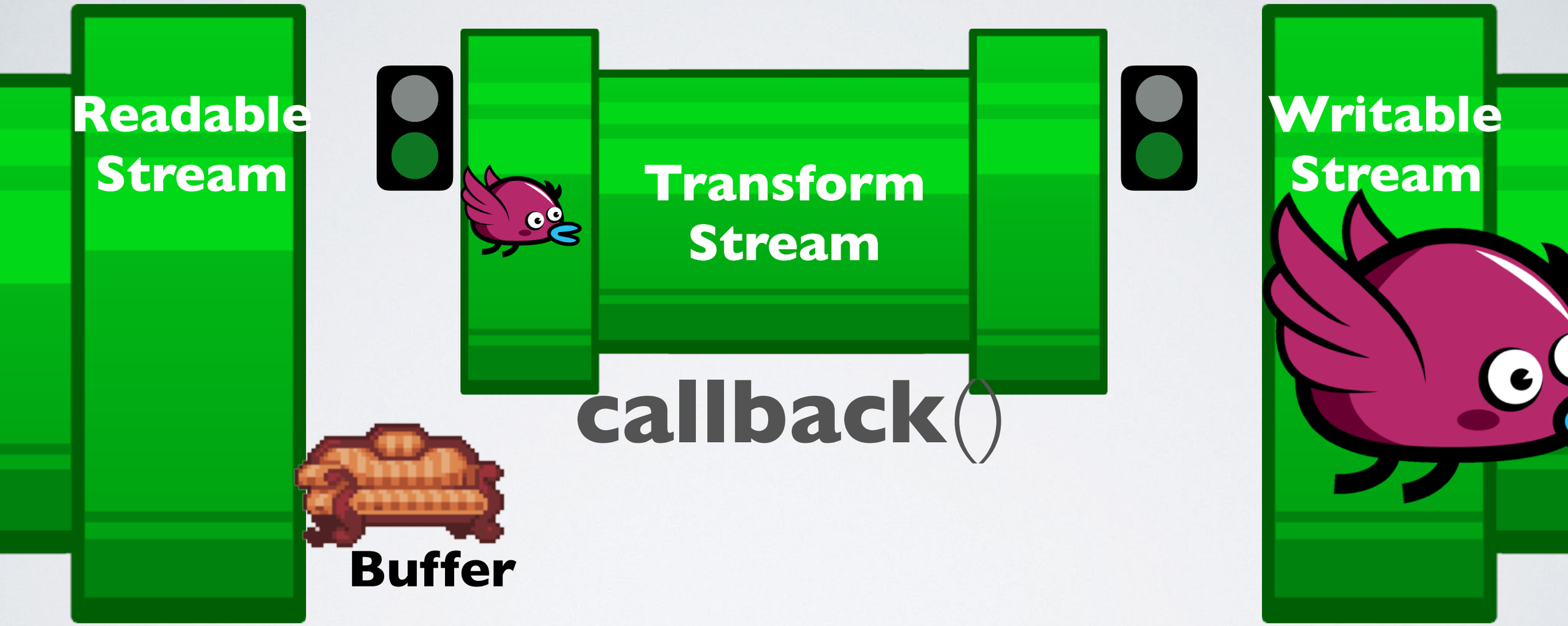
Readable Stream
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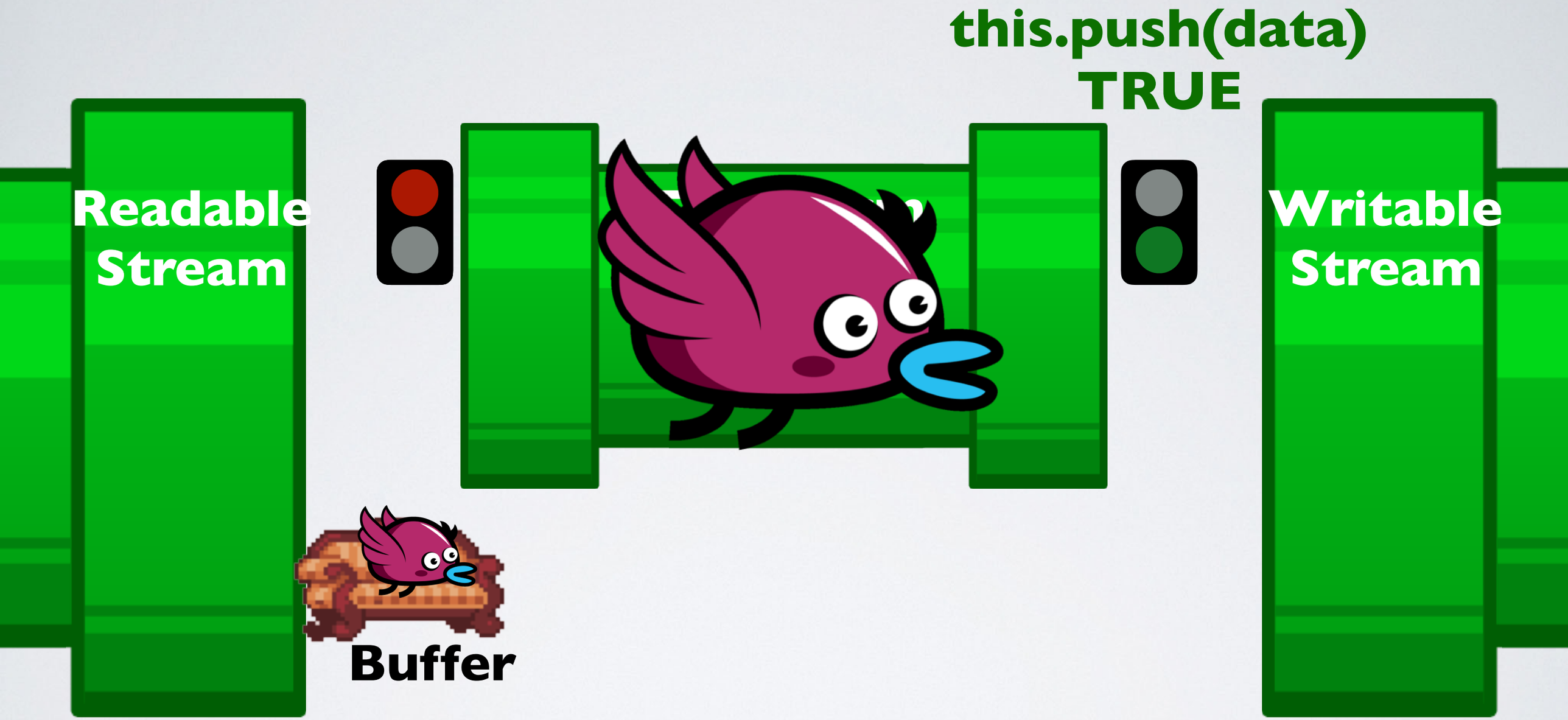
callback()
Buffer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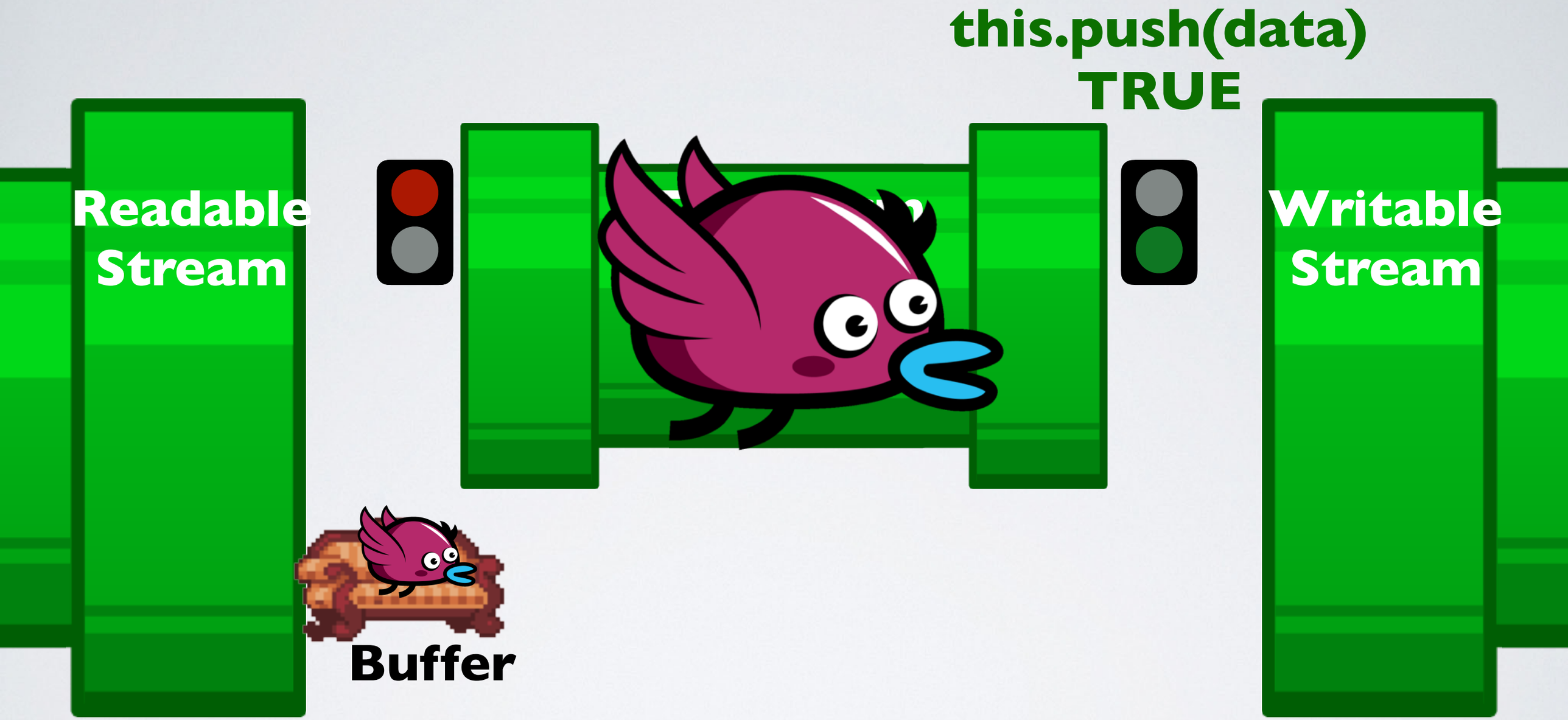
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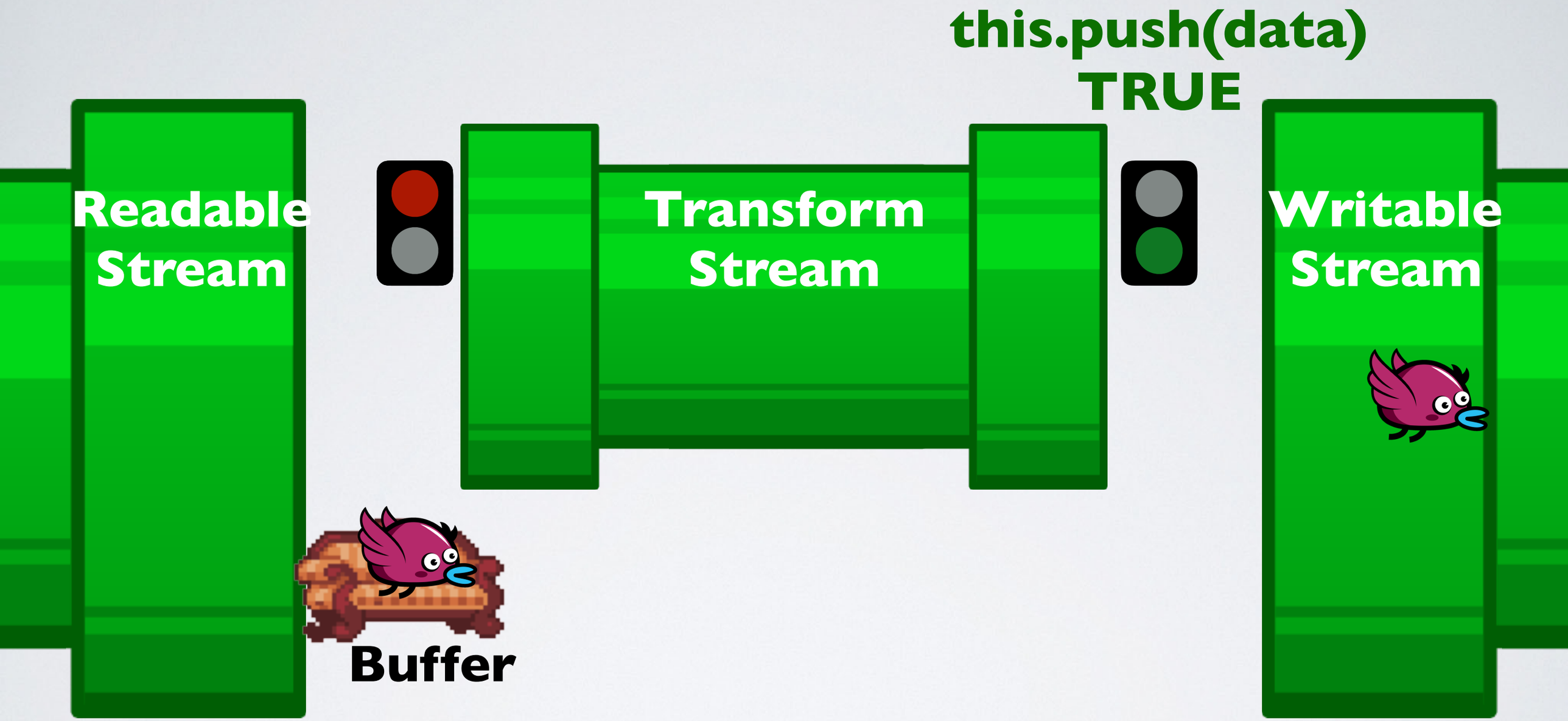
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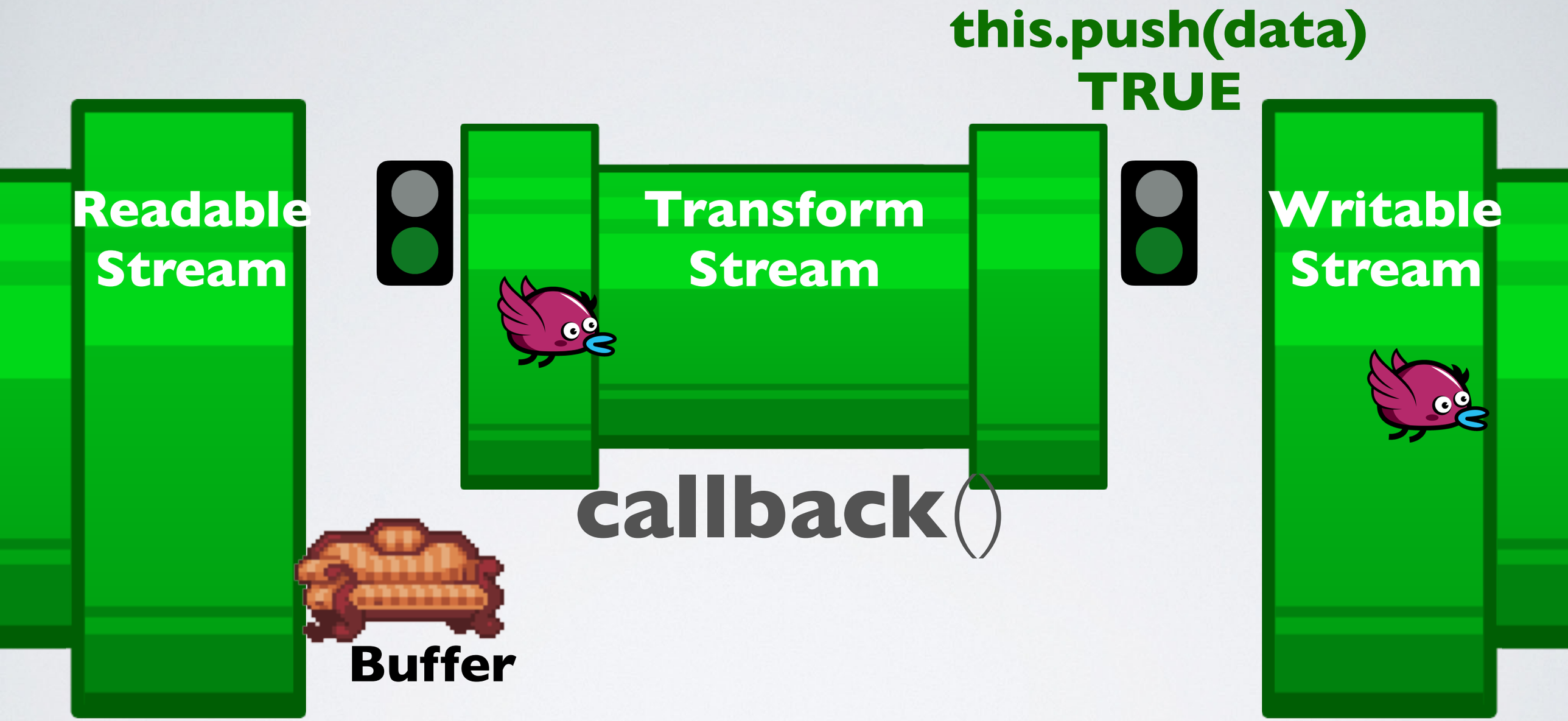
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DUPLEX STREAM

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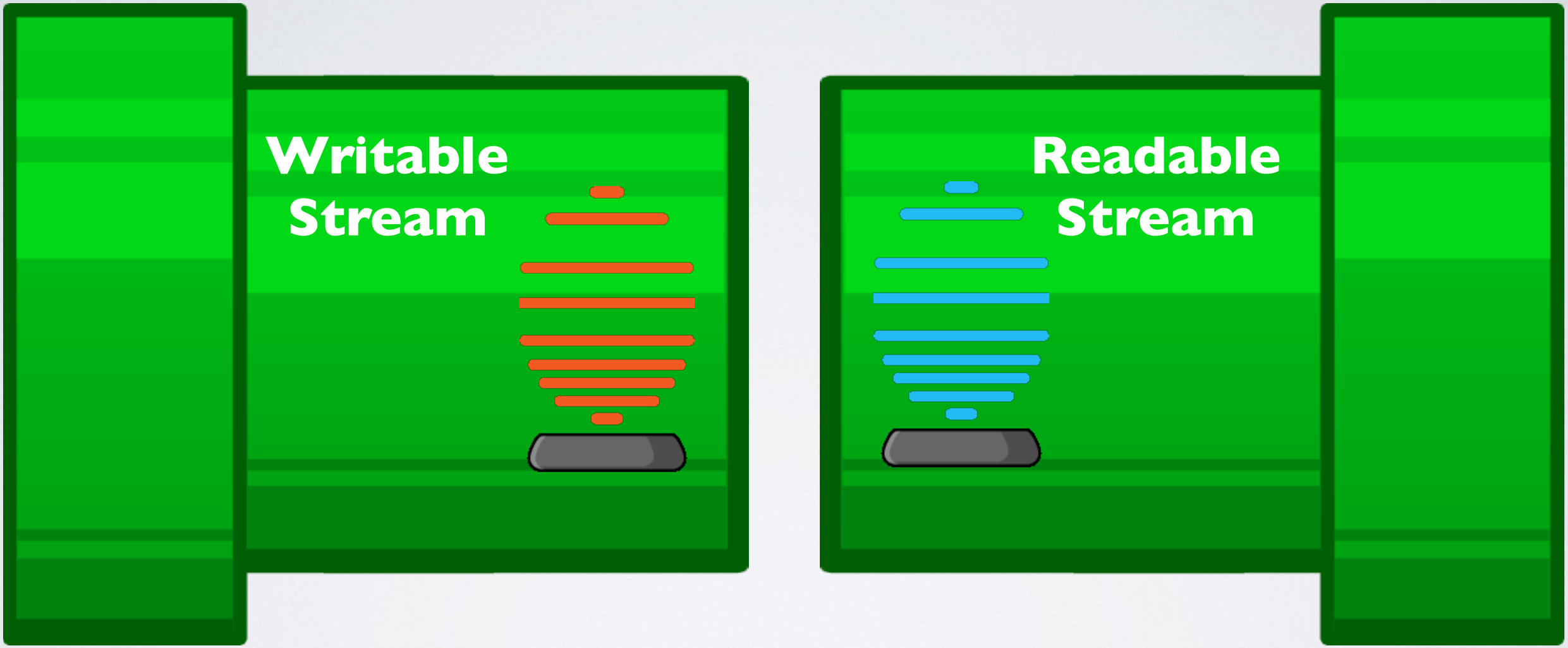

PASSTHROUGH STREAM

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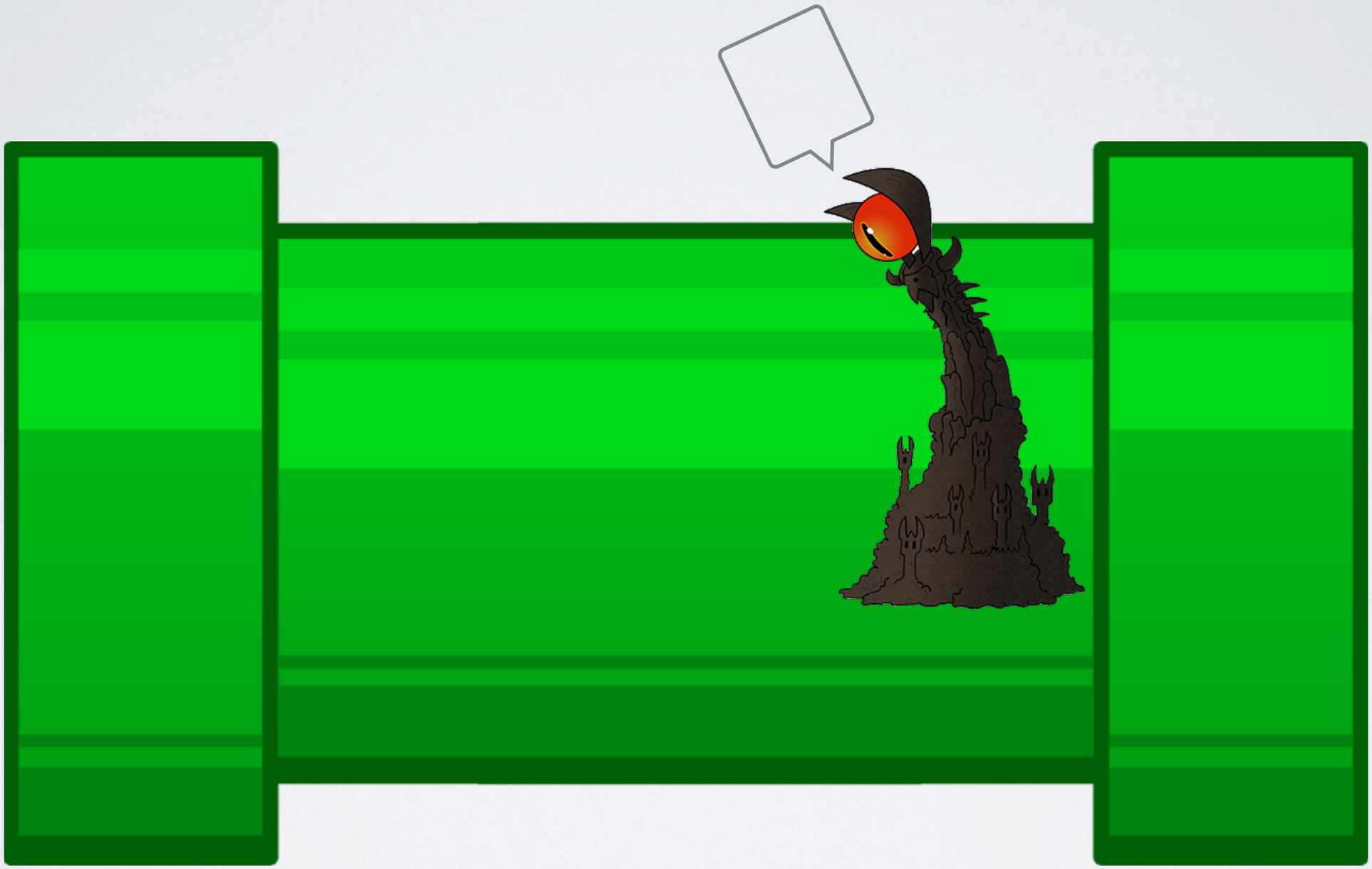

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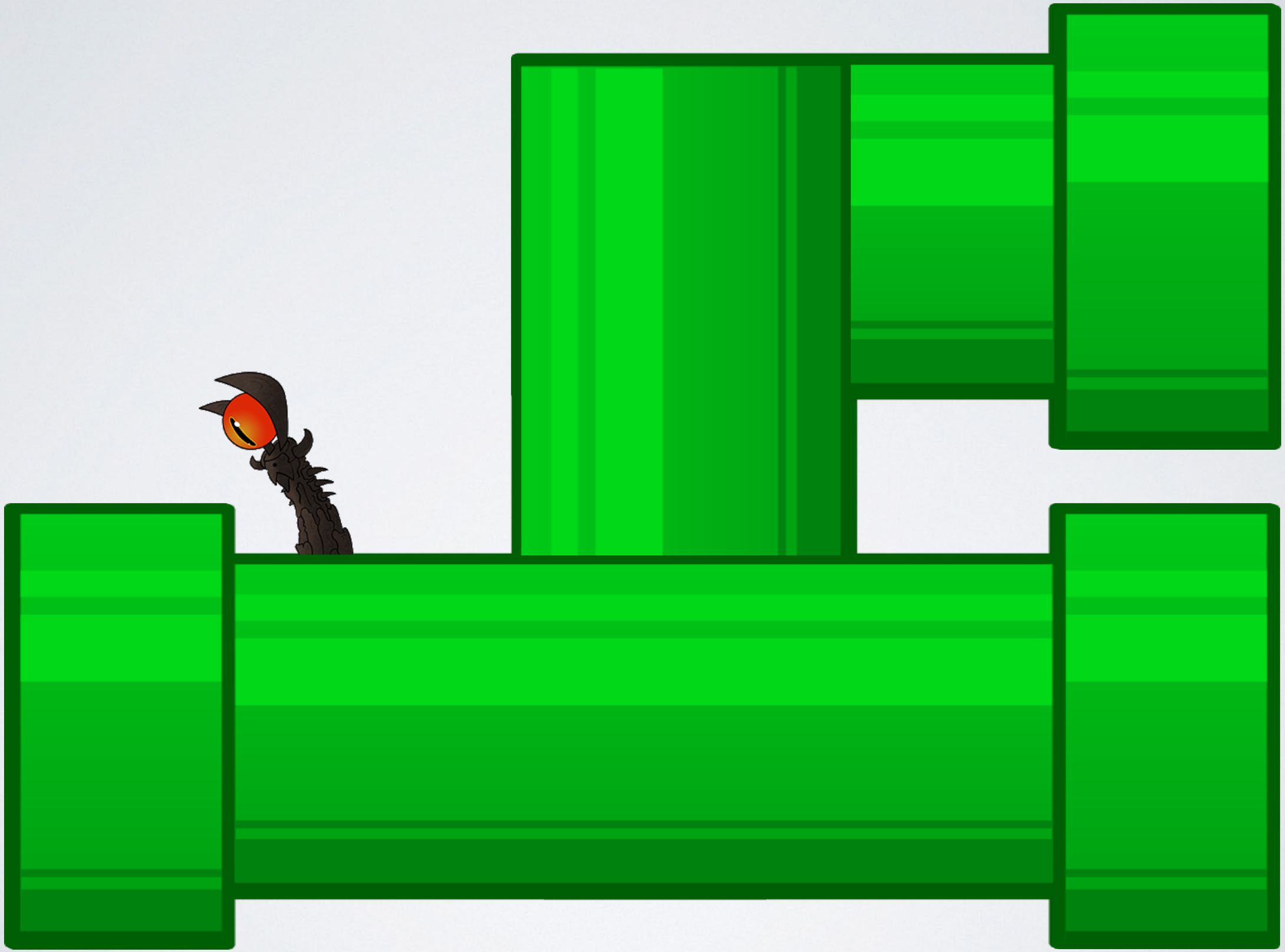

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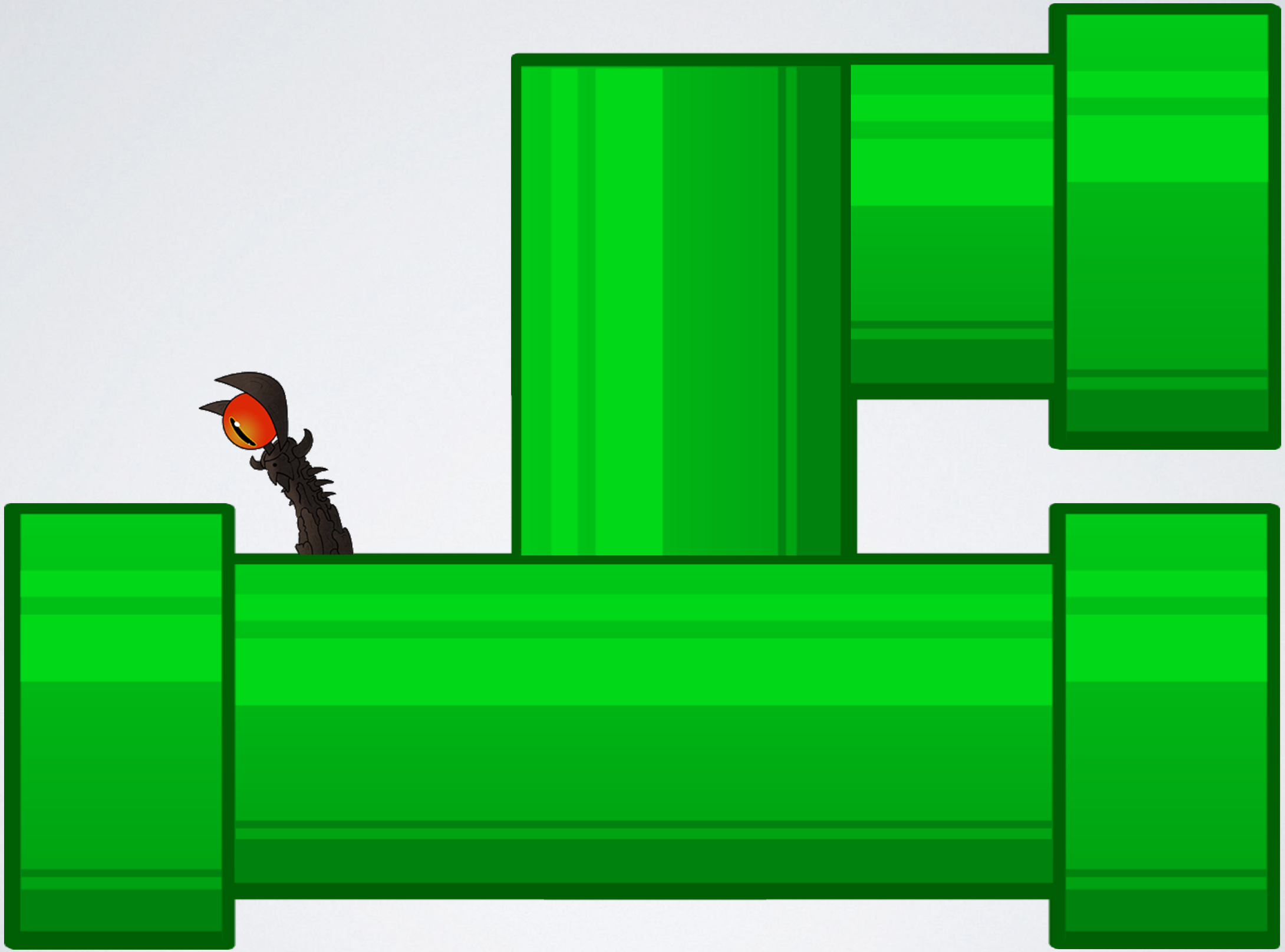

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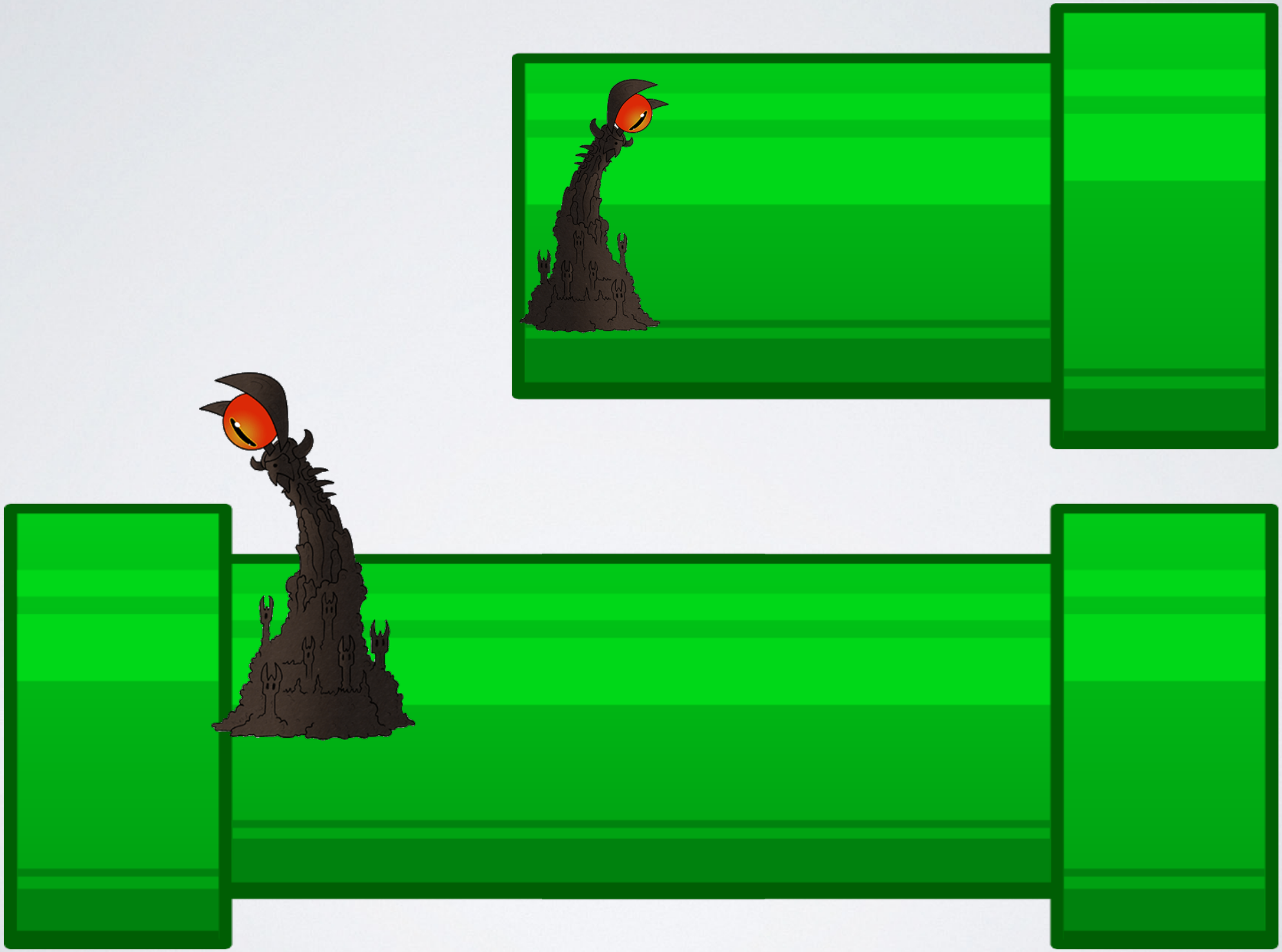

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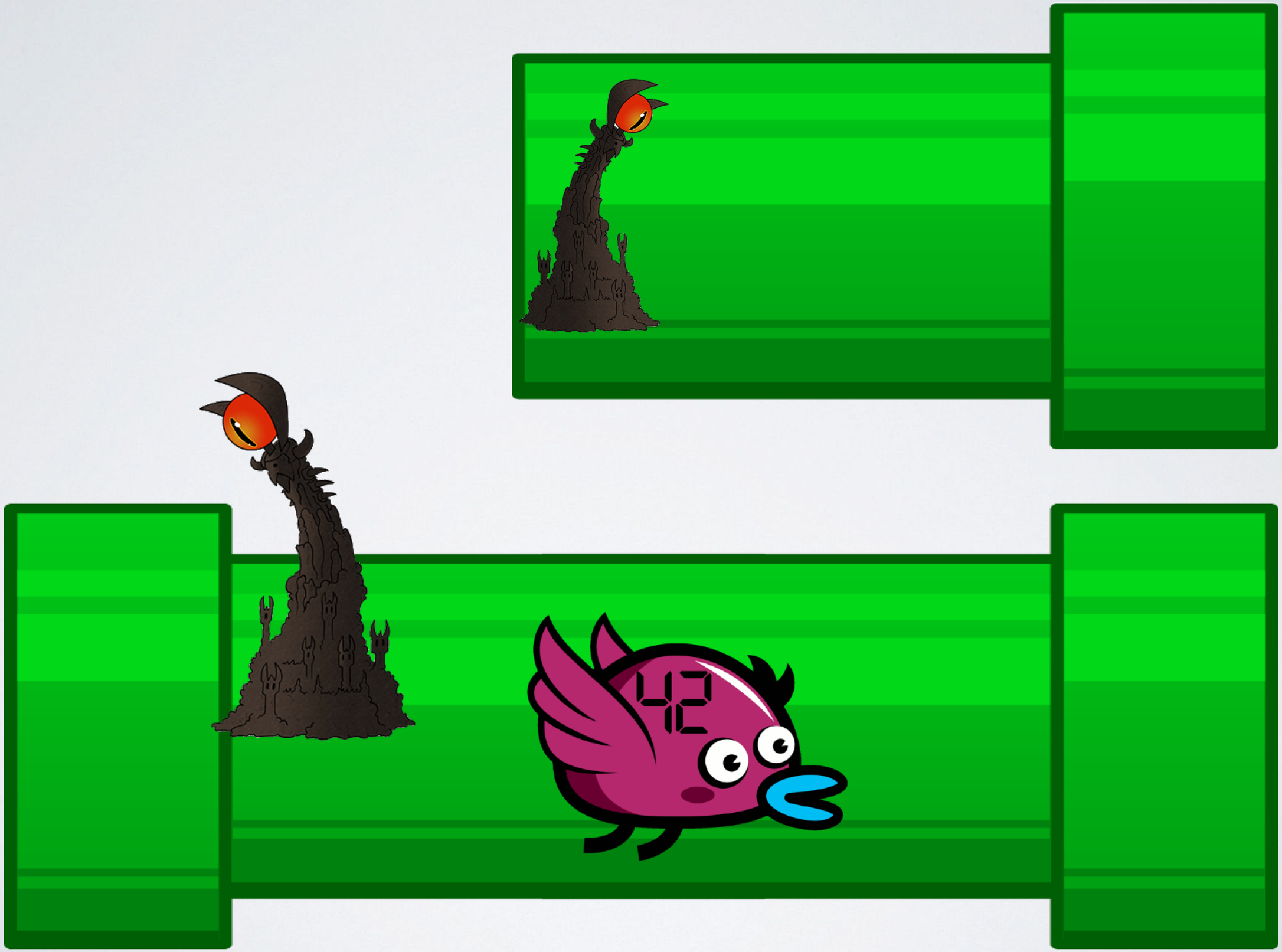

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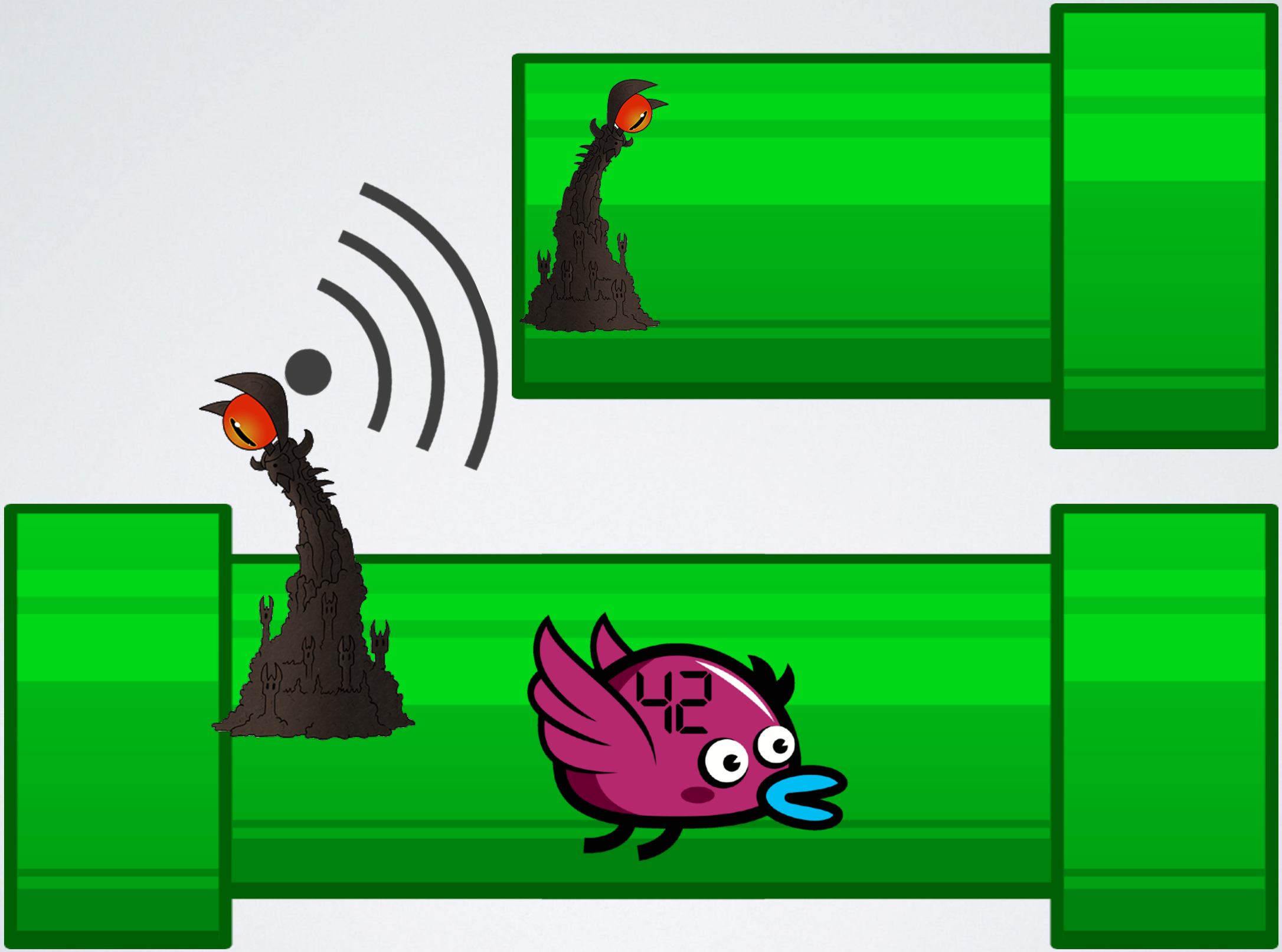

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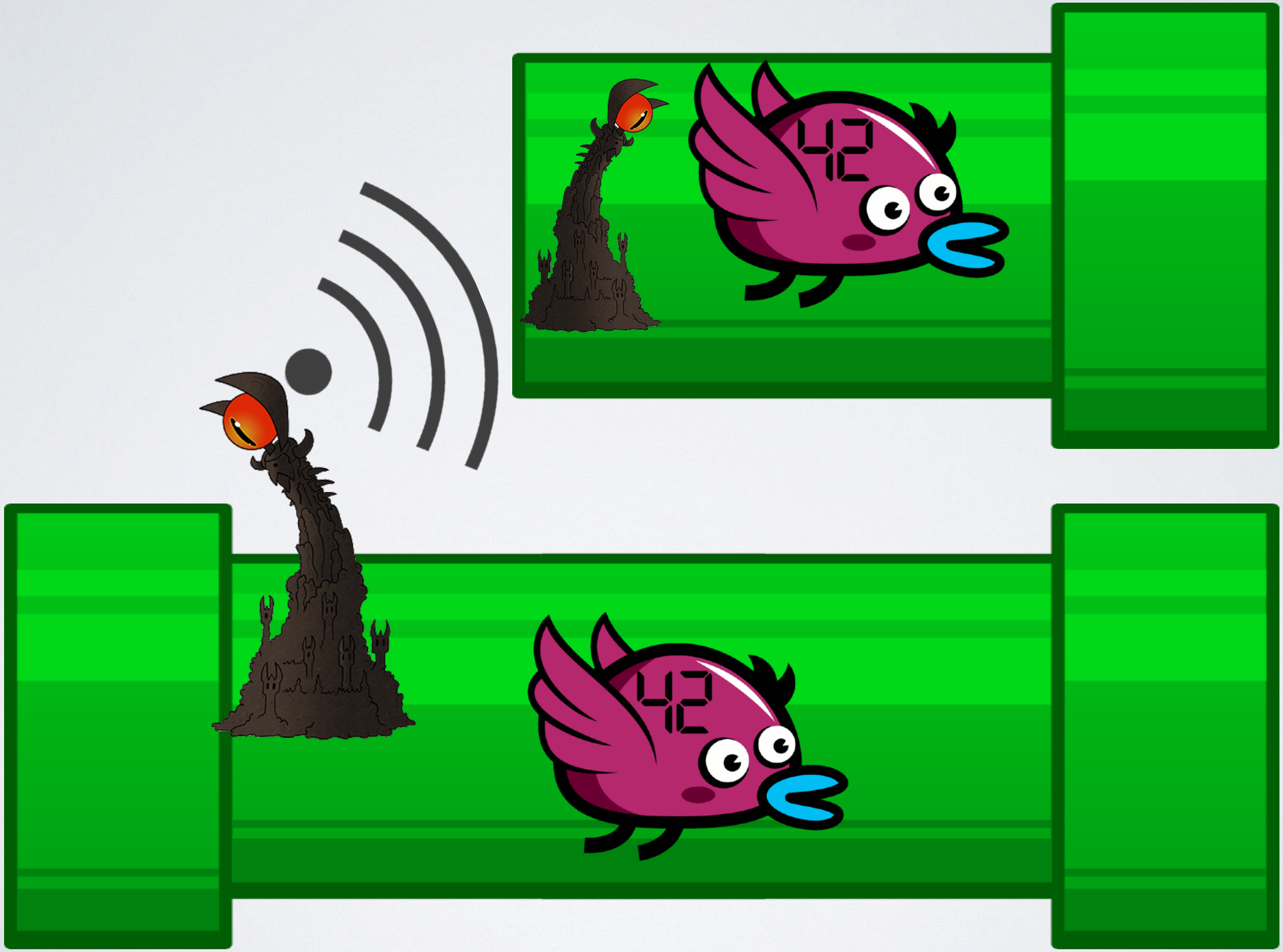

PASSTHROUGH STREAM

STREAM BENEFITS

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- Lazily produce or consume data in buffered chunks.

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- Automatically handle back-pressure
- Buffers allow you to work around the V8 heap memory limit
- Most core Node.js content sources/sinks are streams already!

STREAMS CLASSES

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- Readable -- Data Sources

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- Readable -- Data Sources
- Writable -- Data Sinks

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- Passthrough -- Stream spy

HOW TO IMPLEMENT

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- Use handy abstractions like mississippi module (easy way)

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- Use handy abstractions like mississippi module (easy way)
- Subclass appropriate Stream Class and implement required methods, i.e., _read(), _write(), etc (hard way)

github.com/maxogden/mississippi

a collection of useful stream utility modules

```
var miss = require('mississippi')
```

- **from** - Make a custom readable stream
- **to** - Make a custom writable stream
- **through** - Make a custom transform stream.
- **duplex** - Take two separate streams, a writable and a readable, and turn them into a single duplex (readable and writable) stream.
- **pipeline** - Combine streams together

check github for example code

LINKS

https://github.com/bionode-hack/discussions#useful-nodejs-modules

https://github.com/bionode-hack/discussions#presentation-slides

Follow @maxogden, @mafintosh and @substack

IMAGES SOURCES

http://opengameart.org/content/bevouliin-green-flappy-bird-sprite-sheets

http://neoriceisgood.deviantart.com/art/100-furniture-sprites-405058884

http://android272.deviantart.com/art/Teeworlds-Teleport-570298308

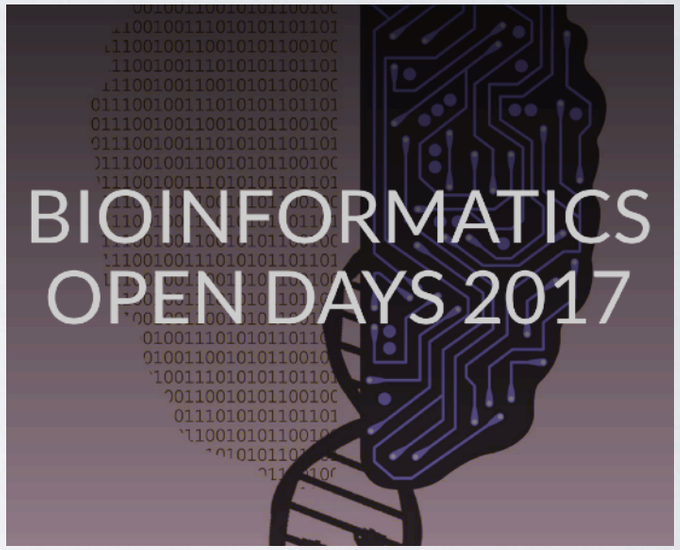
http://www.how-to-draw-cartoons-online.com/eye-of-sauron.html

ACKNOWLEDGMENTS

Research group

Community

BOD2017



Mozilla Science Lab

Fellowship Founder

Friends

THE LEONA M. AND HARRY B.
HELMSLEY
CHARITABLE TRUST

dat
DATA

LIVE CODING!

Module to get data from European Variation Archive EMBL-EBI

fish /home/bmpvieira/bionode-eva — docker ◂ -bash — 73×23

```
~/bionode-eva ▶ node index.js | json | head -n 21
{
  "apiVersion": "v1",
  "warning": "",
  "error": "",
  "queryOptions": {},
  "response": [
    {
      "time": 0,
      "dbTime": 9,
      "numResults": 15,
      "numTotalResults": 15,
      "resultType": "com.mongodb.BasicDBObject",
      "result": [
        {
          "studyId": "PRJEB8661",
          "studyName": "The Exome Aggregation Consortium (ExAC) v0.3"
        },
        {
          "studyId": "PRJEB6042",
          "studyName": "GEUVADIS: Genetic European Variation in Disease"
        },
~/bionode-eva ▶
```

PROCESS DATA IN CHUNKS

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```
request()
```

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```
Binary data
Buffer class
chunks of 16kb
```

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PROCESS DATA IN CHUNKS

```
request()
```

```
process
.stdout
```


```
Binary data
Buffer class
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```

Live Coding Solution step 1 - get JSON

```
var url = require('url')
var request = require('request')

var urlObject = {
  protocol: 'http',
  host: 'www.ebi.ac.uk',
  pathname: '/eva/webservices/rest/v1/meta/studies/list',
  search: '?species=hsapiens_grch37'
}

var urlString = url.format(urlObject)

request(urlString).pipe(process.stdout)
```

PROCESS DATA IN CHUNKS

```
request()
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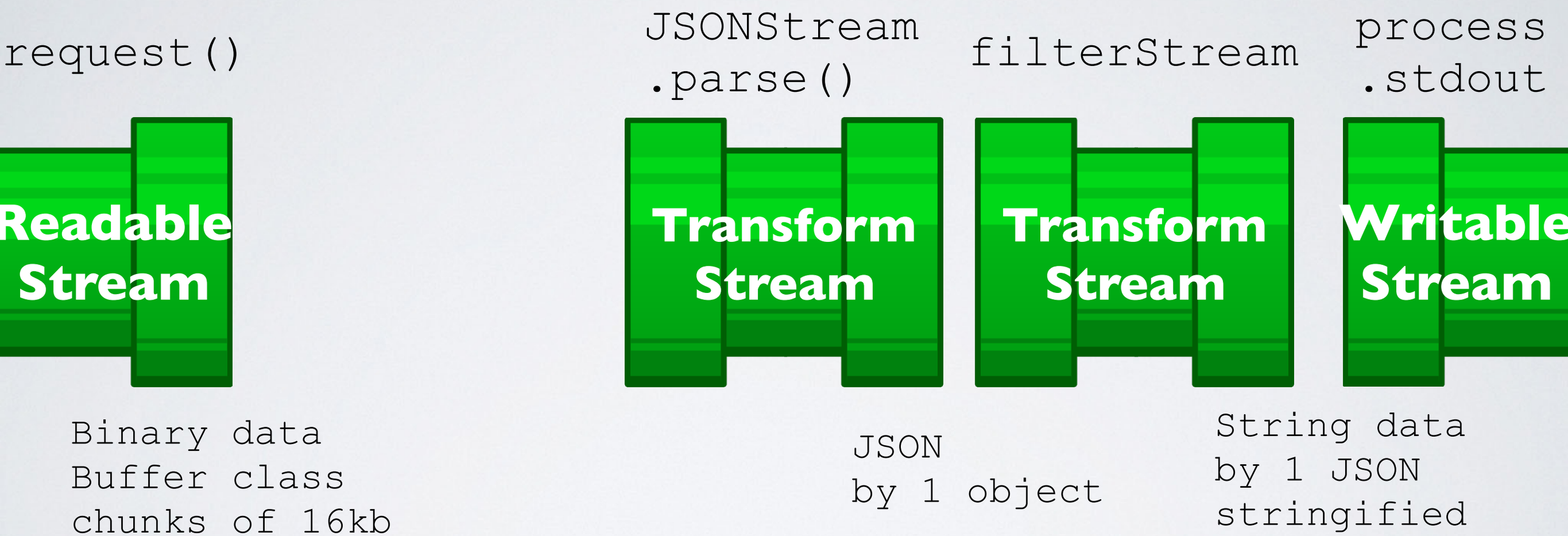

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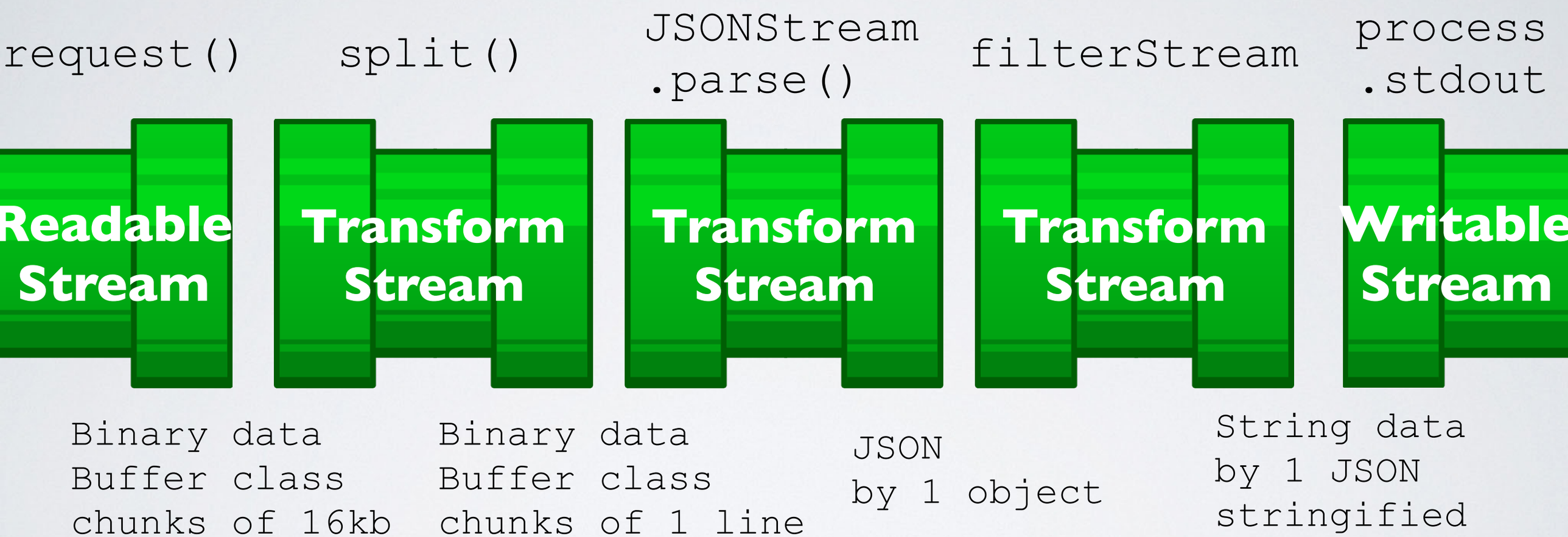

Live Coding Solution step 2 - parse JSON

```
var url = require('url')
var request = require('request')
var split = require('split2')
var JSONStream = require('JSONStream')
var through = require('through2')

var urlObject = {
  protocol: 'http',
  host: 'www.ebi.ac.uk',
  pathname: '/eva/webservices/rest/v1/meta/studies/list',
  search: '?species=hsapiens_grch37'
}

var filterStream = through.obj(filter)

function filter(object, encoding, callback) {
  this.push(JSON.stringify(object))
  callback()
}

var urlString = url.format(urlObject)

request(urlString)
.pipe(split())
.pipe(JSONStream.parse())
.pipe(filterStream)
.pipe(process.stdout)
```

Live Coding Solution step 3 - filter JSON

```
var os = require('os')
var url = require('url')
var request = require('request')
var split = require('split2')
var JSONStream = require('JSONStream')
var through = require('through2')

var urlObject = {
  protocol: 'http',
  host: 'www.ebi.ac.uk',
  pathname: '/eva/webservices/rest/v1/meta/studies/list',
  search: '?species=hsapiens_grch37'
}

var urlString = url.format(urlObject)

var filterStream = through.obj(filter)

function filter(object, encoding, callback) {
  var self = this
  var results = object.response[0].result
  results.forEach(filterAndPush)
  function filterAndPush(result) {
    if (result.studyName.match('1000 Genomes')) {
      self.push(JSON.stringify(result) + os.EOL)
    }
  }
  callback()
}

request(urlString)
.pipe(split())
.pipe(JSONStream.parse())
.pipe(filterStream)
.pipe(process.stdout)
```

LIVE EXAMPLE

Show backpressure in action

```
fish  /home/bmpvieira/backpressure — docker ◂ -bash — 32×7
[                                    ] 16 / 20
[                                    ] 11 / 20

~/backpressure ▶ node index.js
```

```
var _ = require('lodash')
var through = require('through2')
var exec = require('child_process').exec;
var streamify = require('stream-array')
var multimeter = require('multimeter');
var multi = multimeter(process);

process.stdout.write('\033c'); // Clear the console

var jobs = 20

var progress = {
  fastStream: 1,
  slowStream: 1
}

var fastStreamProgressBar = multi(0, 1, {
    width : jobs,
    solid : { text : '█'},
    empty : { text : ' ' },
})

var slowStreamProgressBar = multi(0, 2, {
    width : jobs,
    solid : { text : '█'},
    empty : { text : ' ' },
})
```

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var streamify = require('stream-array')
var multimeter = require('multimeter');
var multi = multimeter(process);

process.stdout.write('\033c'); // Clear the console

var jobs = 20

var progress = {
  fastStream: 1,
  slowStream: 1
}

var fastStreamProgressBar = multi(0, 1, {
    width : jobs,
    solid : { text : '▇'},
    empty : { text : ' ' },
})

var slowStreamProgressBar = multi(0, 2, {
    width : jobs,
    solid : { text : '▇'},
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sourceStream = streamify(_.range(jobs))

var fastStream = through.obj({highWaterMark: 16}, function (obj, enc, next) {
  var self = this
  exec('sleep 1', function (err, stdout, stderr) {
    fastStreamProgressBar.ratio(progress.fastStream++, jobs)
    self.push(obj)
    next()
  })
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var slowStream = through.obj({highWaterMark: 16}, function (obj, enc, next) {
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LIVE EXAMPLE

Show backpressure in action

```
fish  /home/bmpvieira/backpressure — docker ◂ -bash — 32×7
[                                    ] 16 / 20
[                                    ] 11 / 20

~/backpressure ▶ node index.js
```