

# Image compression:

On-demand systems seeking minimal latency.

# Graduation work

## *Optimisation techniques for mobile*

- Graphics      Textures
- Software      Loading time
- Files      Compression

# Web pages

Not everything is an app

Environments change

Web pages are universal

- Chrome OS
- iPhone

# On-demand Systems

- Web pages
- Games
- Adverts
- Chats
- Etc.

Timing not known

Resources not known

Request > Response

# Image compression

- Important
- Large
- Ubiquitous

Long loading times

Visual delays

# Analysis

- |               |                                    |
|---------------|------------------------------------|
| 1. Request    | Lag                                |
| 2. Response   | Network latency                    |
| 3. Download   | Network bandwidth<br>Resource size |
| 4. Processing | Decompression time                 |
| 5. Ready      | Buffer update time                 |

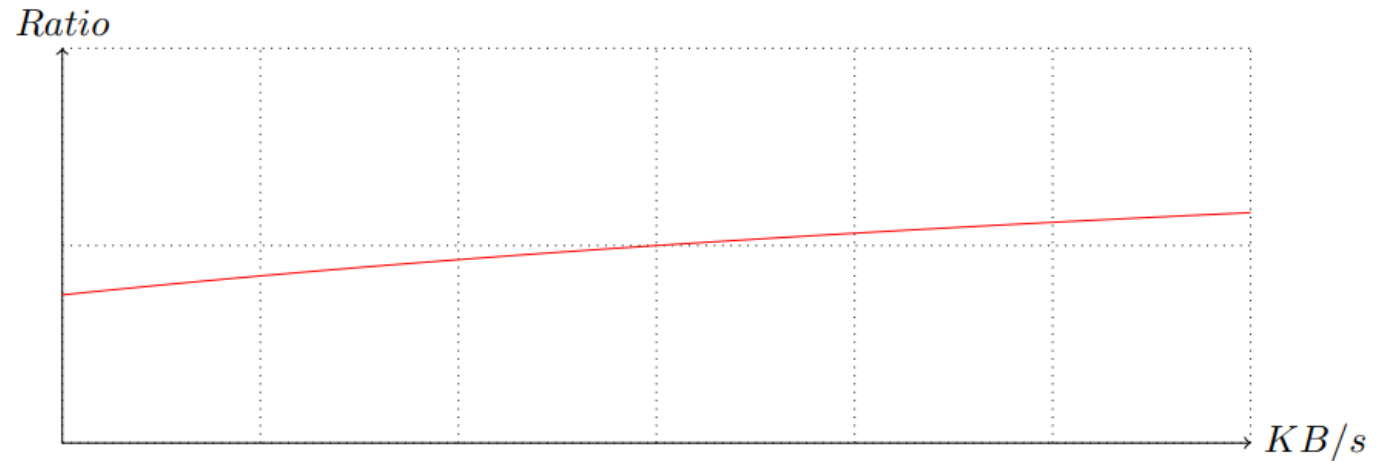
# Analysis Network

- Network speed
- File size

$$T = (size * ratio) / speed + latency$$

# Analysis Network

- Comparing two functions



$$speed < size * (ratio1 - ratio2) / (latency2 - latency1)$$



# Analysis

## Decompression

- Time complexity
- Initialisation
- Error

$$latency = O(size) * factor * (1 \pm error) + base$$

# Benchmark

Source	• Size
	• Time
Archive	• Size
	• Time
Soucre	

# Benchmark

Executables      Reference implementation

Constraint      Single threaded

Environment      RAM disk

Script      PowerShell

# Formats

## Web formats

Jpeg Not lossless

PNG Lossless

WebP "Format for the Web"  
(Google. 2012)

Jpeg XL Recent JPEG format

AVIF Free HEVC (AV1) codec

# Formats

## General formats

(Deflate) LZ77    .png   .gif   .zip   ...

Gzip    .gz

LZMA    .xz   .7z

bzip2    .bz

PPMd    .7z

# Formats

## Niche formats

Flic	Alexander Rhatushnyak
Qlic	(Rhatushnyak. 2010)
Qic	

Kvick	DCGC
EMMA	(MSU Media Group. 2020)

# Benchmark

7	Quick test	~5 minutes
500	Decent test	~7 hours
16000	Thorough test	~? Days

# Benchmark



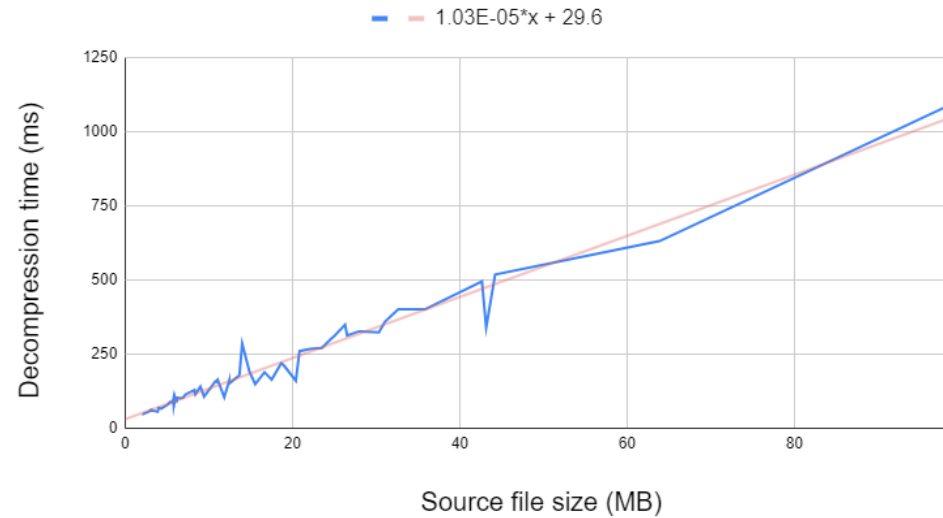
# Complexity

Source file size

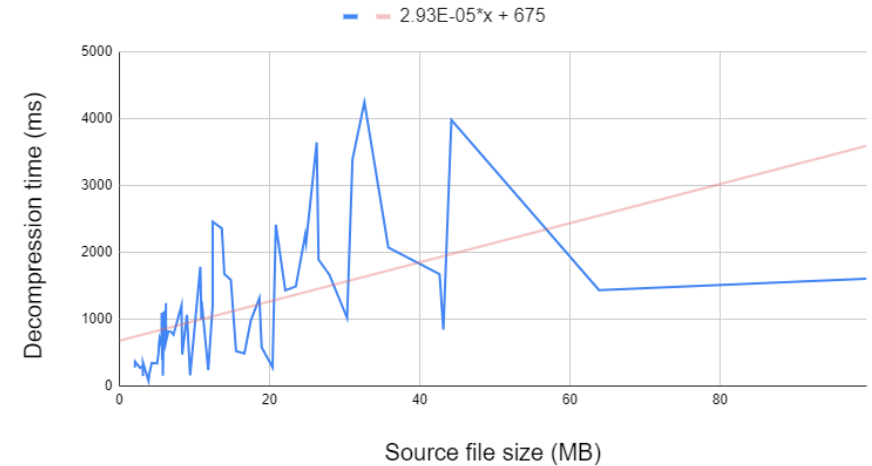
Decompression time

$$latency = O(size) * factor * (1 \pm error) + base$$

PNG



PPMD



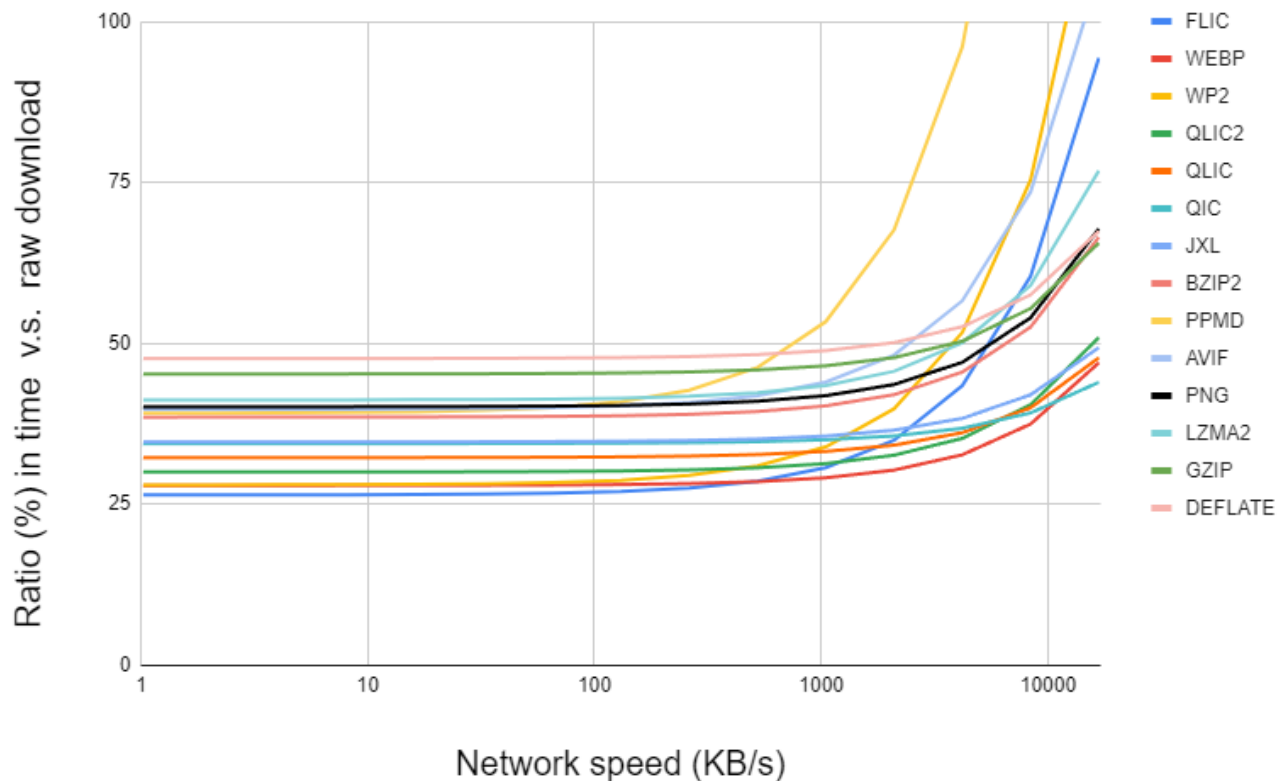
# Model

## Variable network

$$T = (size_0 * ratio) / speed + size_0 * factor + base$$

### All formats

Source file: 5 MB



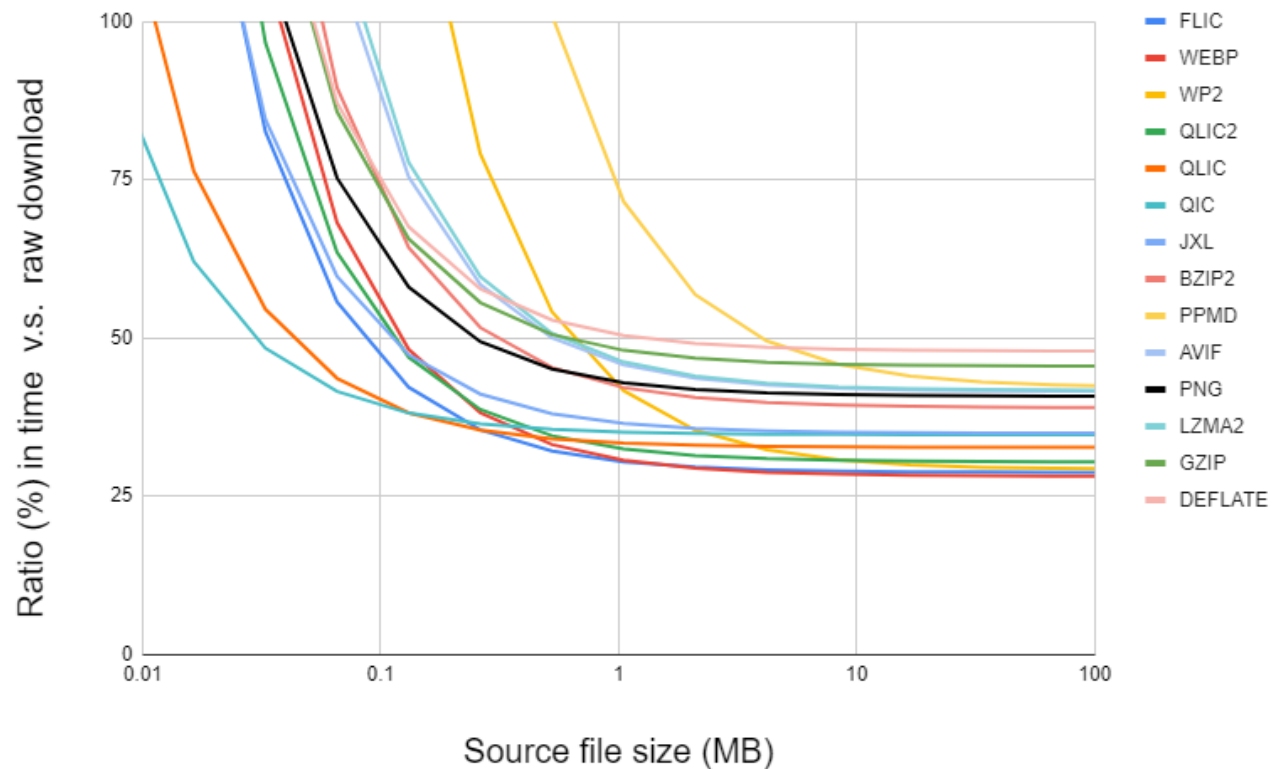
# Model

## Variable size

$$T = (size_0 * ratio) / speed + size_0 * factor + base$$

All formats

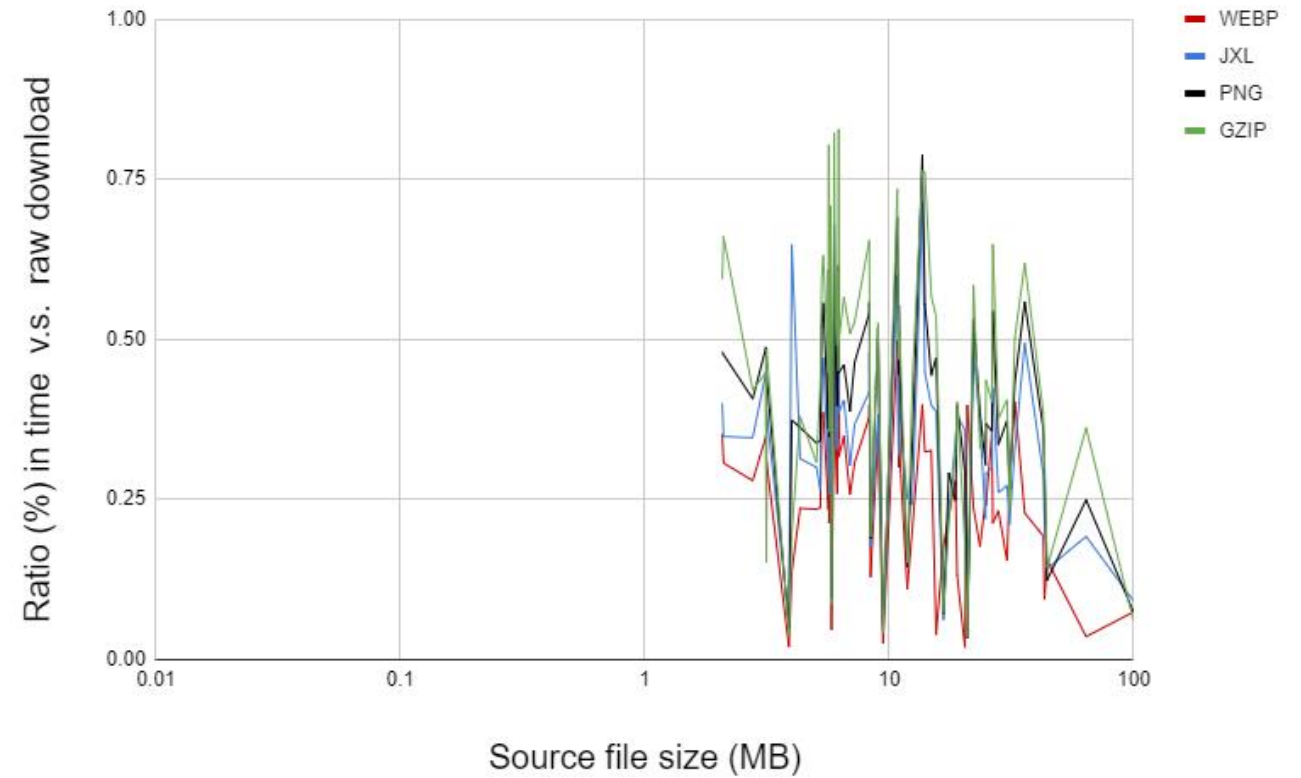
Network speed: 650 KB/s



# Real data

## Real data

Network speed: 650 KB/s

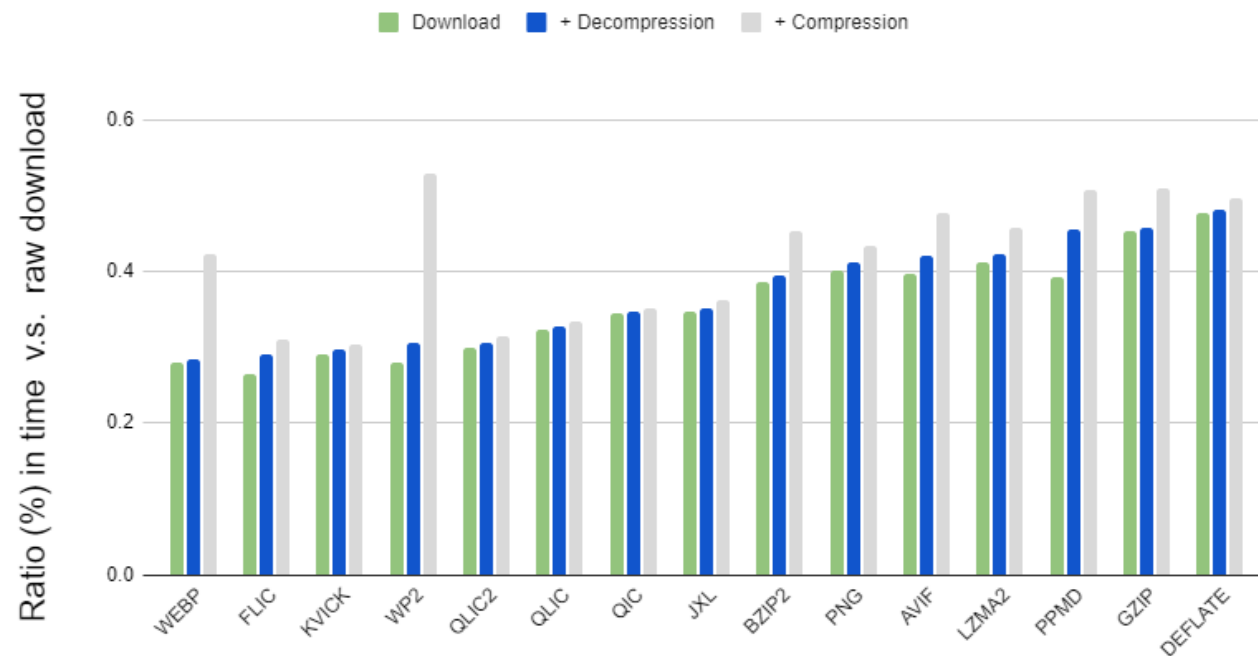


# Ranking

## Combined average

All formats

Network speed: 650 kb/s

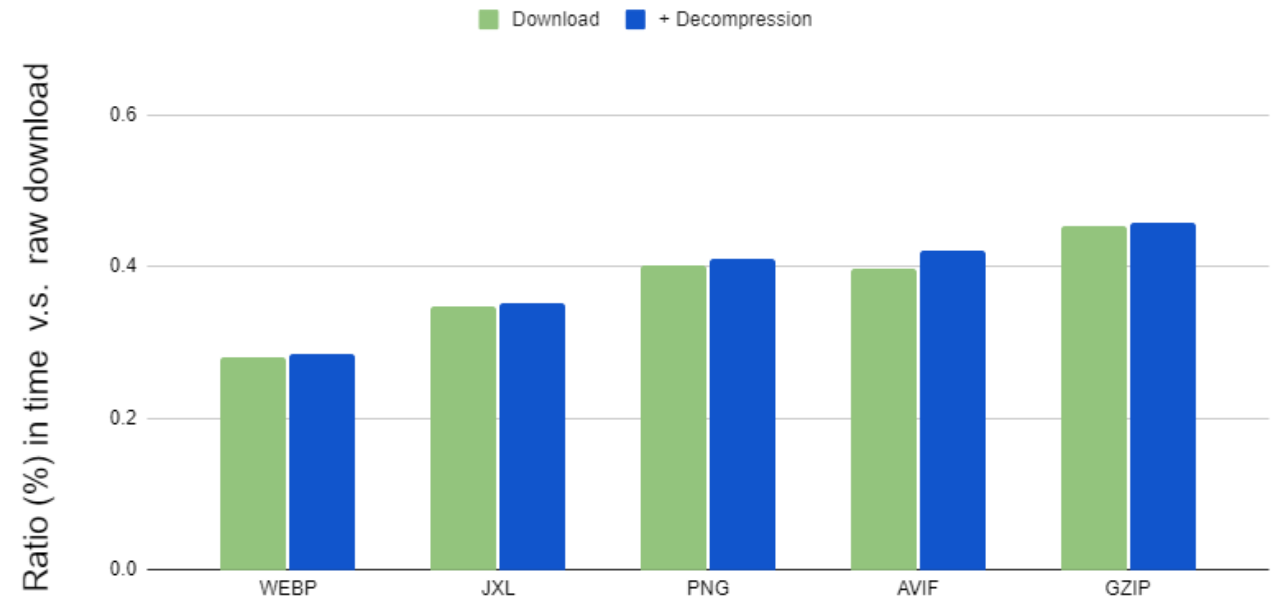


# Ranking

## Combined average

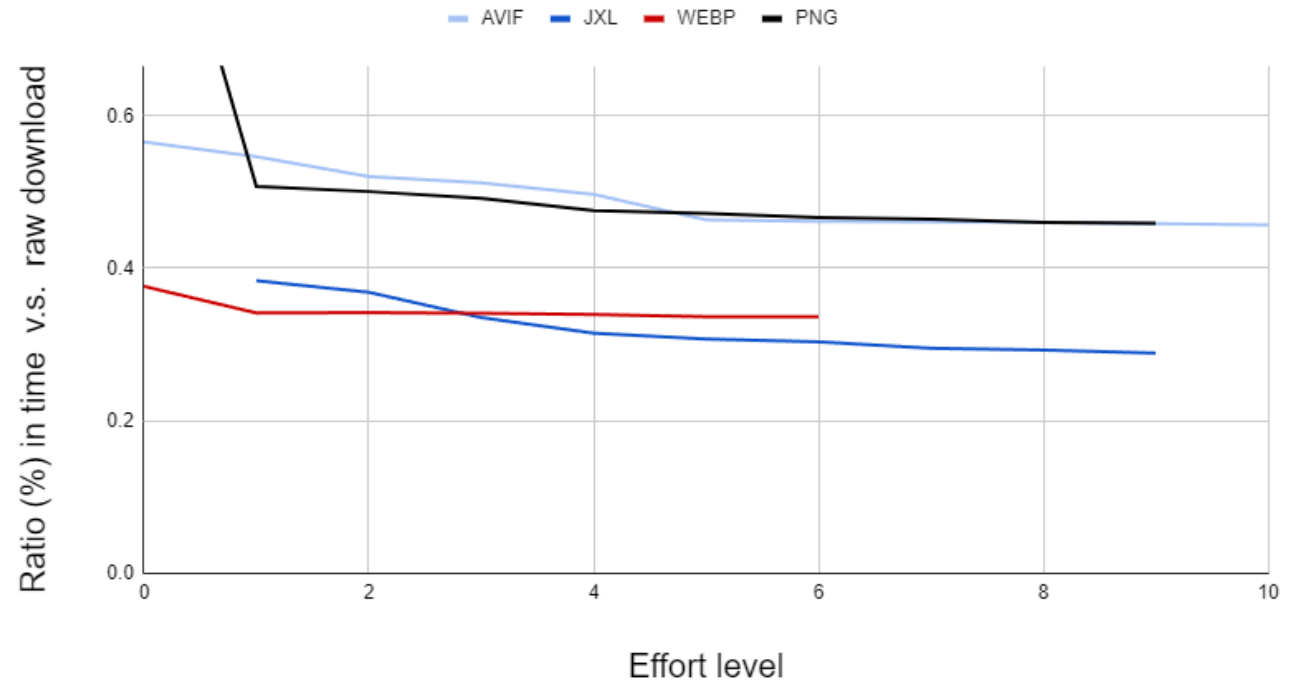
### Web formats

Network speed: 650 KB/s



# Effort

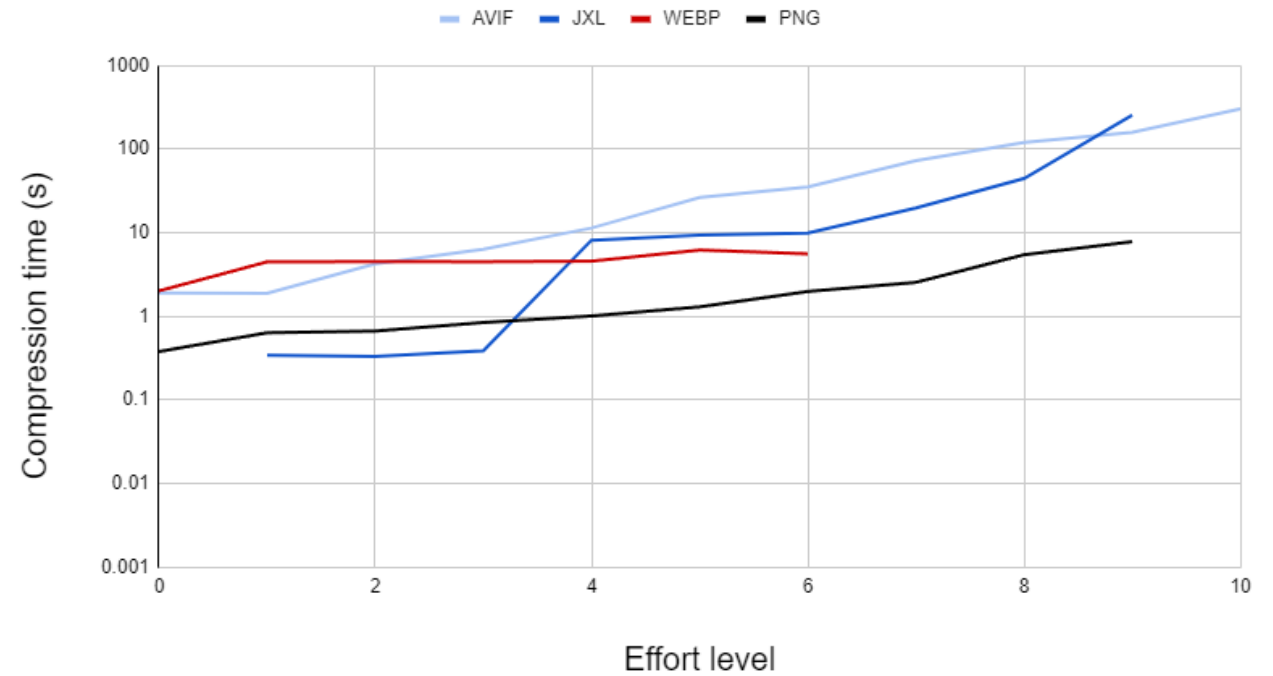
Effort: Download + Decompression



# Effort

## Compression time

Effort: Compression



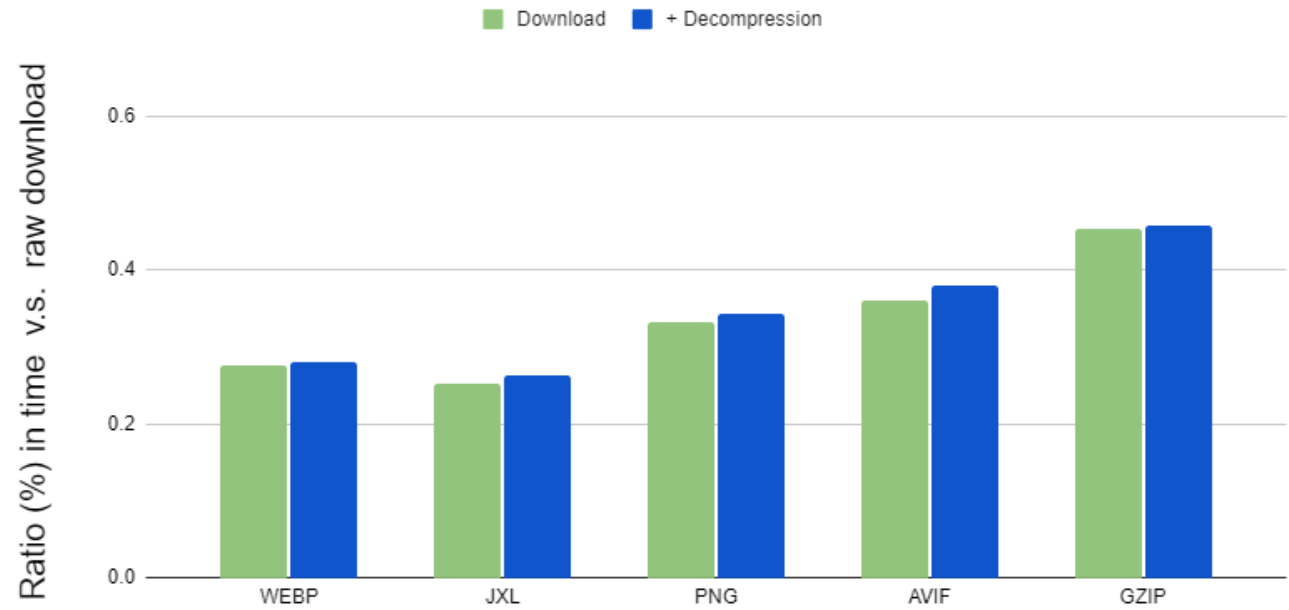


# Effort

## Web formats

Network speed: 650 KB/s

+ Effort gain



# Conclusion

- Jpeg XL Best (absolute)
- WebP Best (browser support)
- Flic Honourable mention

Questions ?