

# A Brief Introduction to High Dynamic Range Lighting on the Xbox 360

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# PINWATA TROUBLE IN PARADISE



# Outline

- High Dynamic Range (HDR) lighting
- The Xbox 360 graphics architecture
- The slow solution
- Bungie's solution
- Our solution
- Implementation details

# Viva Piñata example



# Viva Piñata example



# Viva Piñata example





# Viva Piñata example



# Halo example

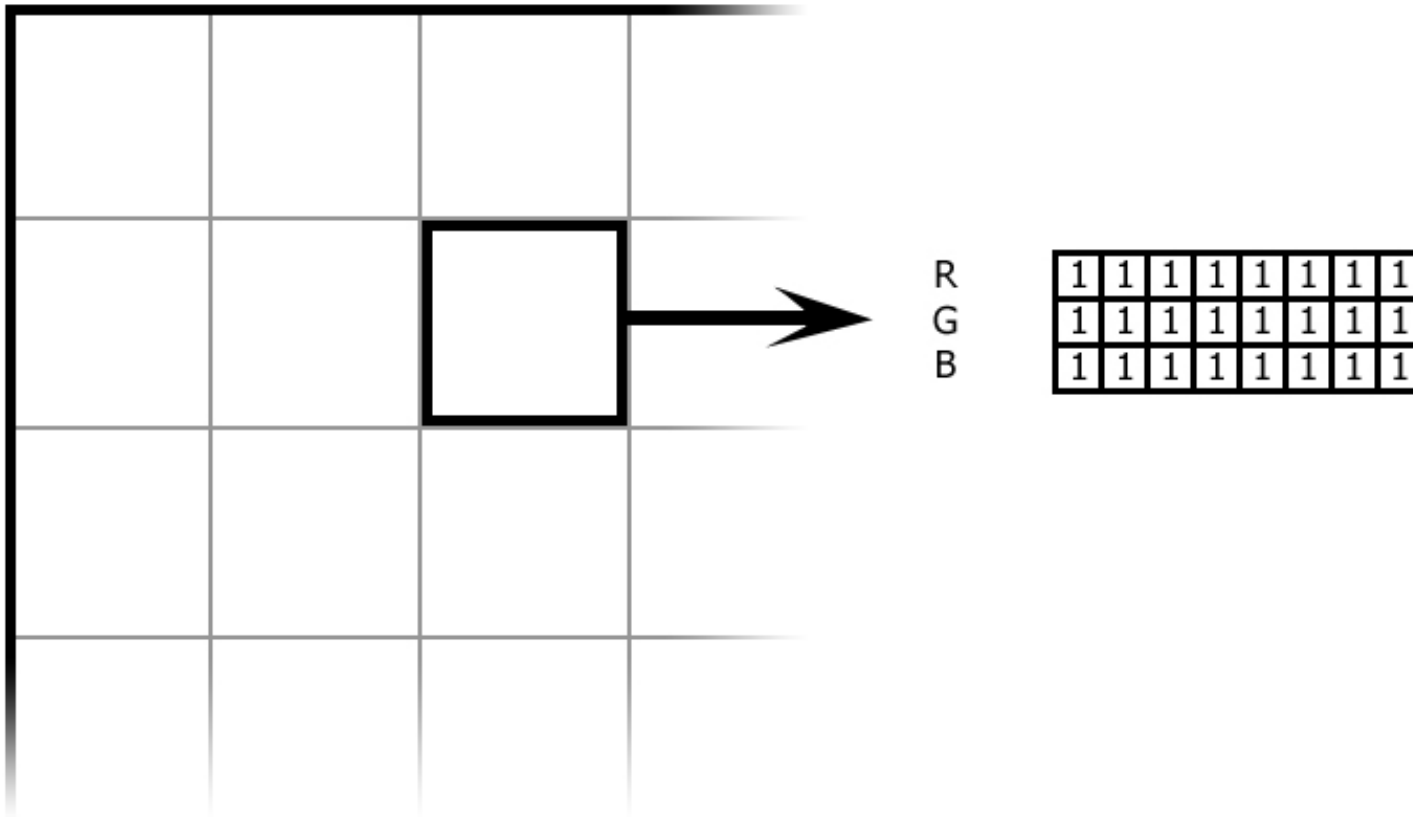




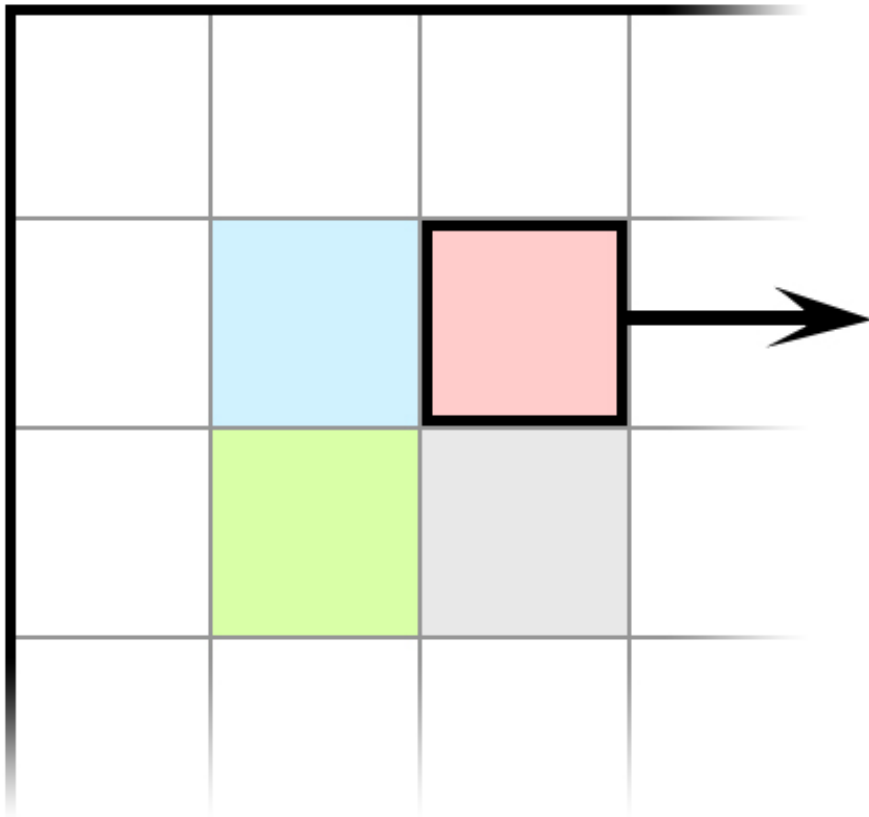
# Halo example



# Over-exposure: current situation



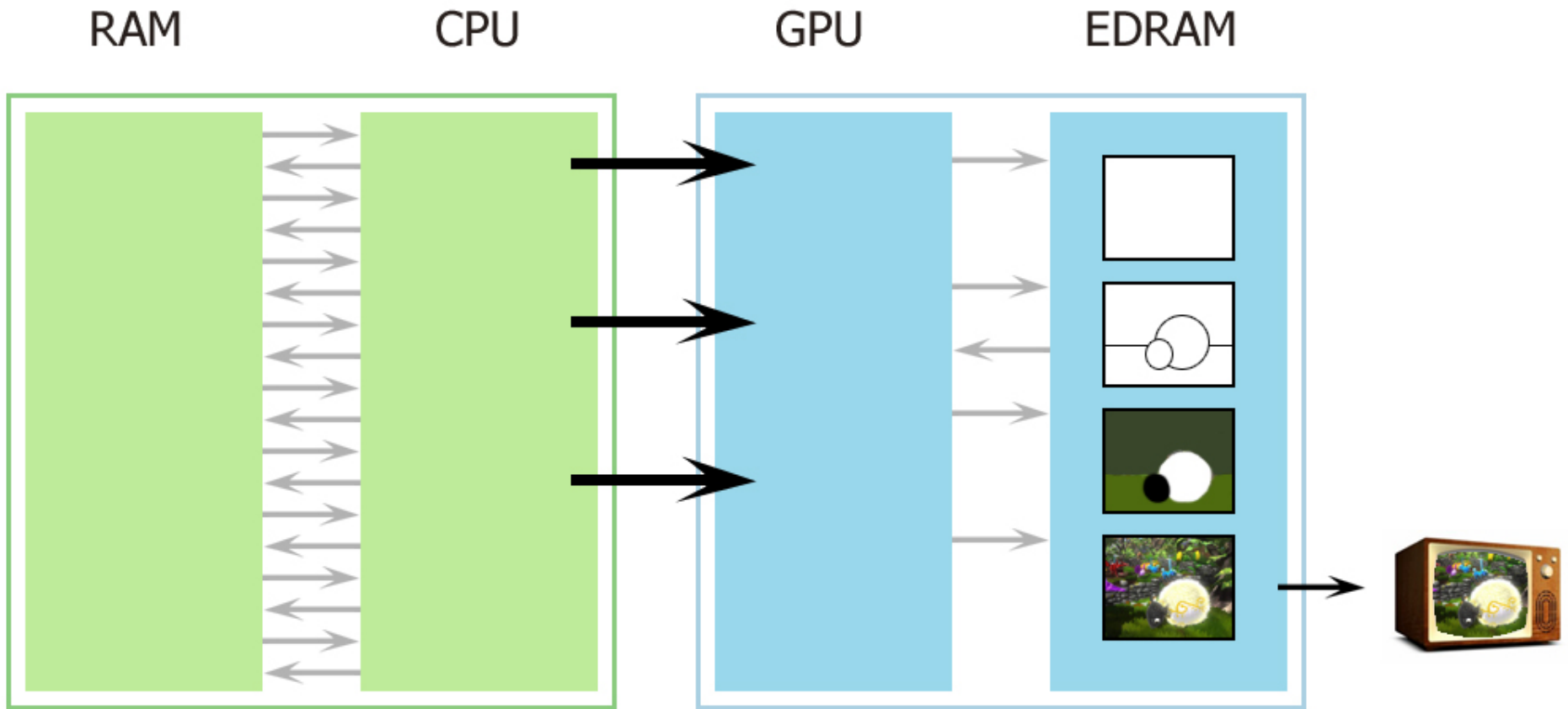
# Over-exposure: ideal situation



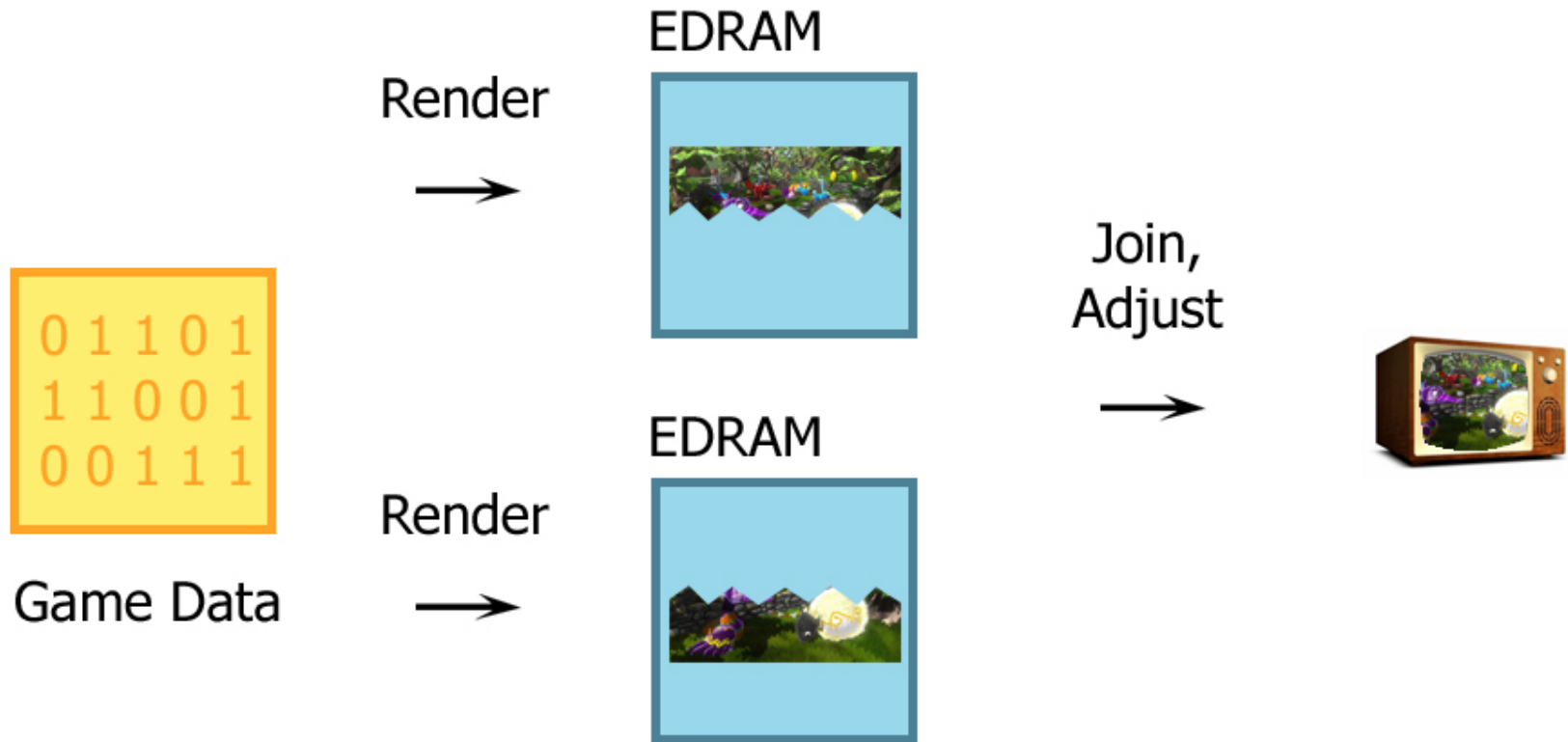
R  
G  
B

1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	0
1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0

# The Xbox 360 graphics architecture



# The slow solution





# Bungie's solution

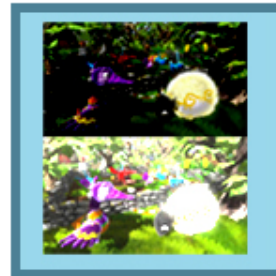


Game Data

Render,  
Shrink



EDRAM



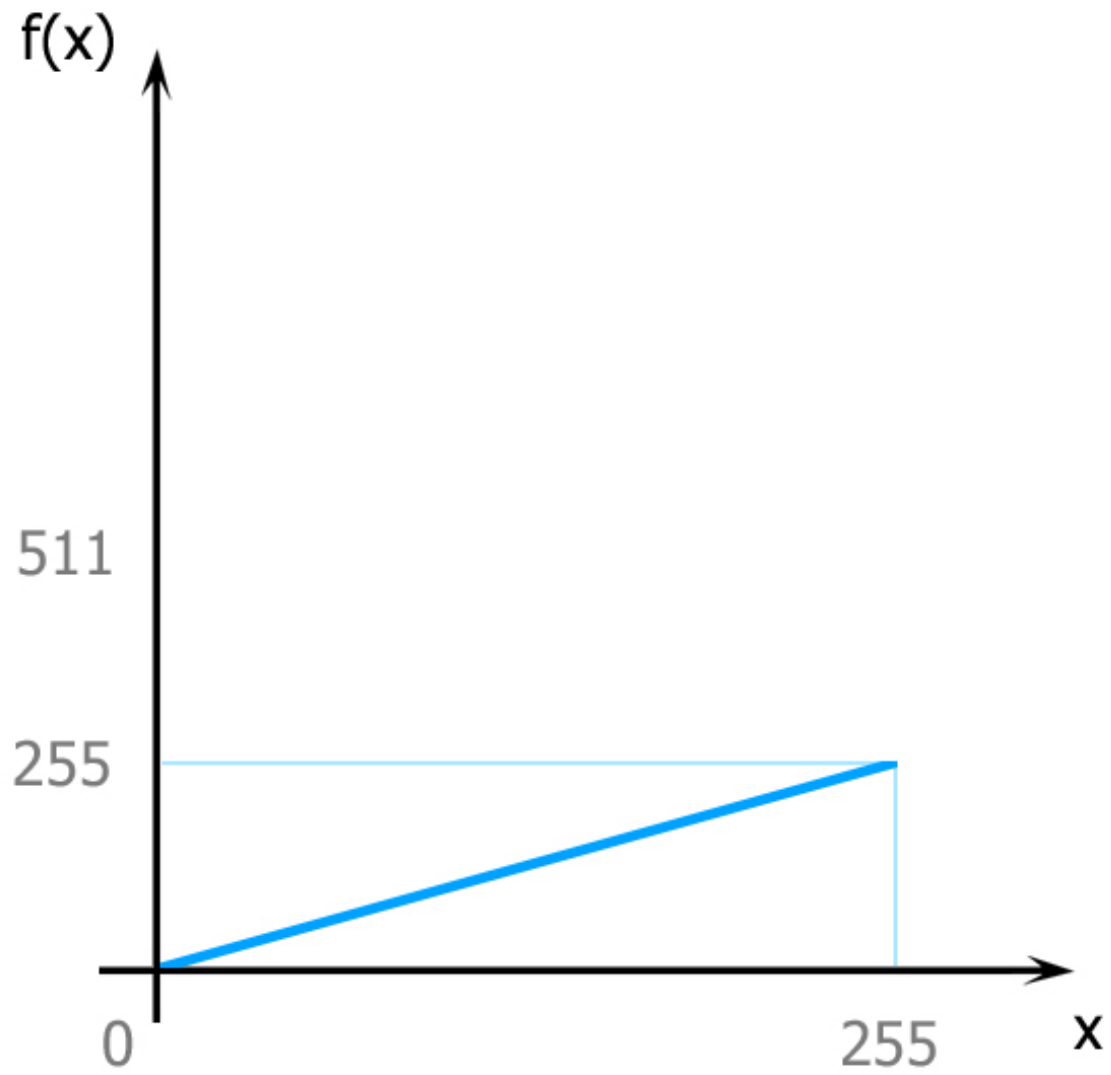
Adjust,  
Stretch



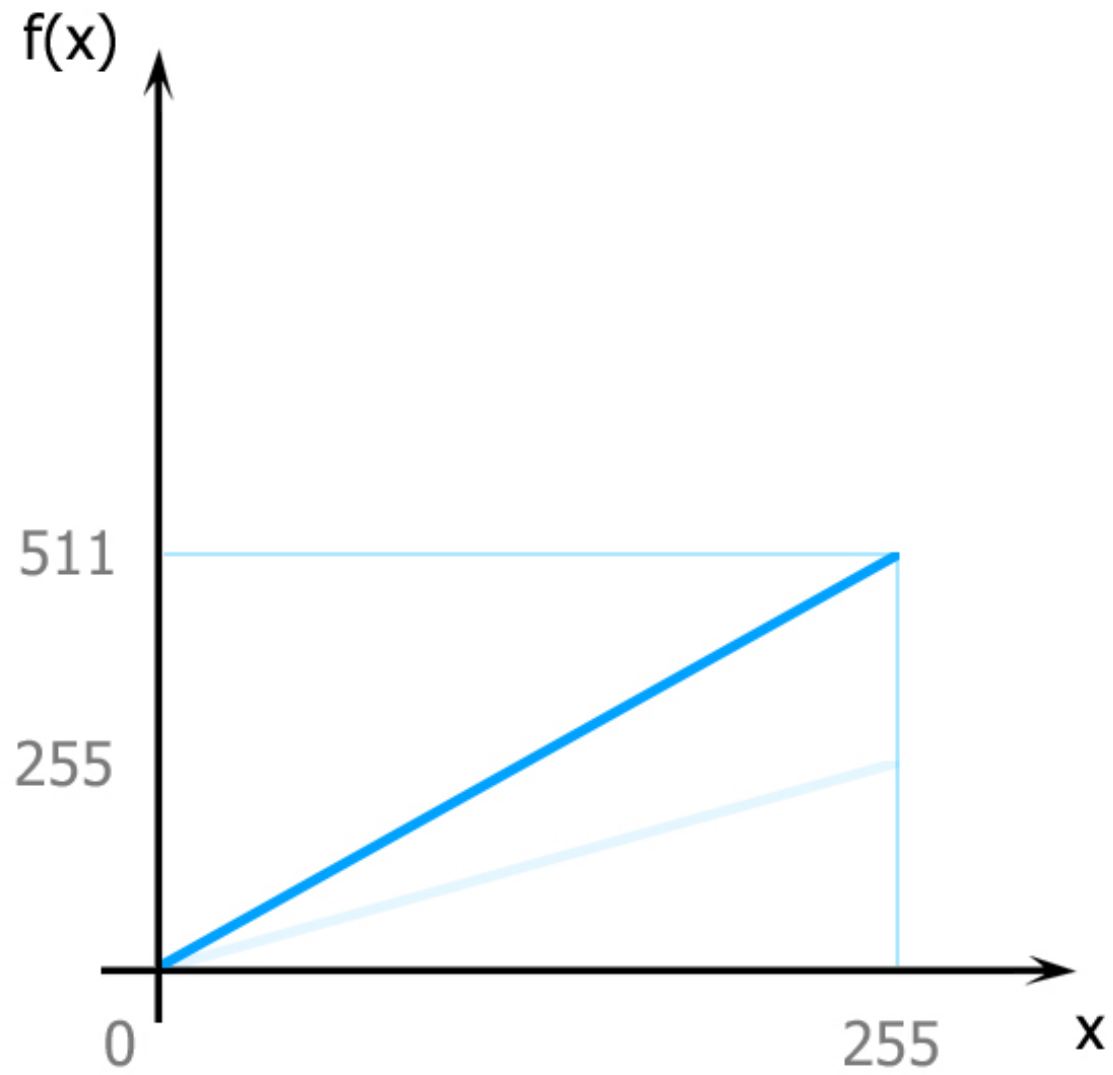
# Our solution



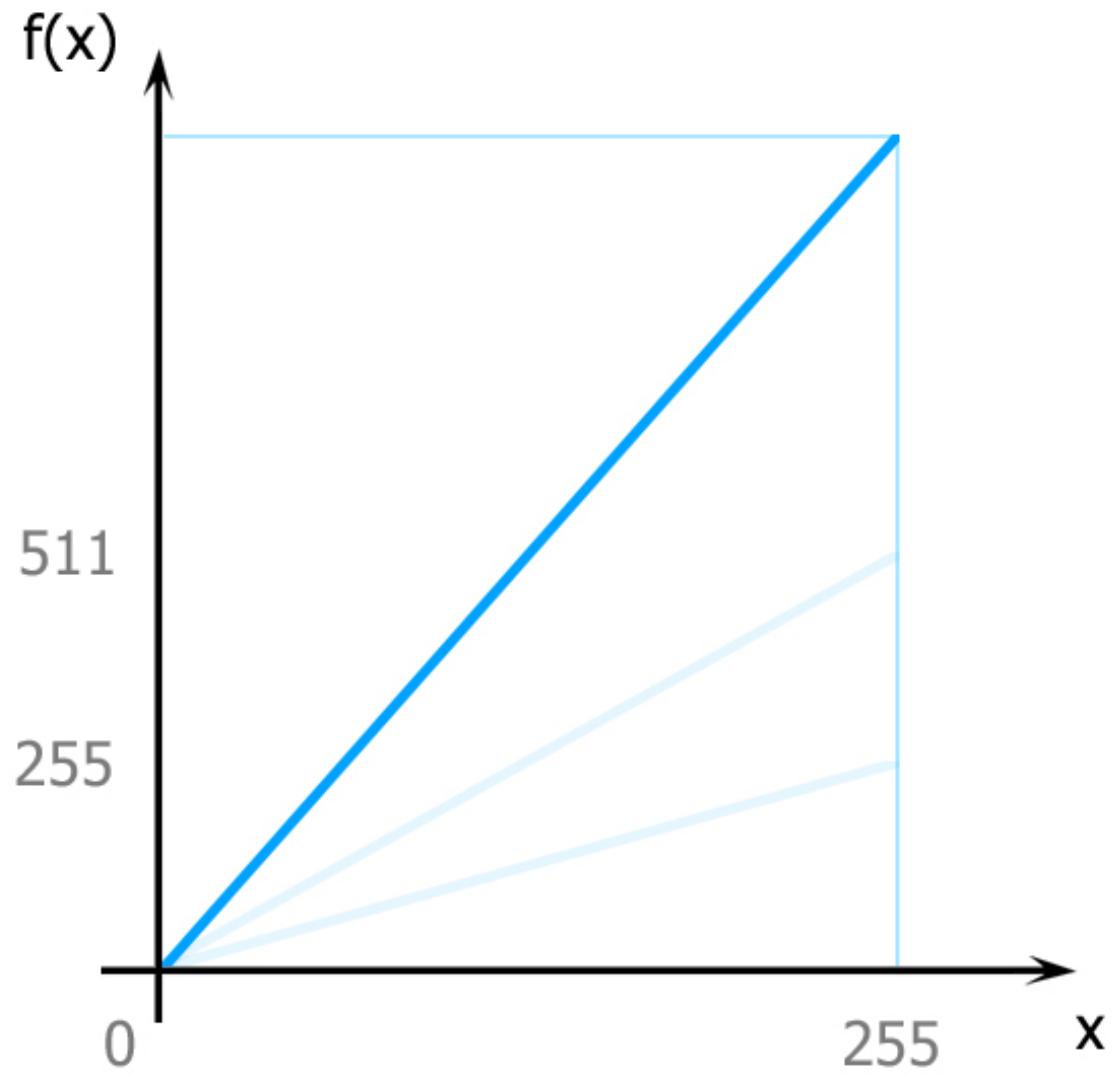
# Compression



# Compression

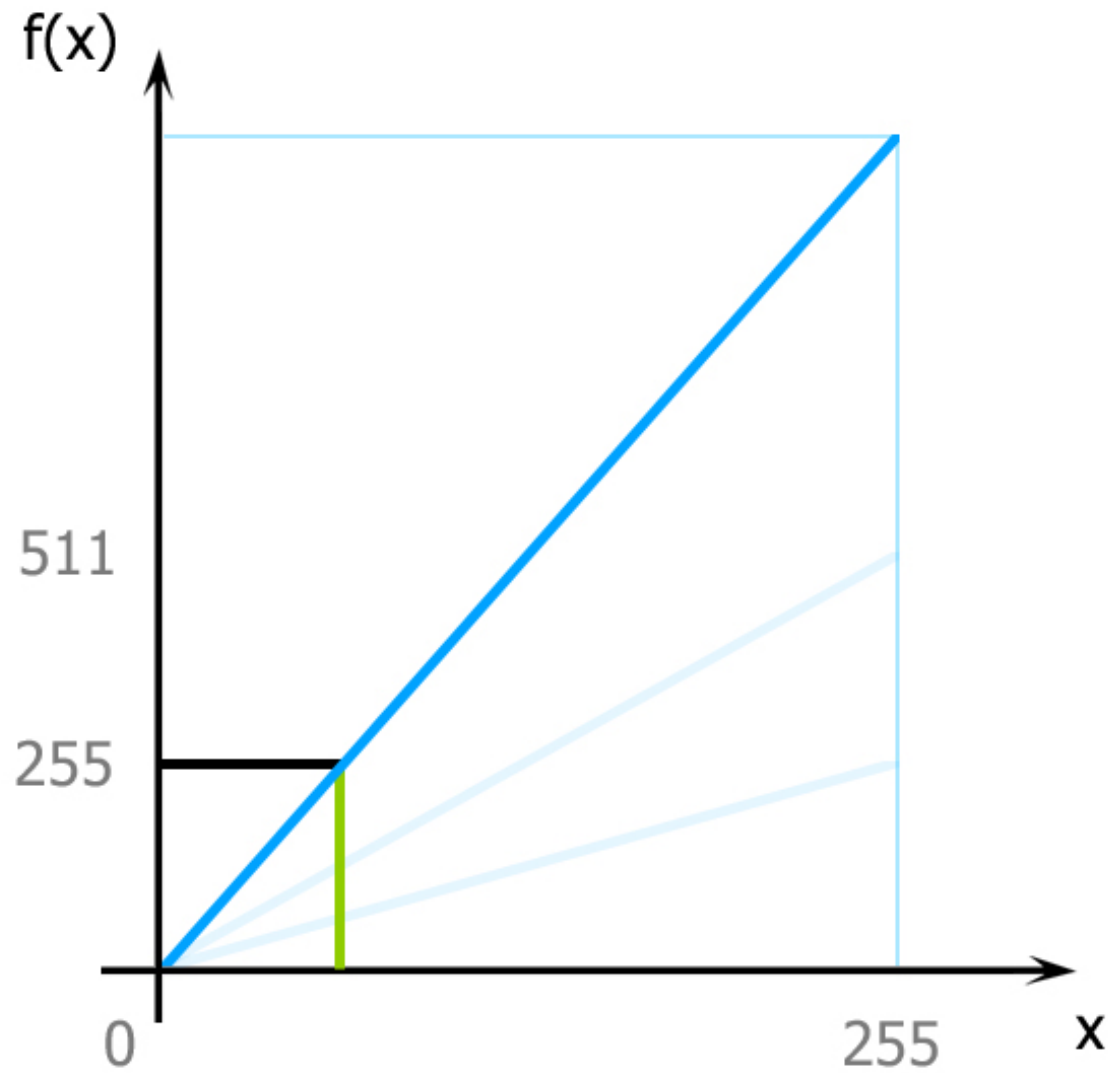


# Compression



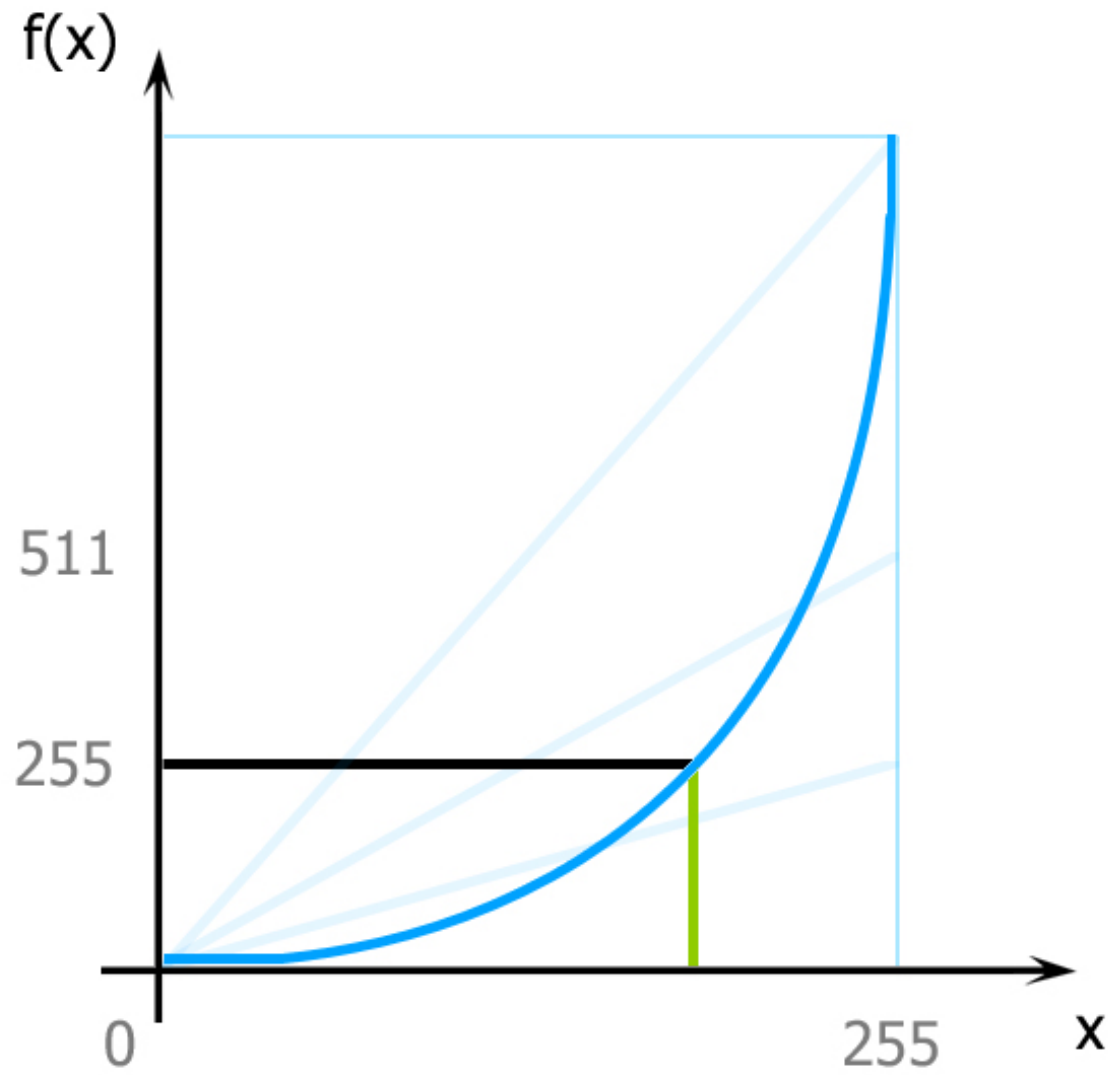


# Compression





# Compression



# Implementation details

Other considerations:

- Frame brightness
- Bloom post-processing
- Framerate
- Artist control

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## Implementation:

- DirectX 9.0 API
- Pixel and Vertex Shaders written in Microcode



# Implementation details

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- Frame brightness
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## Implementation:

- DirectX 9.0 API
- Pixel and Vertex Shaders written in Microcode
  - Registers are  $(x,y,z,t)$  /  $(r,g,b,a)$  constructs
  - Assembly-level instructions: add, sub, mov, cndge

# Questions?

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