

podfodka

iOS Crew

15– 19 апреля

Хардкорный UI

Григорий Бернгардт

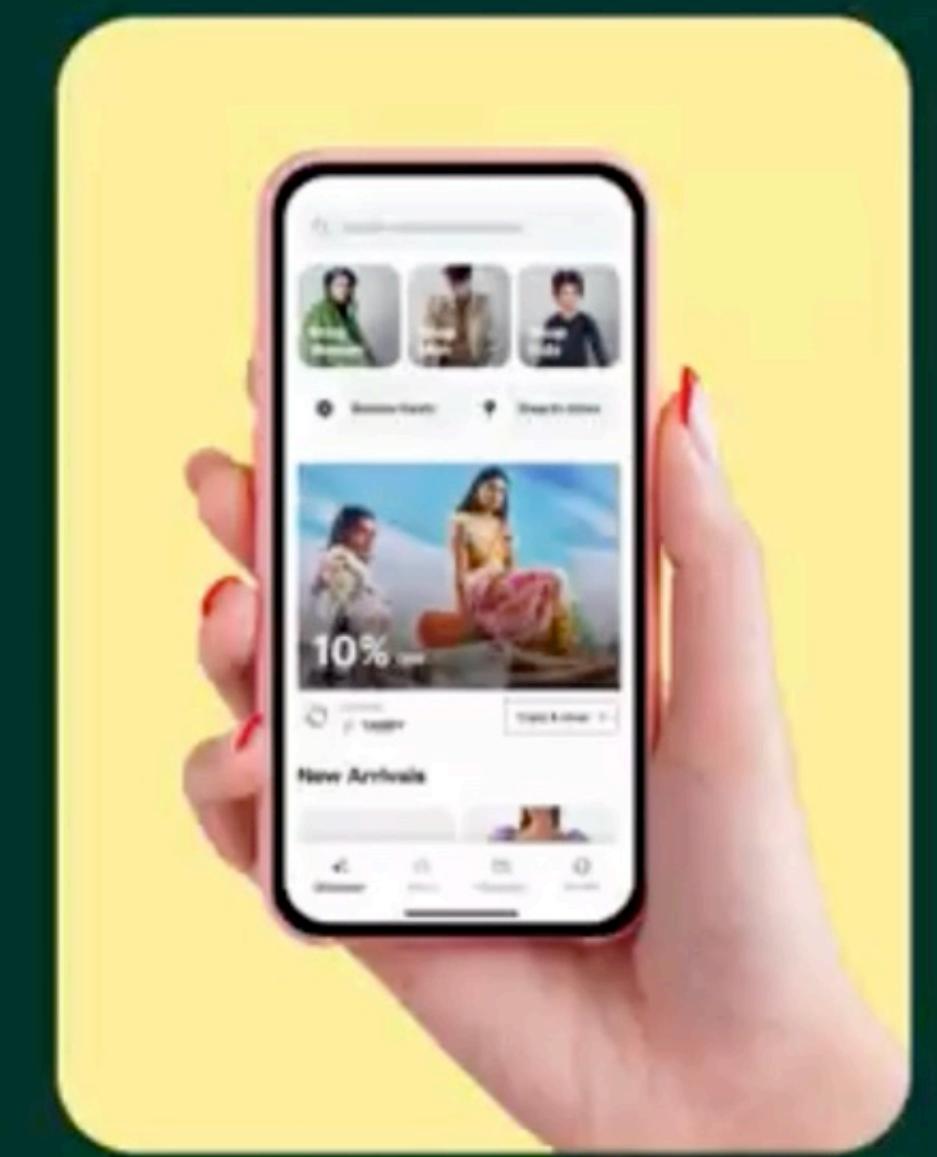
Tabby

Лайв-кодинг:
Преодолевая границы видимого
с `CATiledLayer`

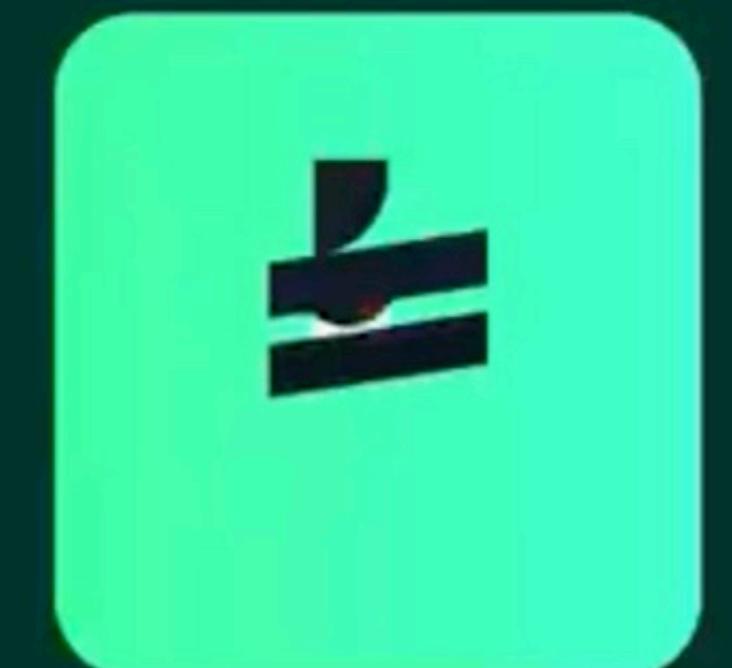


10 million
10 million
10 million
10 million

10 million users



The region's 1st
fintech unicorn



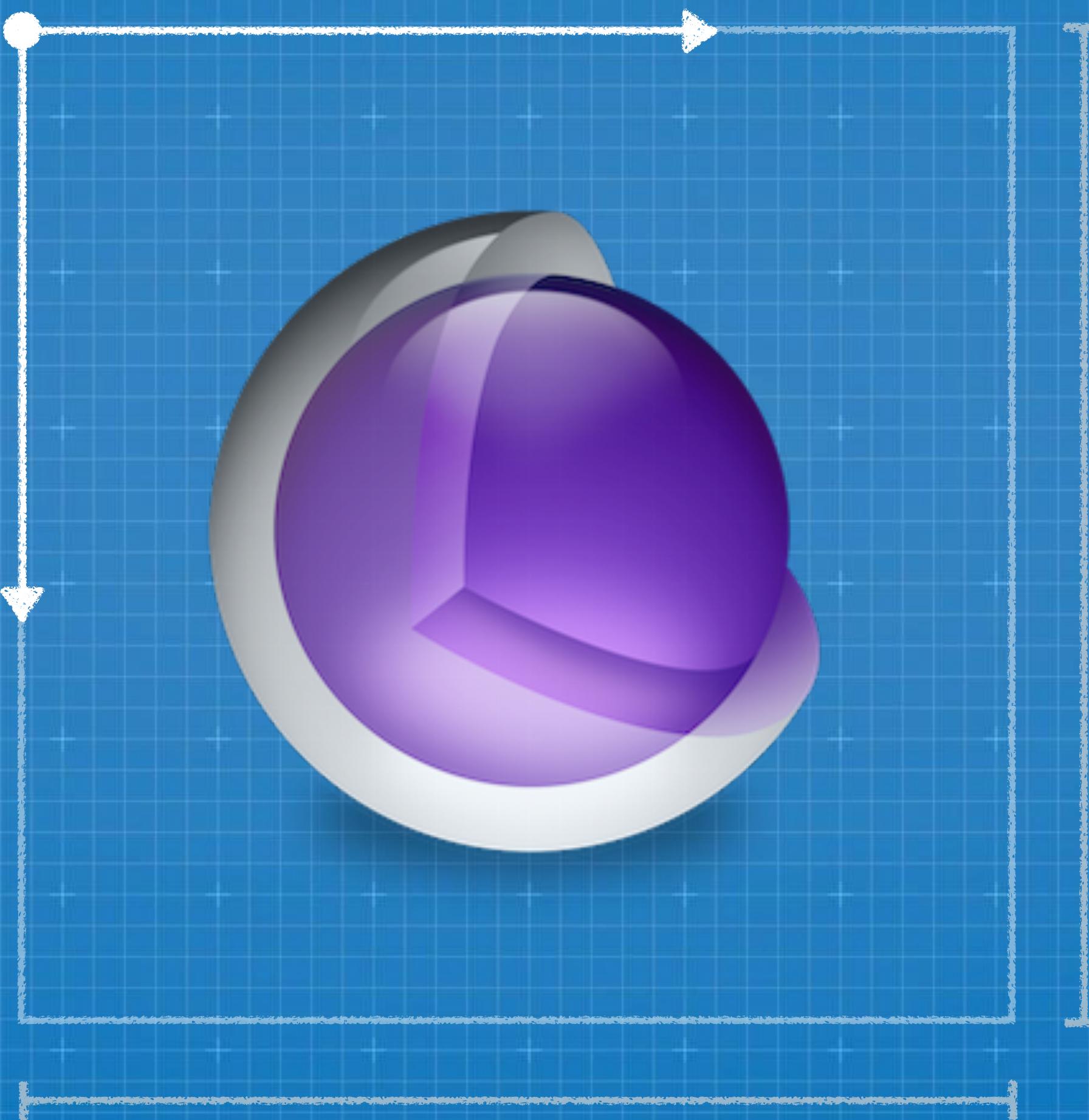
30,000+
corporations



Agenda

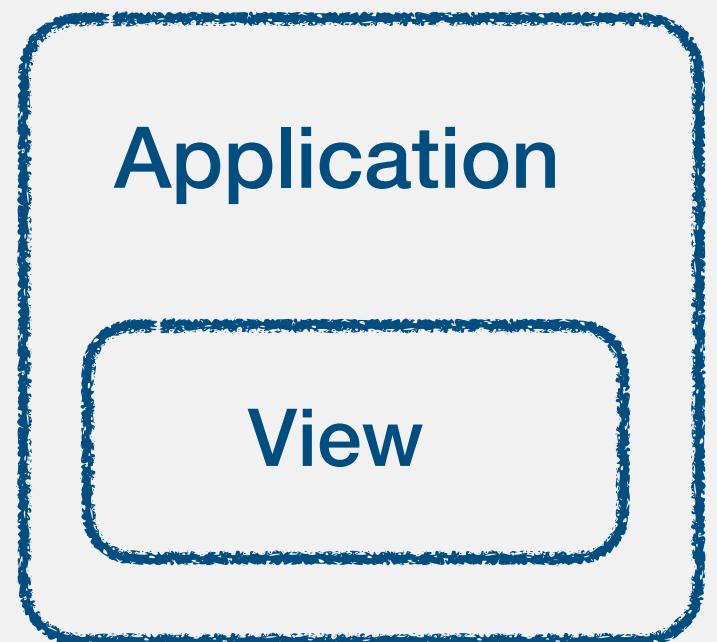
- 🤔 What is CATiledLayer and how it works
- 🧩 Some CATiledLayer recipes
- 🖼 Gigapixel images + CATiledLayer

Core Animation



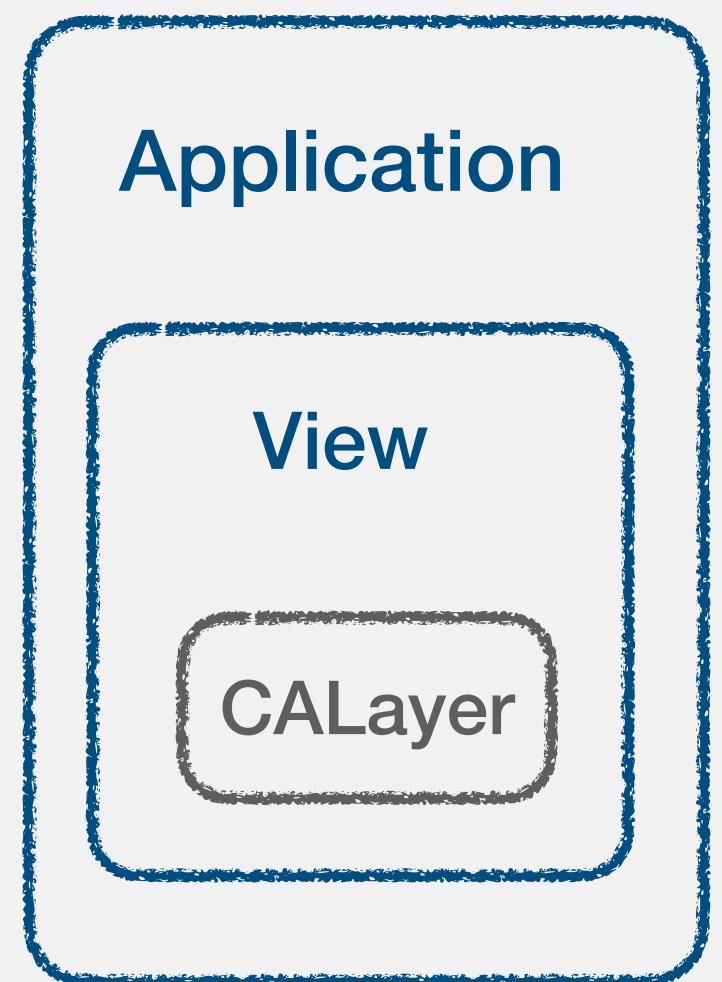
Core Animation

Overview



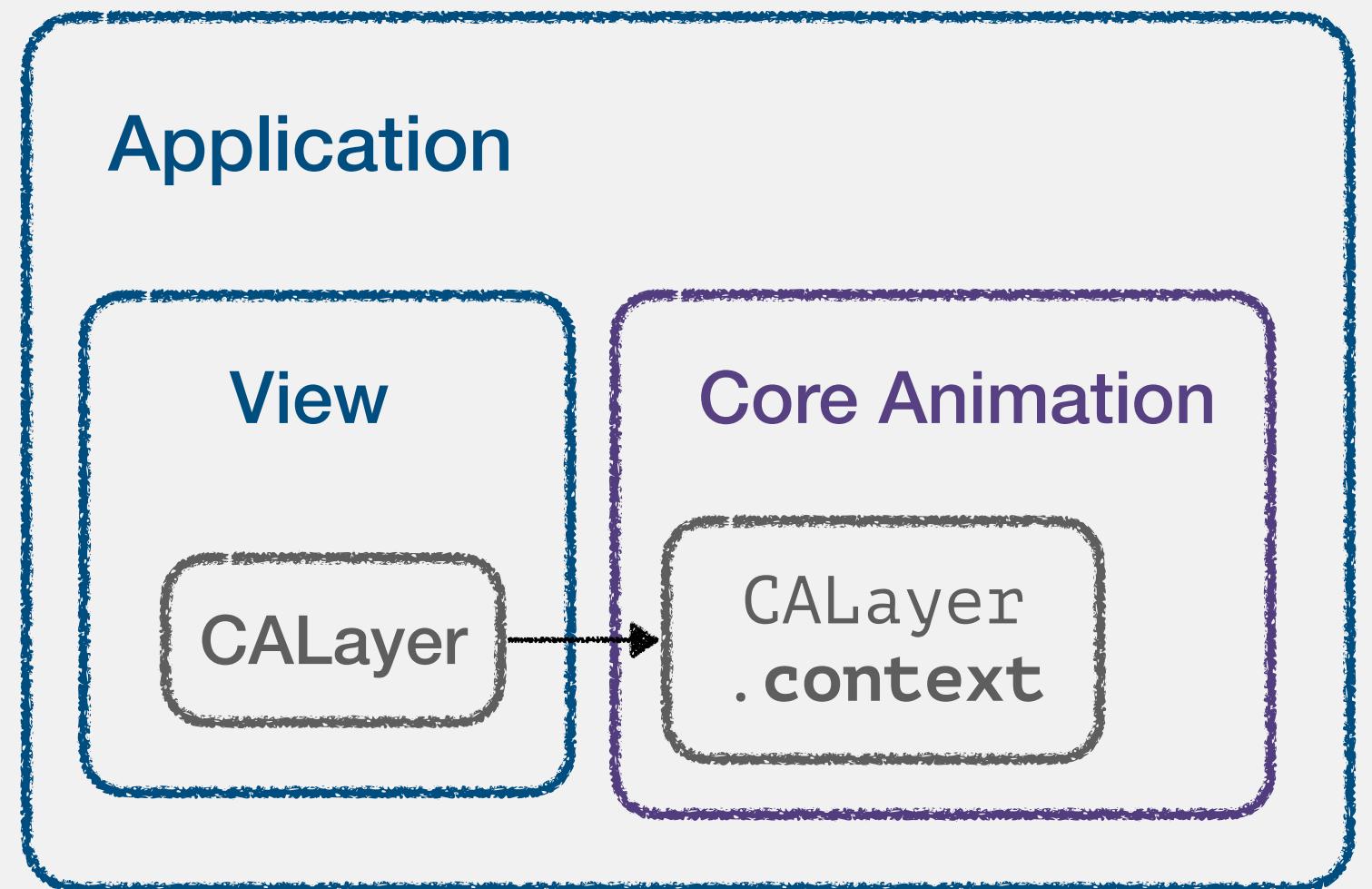
Core Animation

Overview



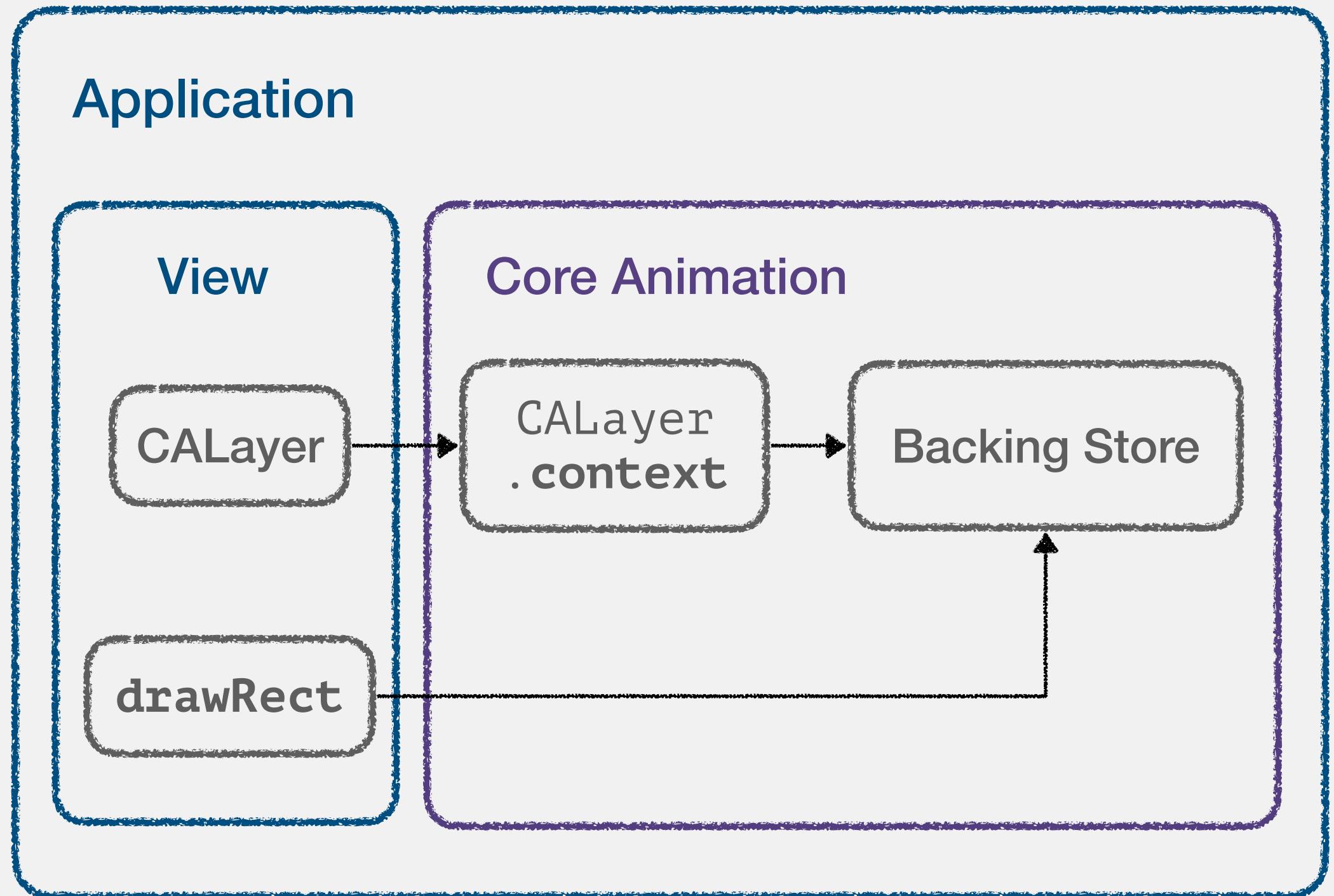
Core Animation

Overview



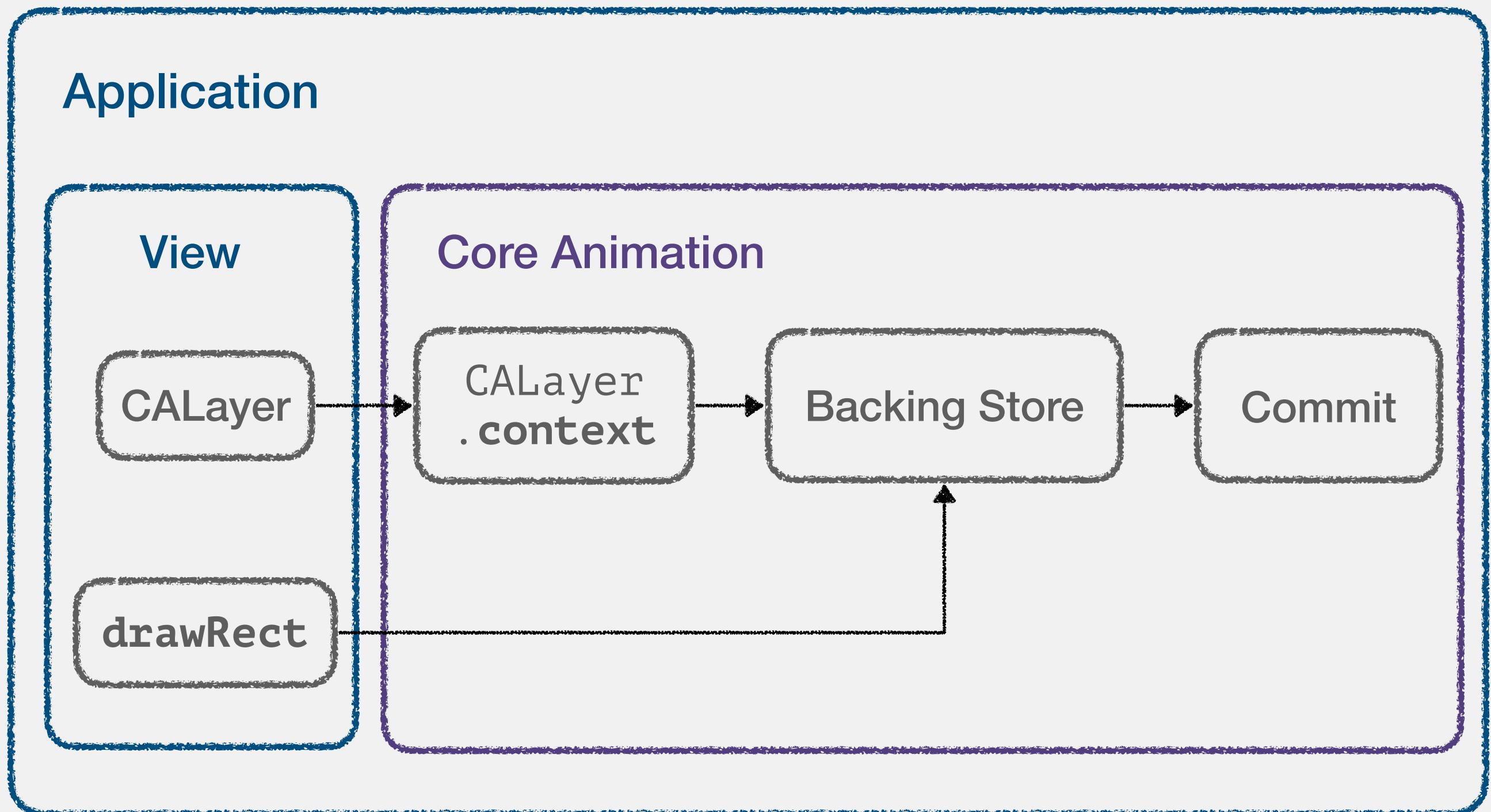
Core Animation

Overview



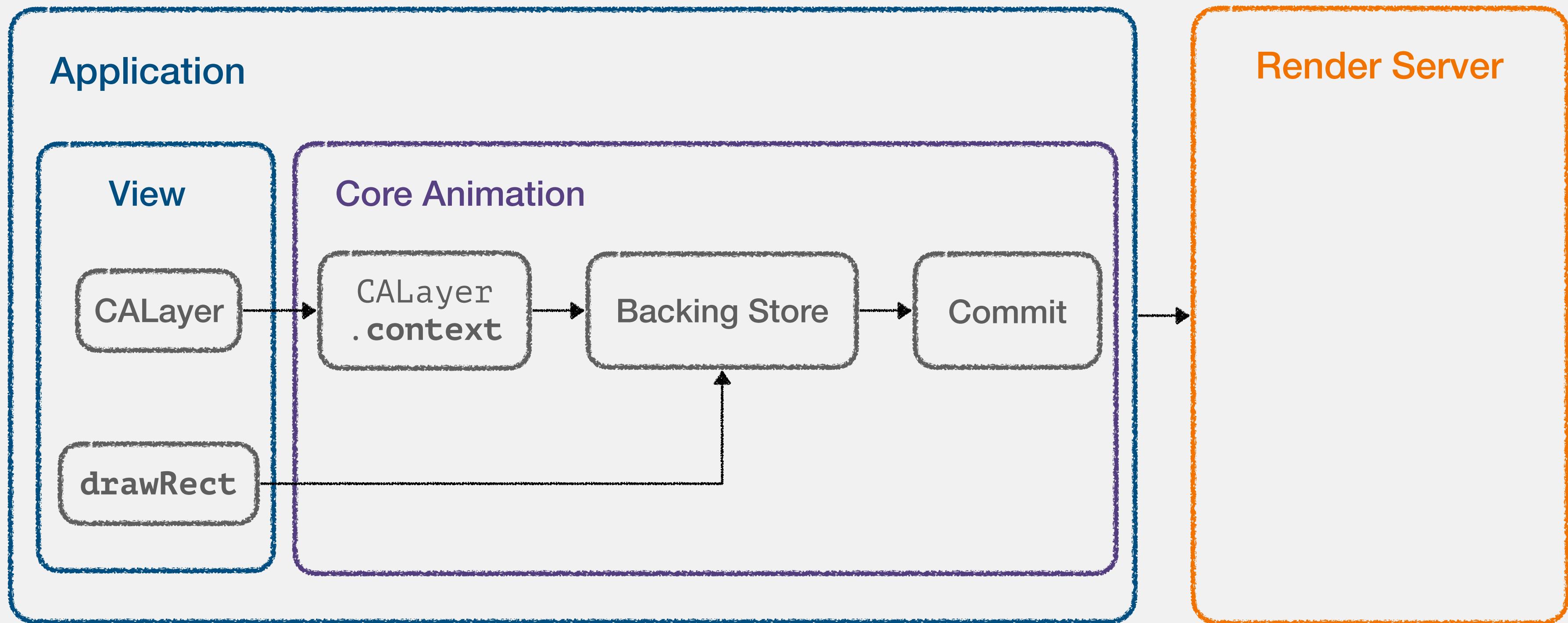
Core Animation

Overview



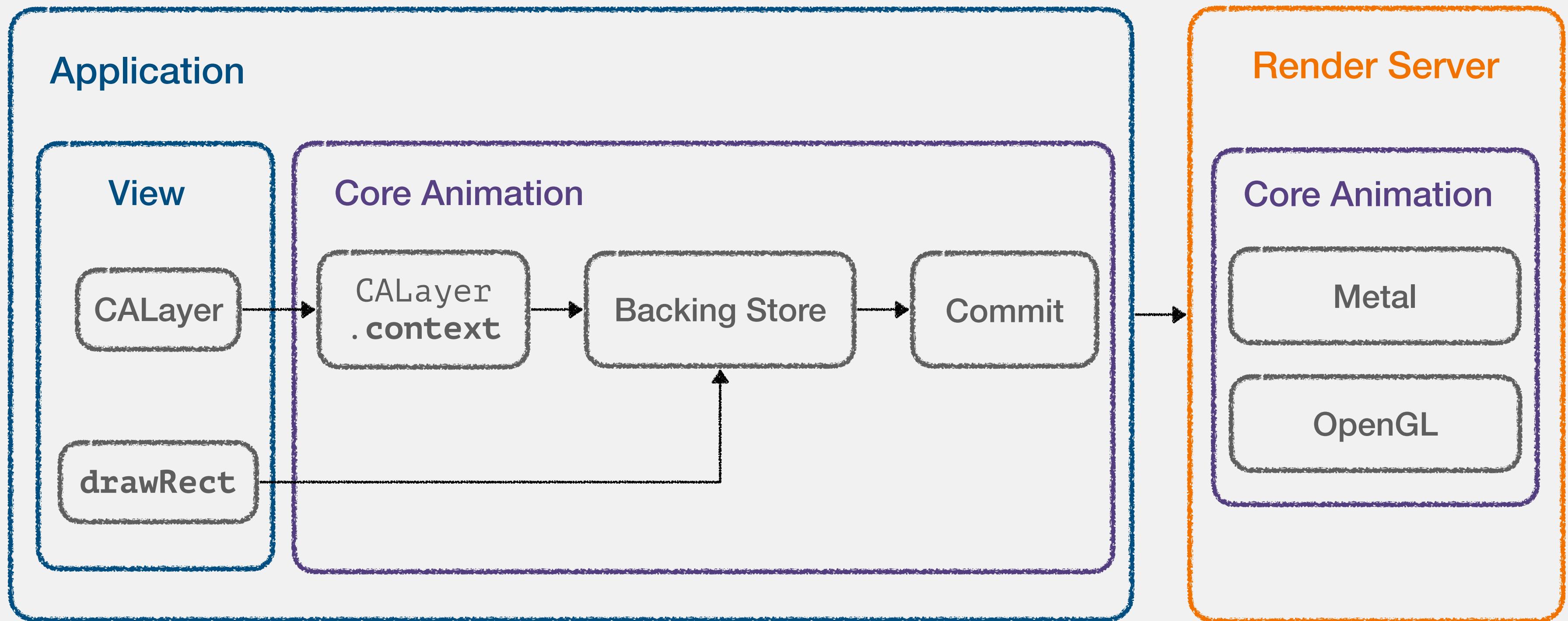
Core Animation

Overview



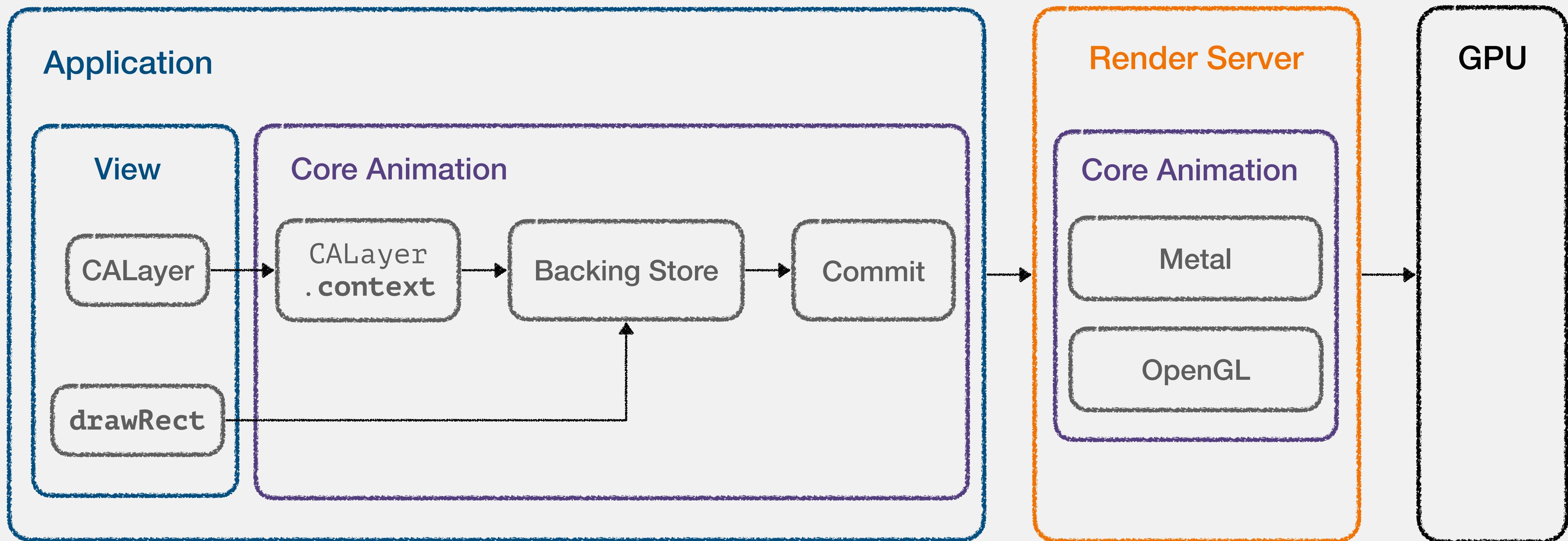
Core Animation

Overview



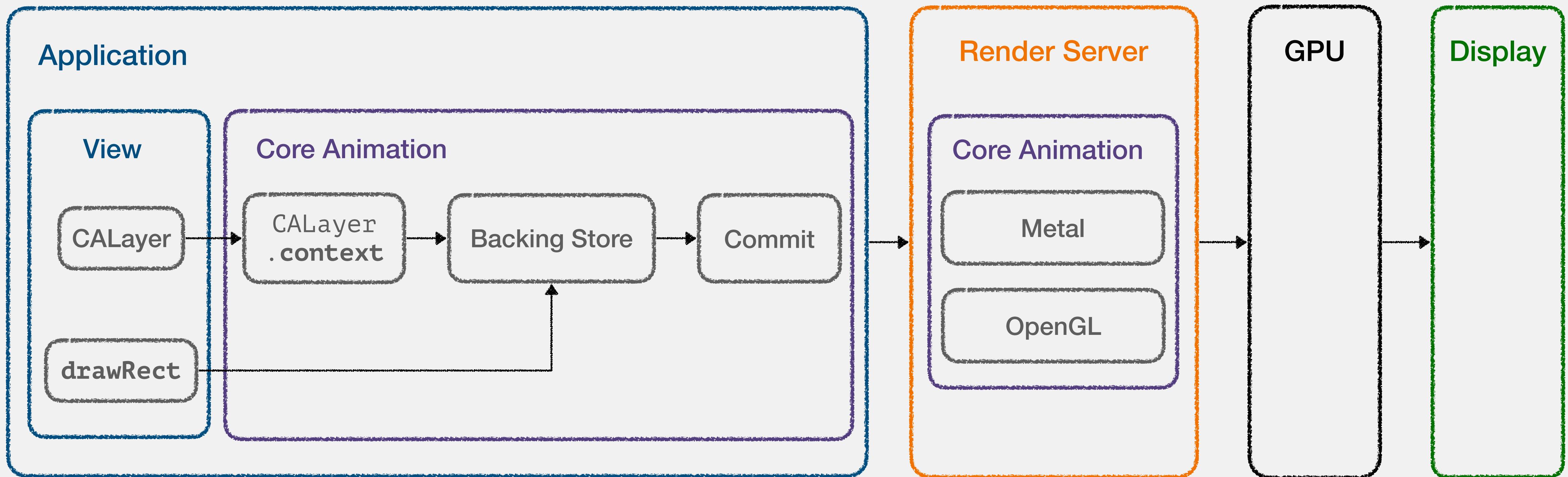
Core Animation

Overview



Core Animation

Overview



Core Animation

Detailed



Nick Lockwood

iOS Core Animation: Advanced
Techniques



Podlodka Crew# 7

Advanced анимации с CALayer



CALayer

- CAShapeLayer
- CAGradientLayer
- CATextLayer
- CAReplicatorLayer
- CATransformLayer
- CATiledLayer
- CAScrollLayer
- CAEmitterLayer
- CAMetalLayer

CALayer

- CAShapeLayer
- CAGradientLayer
- CATextLayer
- CAReplicatorLayer
- CATransformLayer
- **CATiledLayer**
- CAScrollLayer
- CAEmitterLayer
- CAMetalLayer

CATiledLayer

When to use



CATiledLayer

When to use



CATiledLayer

When to use



CATiledLayer

When to use



CATiledLayer

When to use



CATiledLayer

When to use



CATiledLayer

When to use

Once upon
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I pondered, weak
er many a quaint an
forgotten lore, Whil
apping, suddenly there
some one gently rapping,
at my chamber door. "'Tis
visitor," I muttered, "tap
t my chamber door- Only thi
more." Ah, distinctly I rem
eak December, And each sepa
ts ghost upon the floor. Ea

CATiledLayer

When to use

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CATiledLayer

When to use

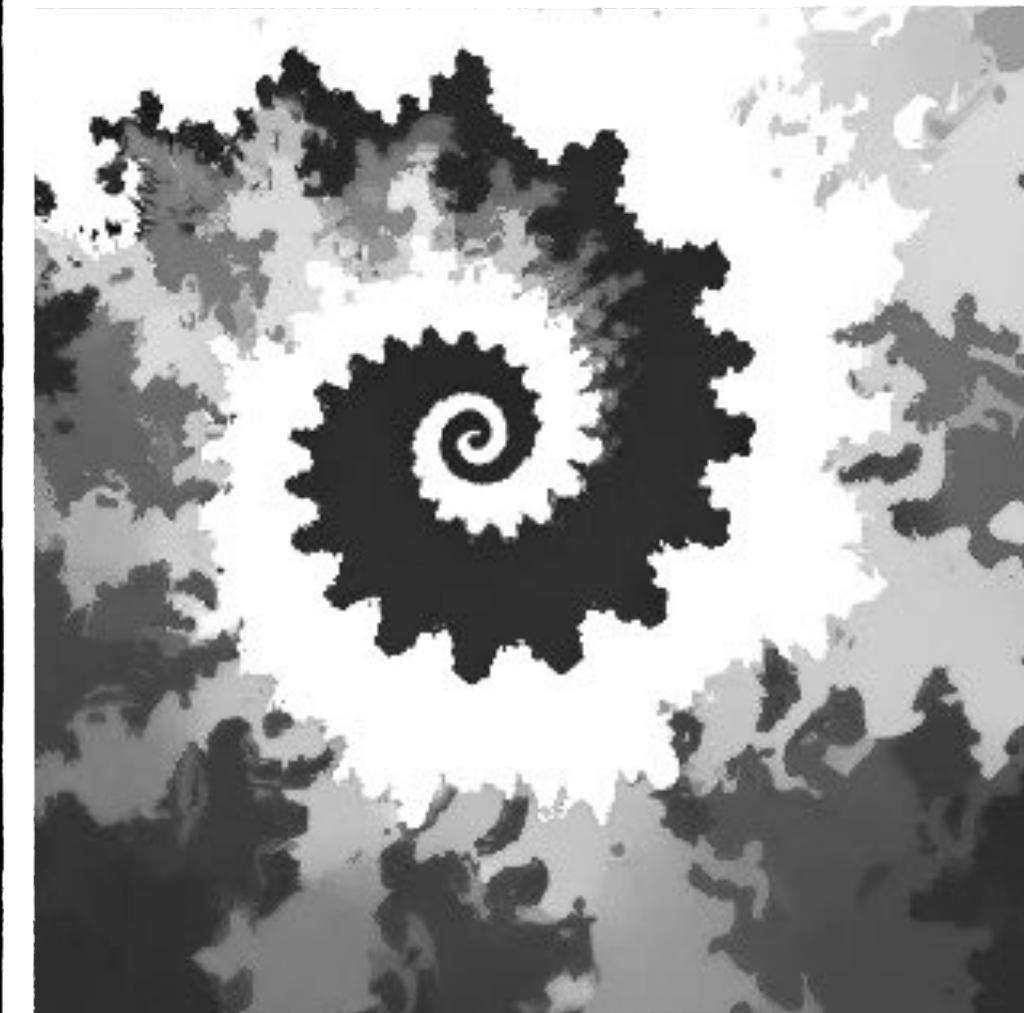
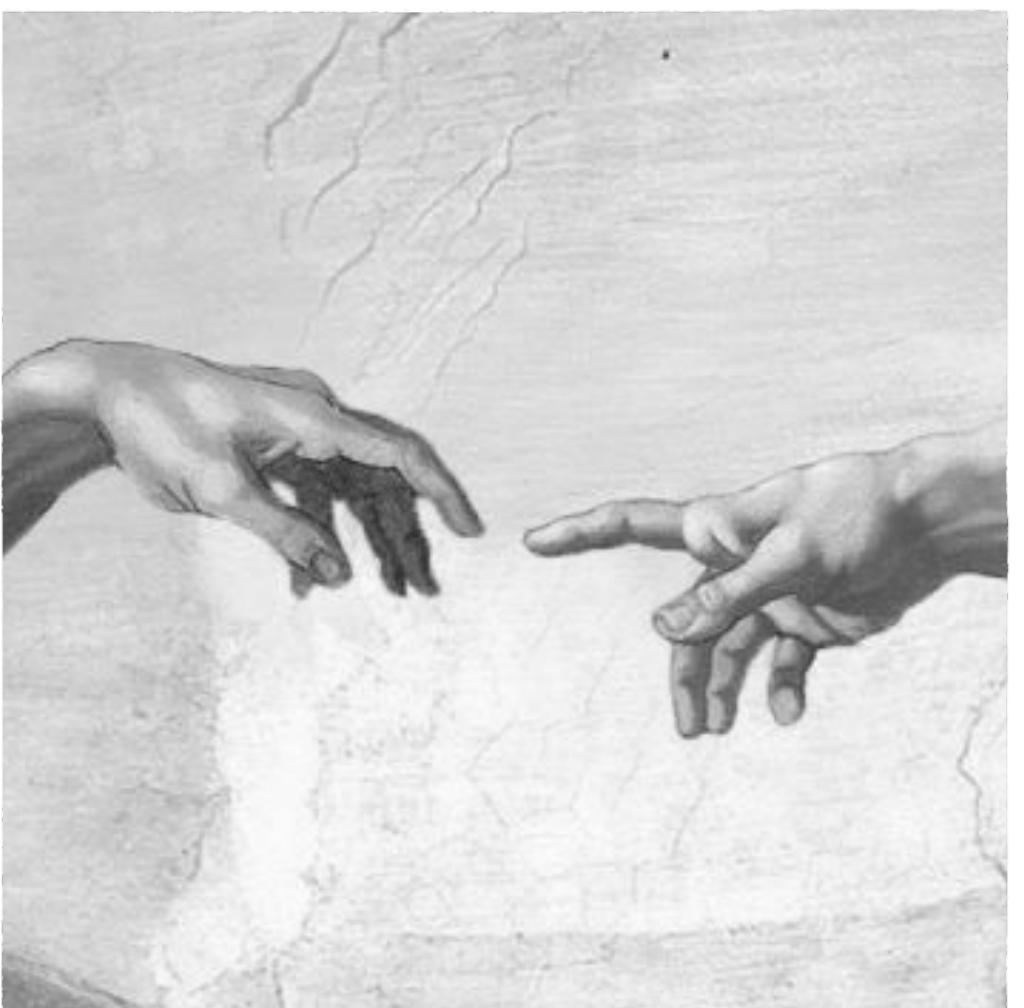
Once upon
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ts ghost upon the floor. Ea



CATiledLayer

Intro

A layer that provides a way to **asynchronously** provide **tiles** of the layer's content, potentially **cached** at multiple levels of detail.

CATiledLayer

Intro

- `drawsAsynchronously = true`

CATiledLayer

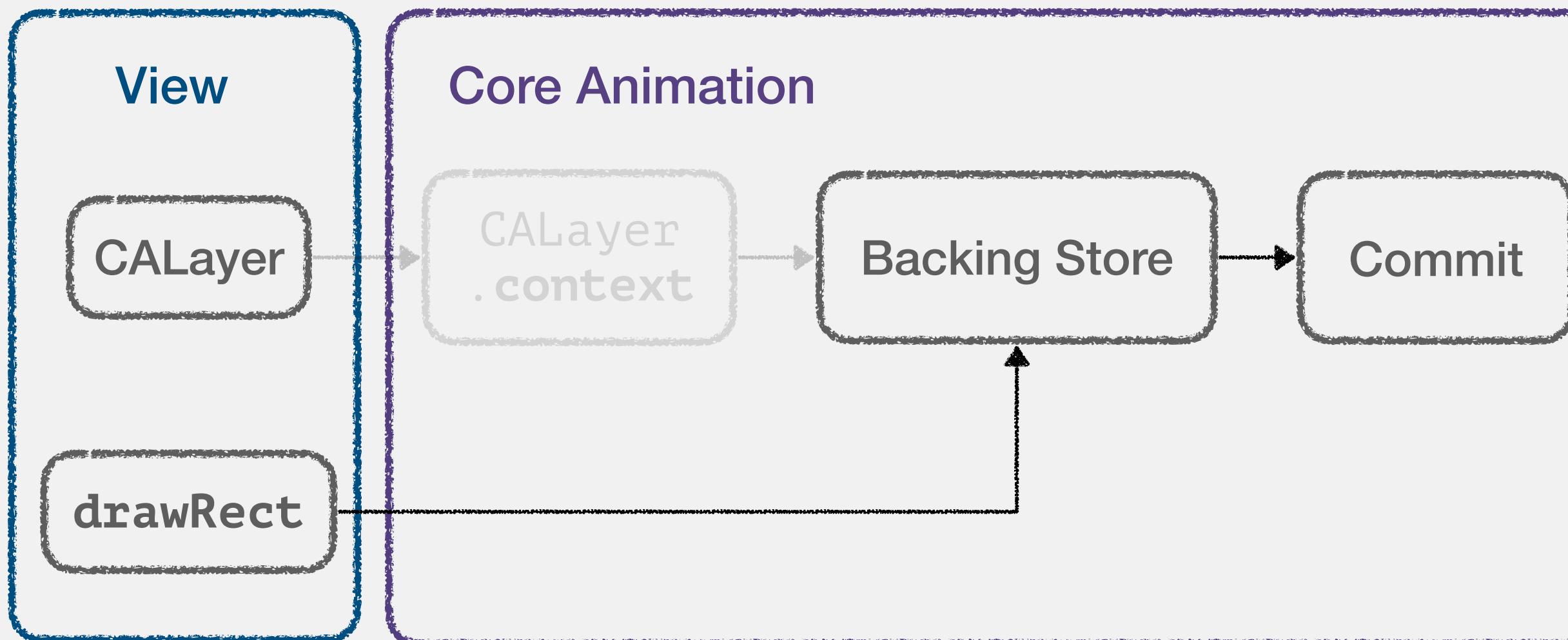
Intro

- `drawsAsynchronously = true`
- Needs to use `draw(in:)` calls instead of setting contents directly

CATiledLayer

Intro

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CATiledLayer

Intro

- `drawsAsynchronously = true`
- Needs to use `draw(in:)` calls instead of setting contents directly
- Additional properties: `levelsOfDetail`, `levelsOfDetailBias`, `tileSize`

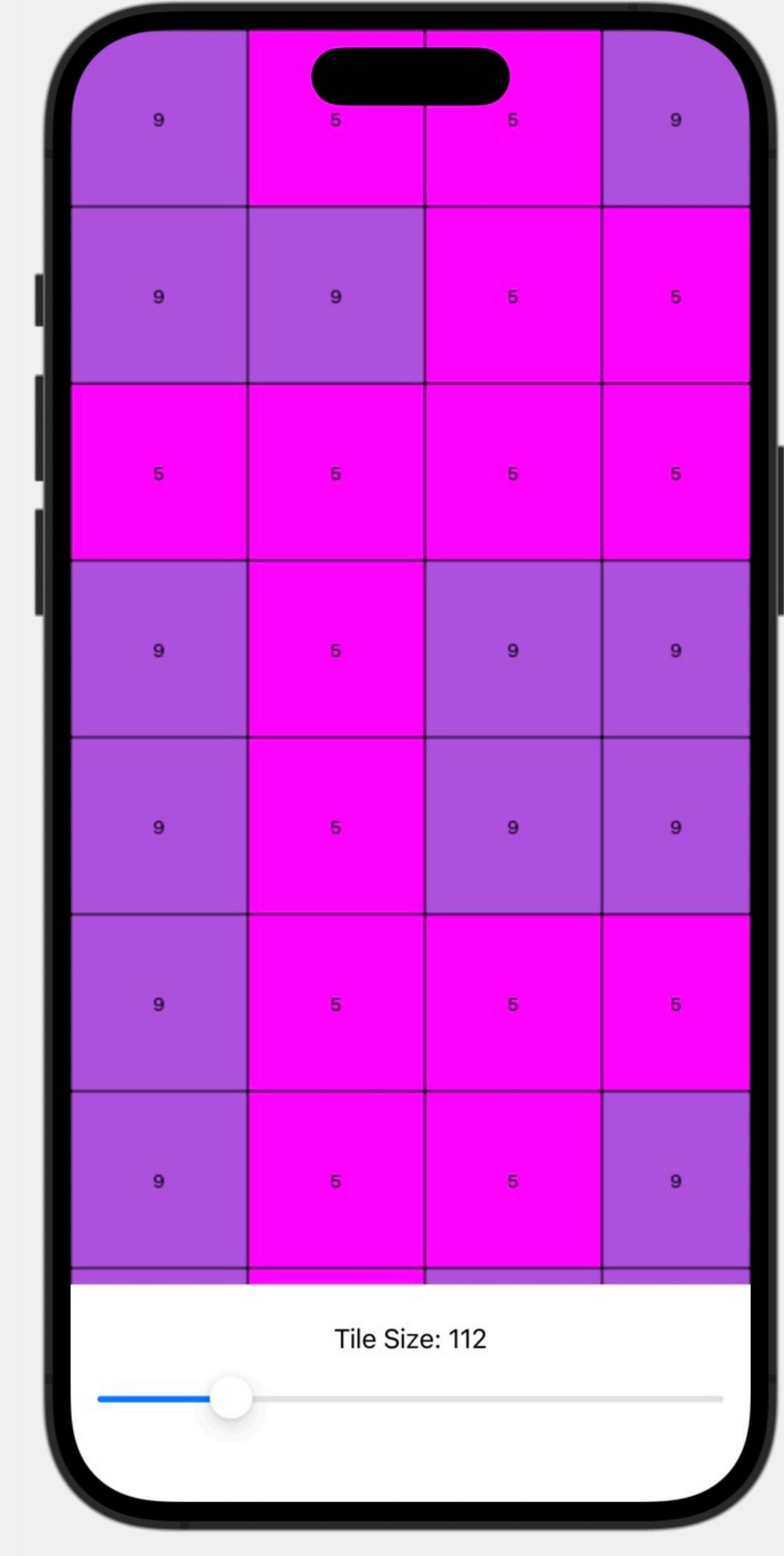
Demo 1

Meet CATiledLayer

Meet CATiledLayer

#1. Simple CATiledLayer

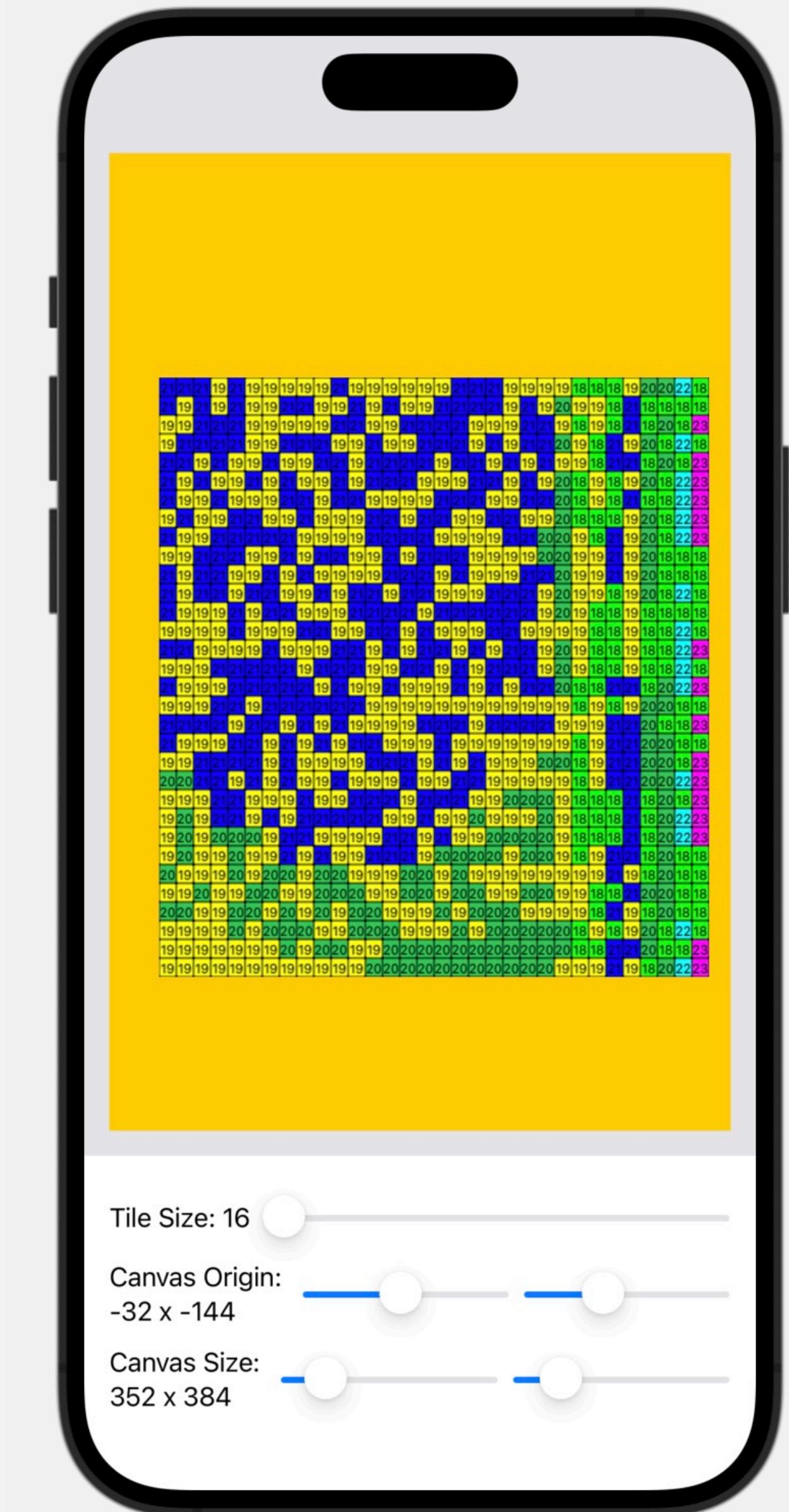
- Create project
- Simple version of CATiledLayer
- Differences between CATiledLayer and CALayer



Meet CATiledLayer

#2. Beyond edges CATiledLayer

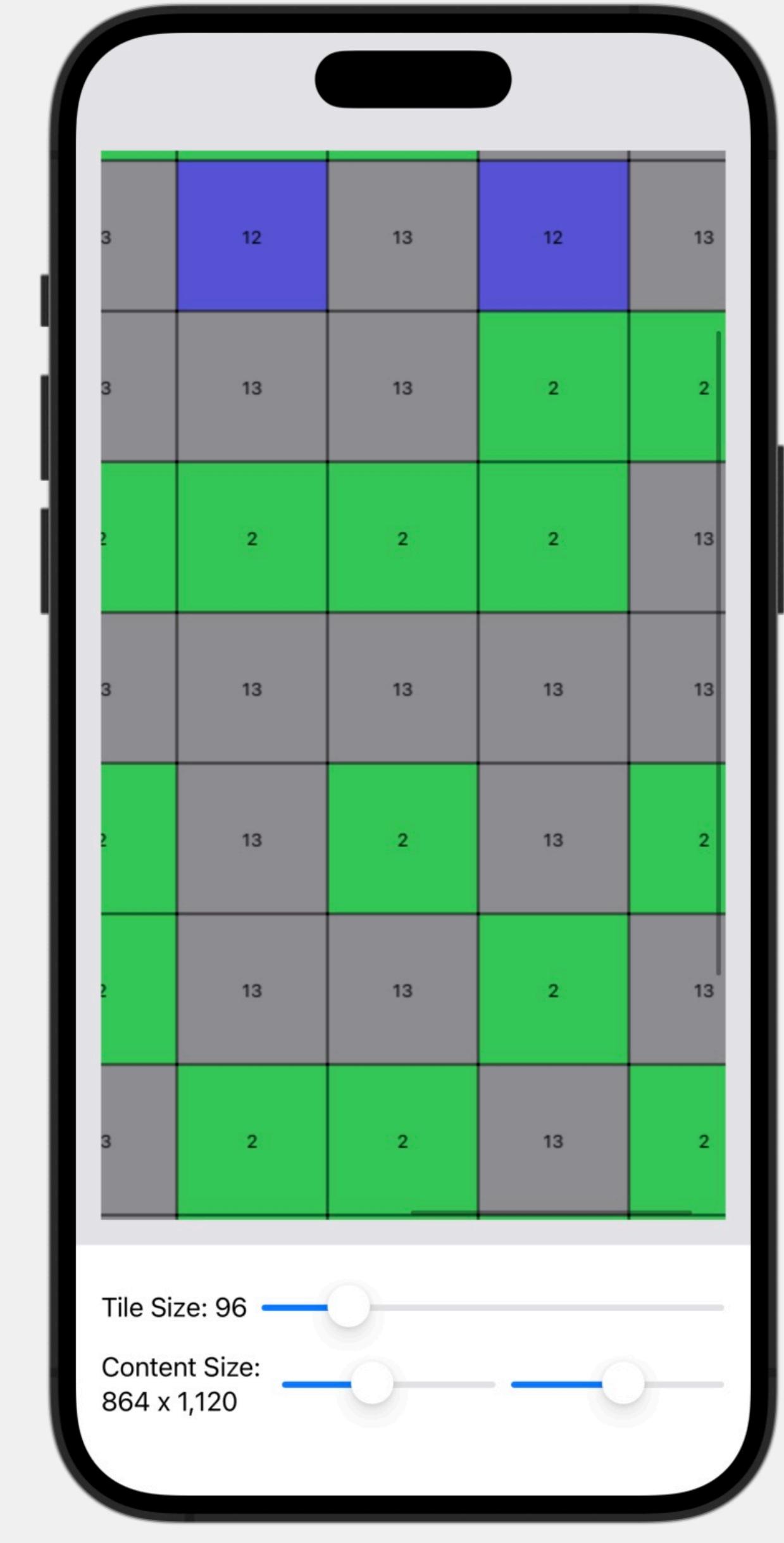
- How it works beyond edges
- Played with size
- Looked on draw calls and setNeedsDisplay



Meet CATiledLayer

#3. CATiledLayer + ScrollView

- Basic ScrollView support



Meet CATiledLayer

Summary

- Working with CATiledLayer
 - From Delegate
 - Baked with UIView
- Differences between CATiledLayer and CALayer
- Tiles drawing
- Basic ScrollView configuration

CATiledLayer

Intro

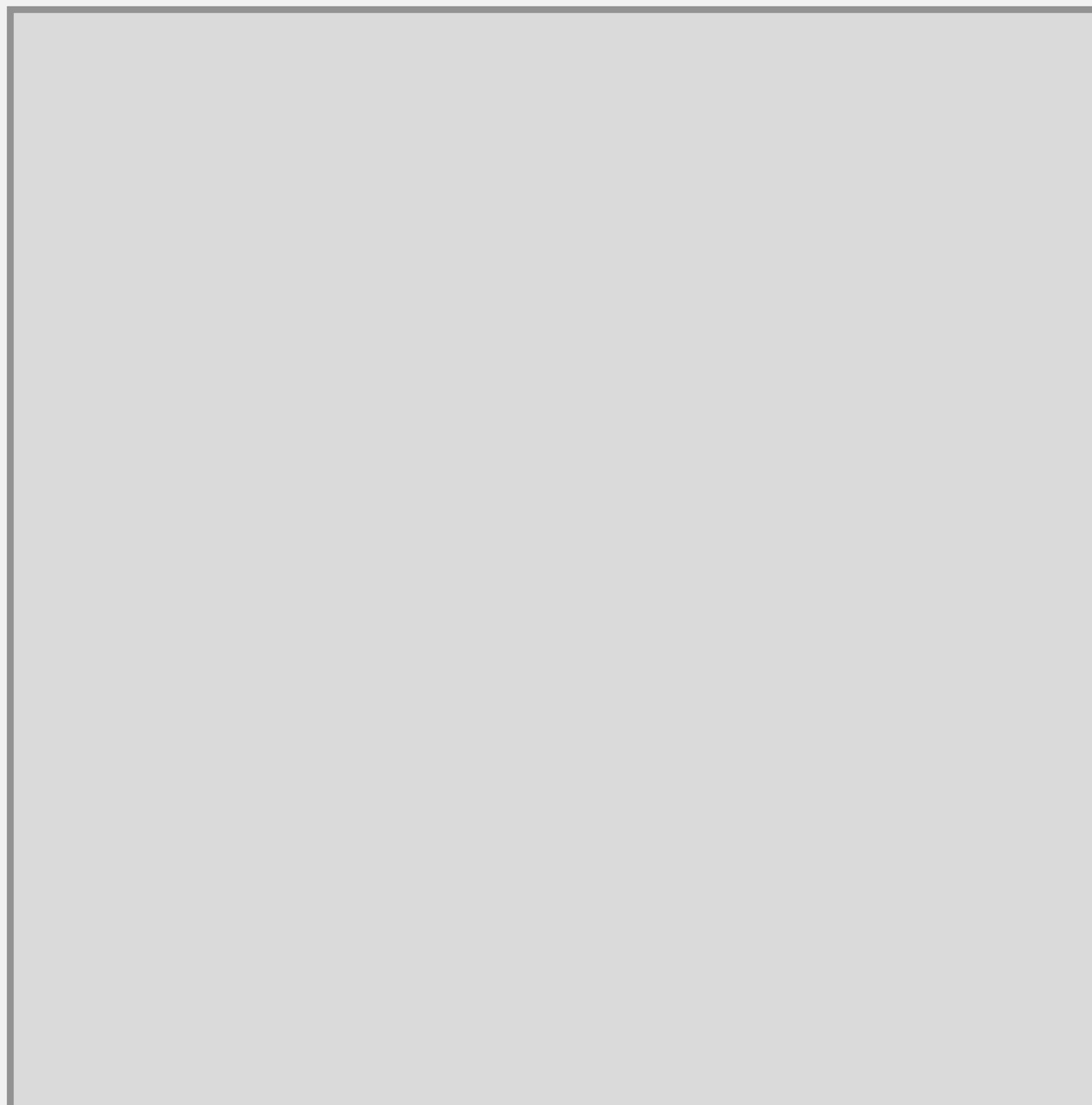
- `drawsAsynchronously = true`
- Needs to use `draw(in:)` calls instead of setting contents directly
- Additional properties: `levelsOfDetail`, `levelsOfDetailBias`, `tileSize`

CATiledLayer

Intro

- ~~drawsAsynchronously = true~~
- ~~Needs to use draw(in:)~~ calls instead of setting contents directly
- Additional properties: levelsOfDetail, levelsOfDetailBias, tileSize

Levels of Detail



1,024

Image size: 1024

Levels of Detail

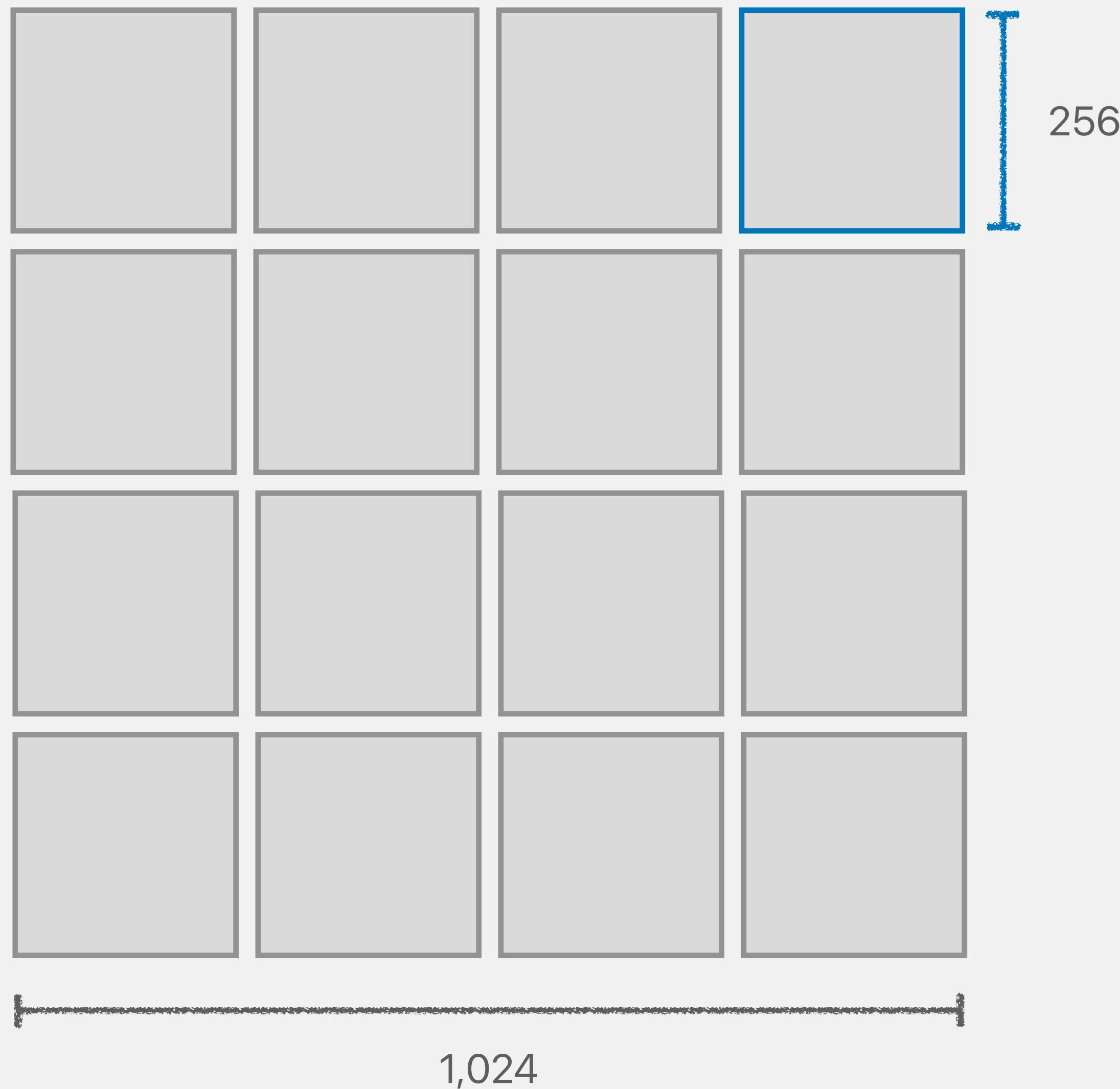
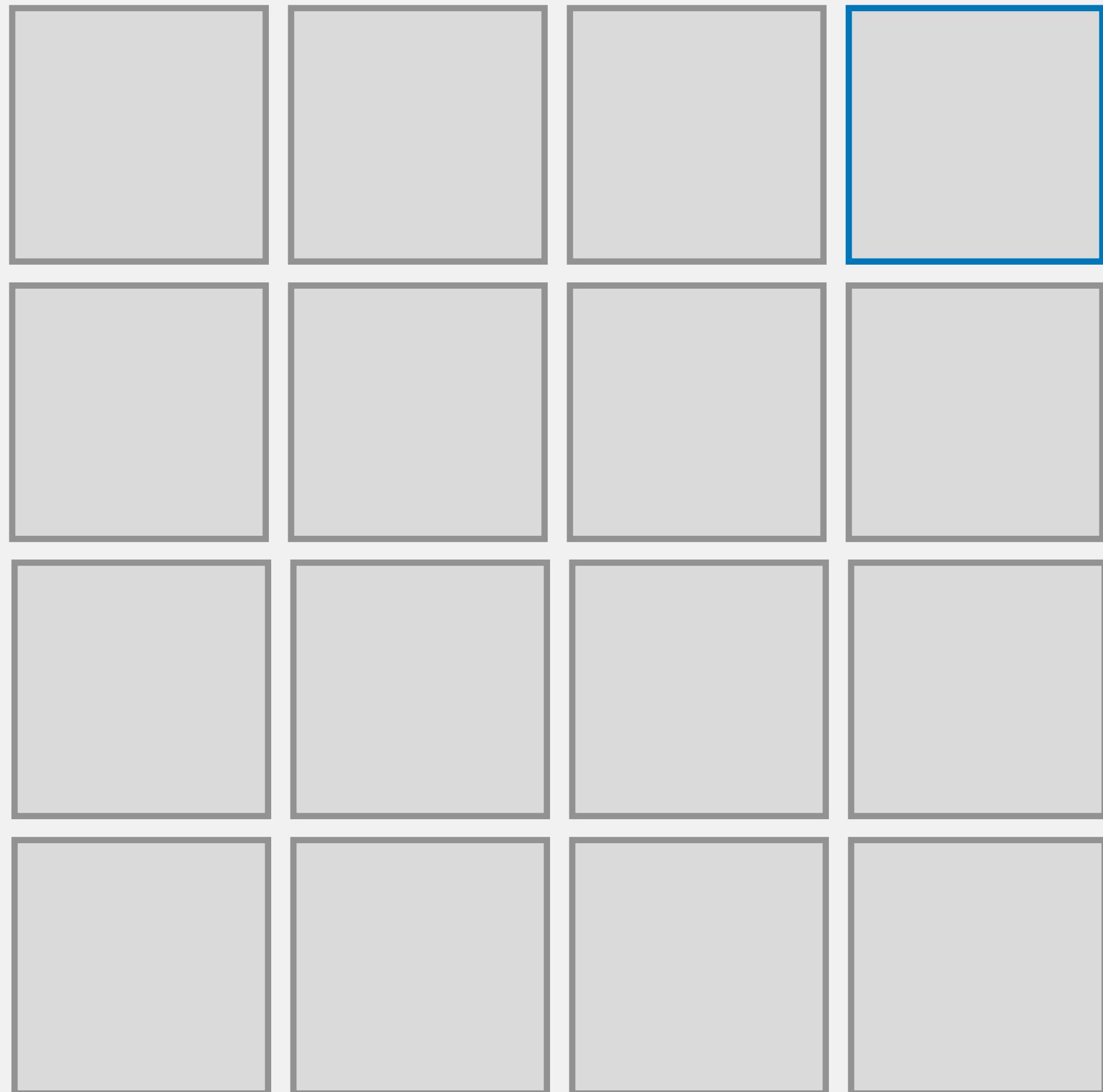


Image size: 1024
Tile size : 256

Levels of Detail



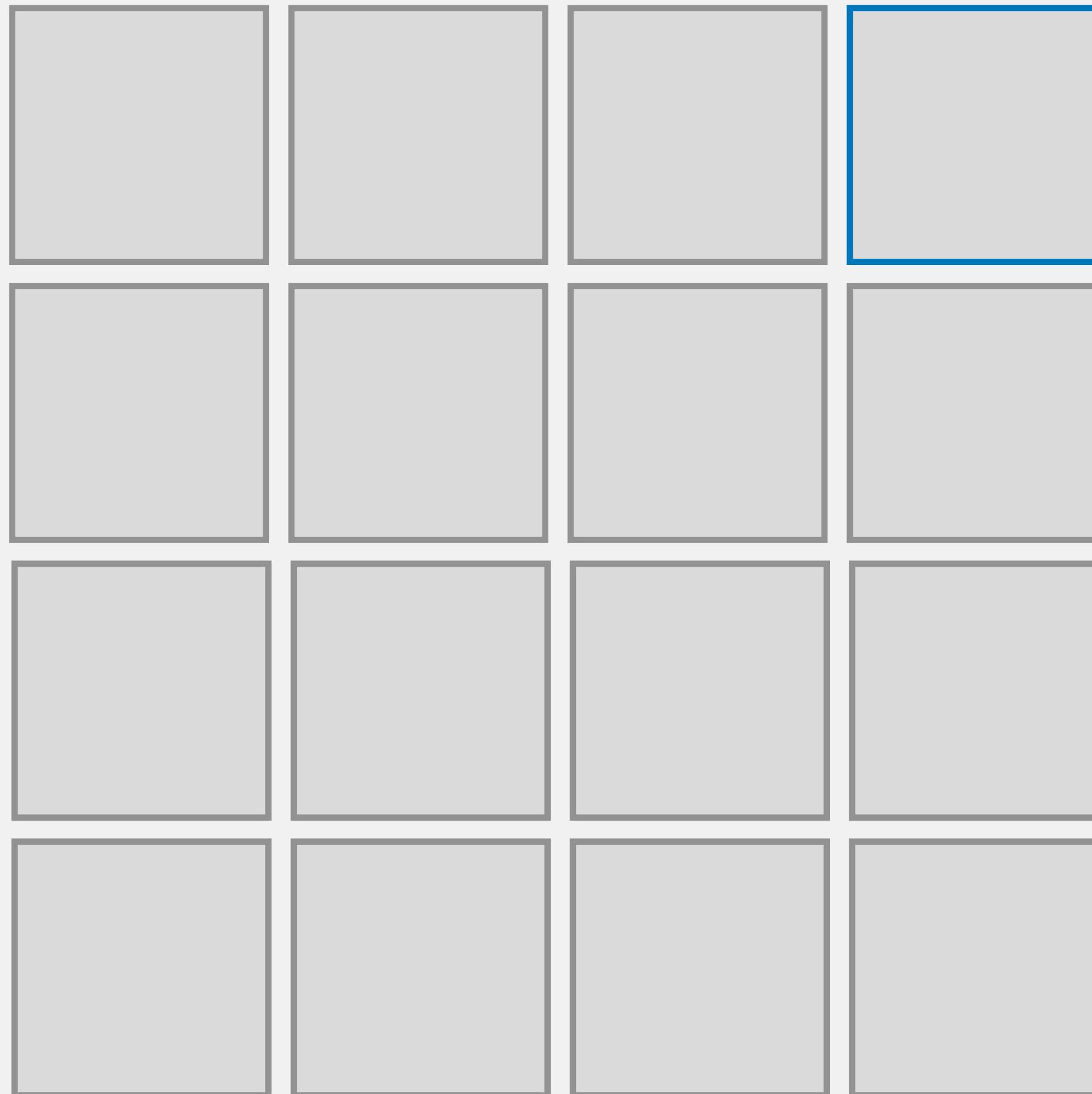
Scale – 1.0

Image size: 1024

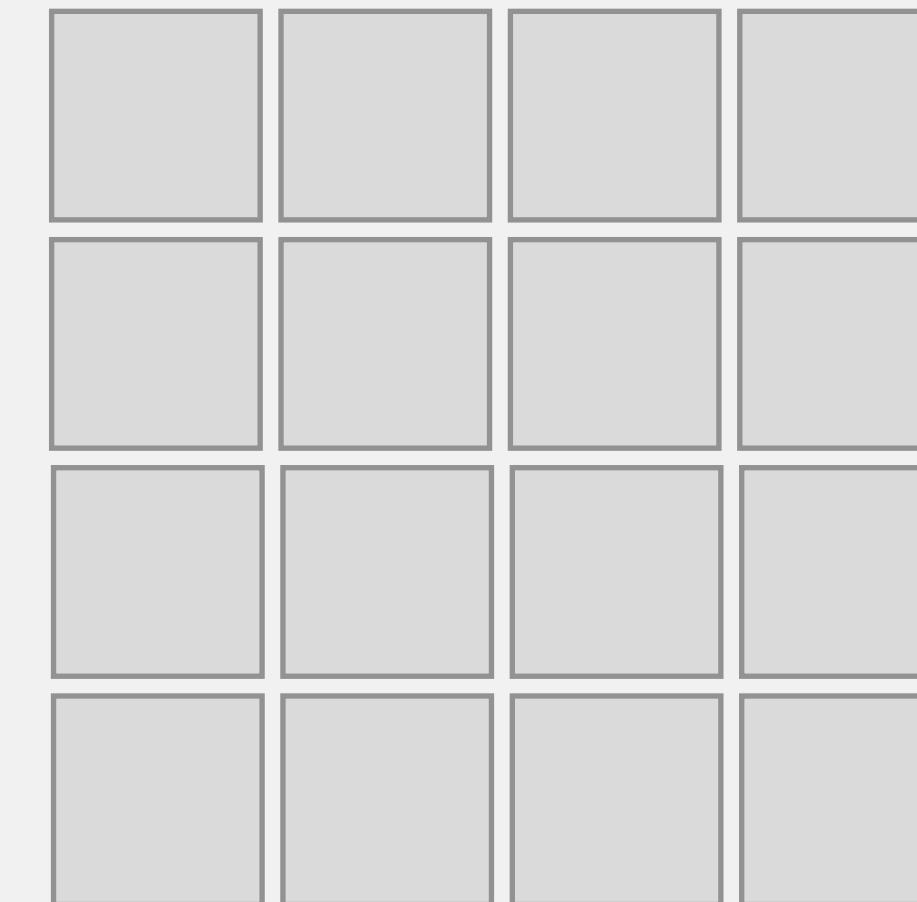
Tile size : 256

levelsOfDetail = 1

Levels of Detail



Scale – 1.0



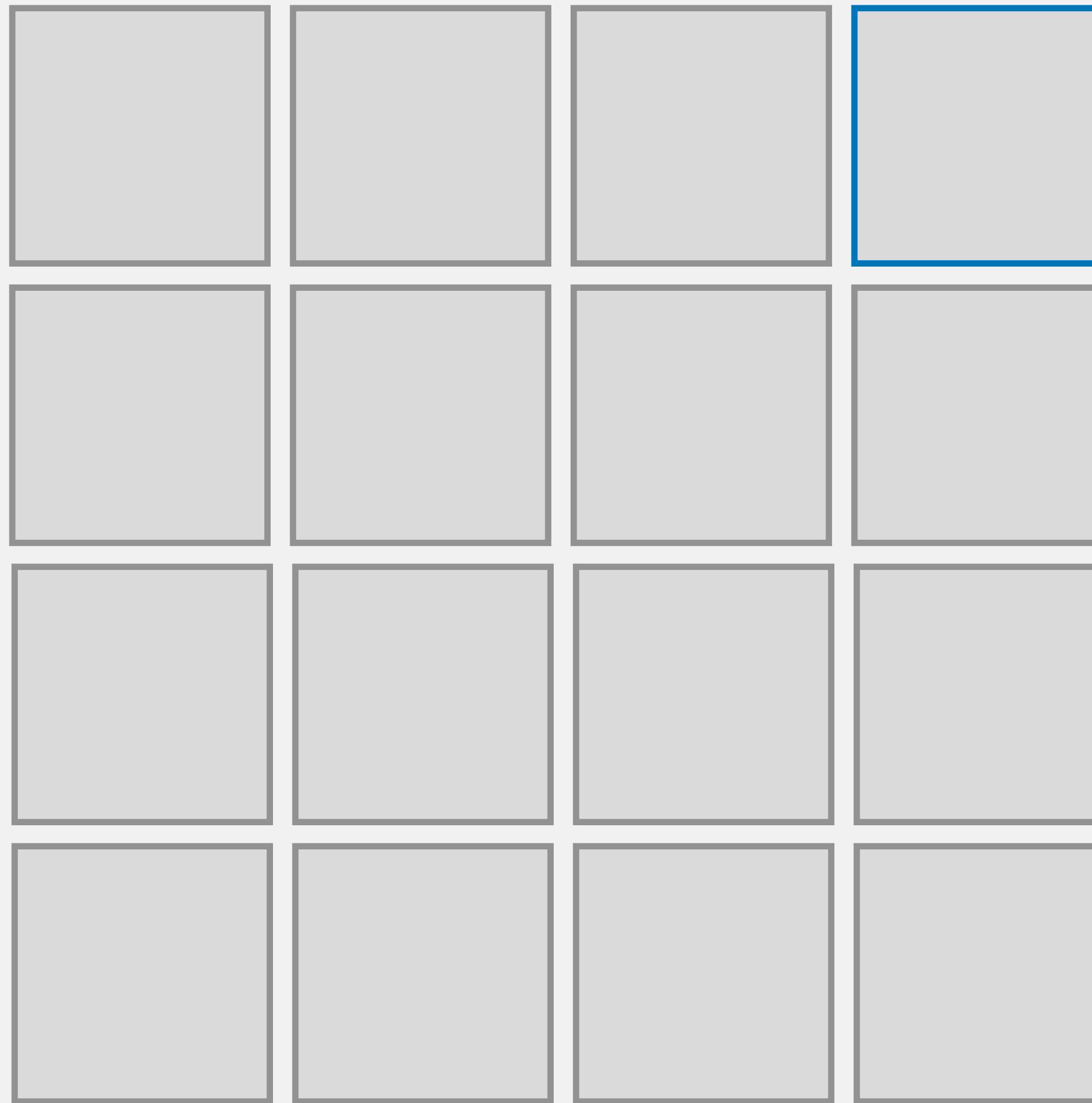
Scale – 0.5

Image size: 1024

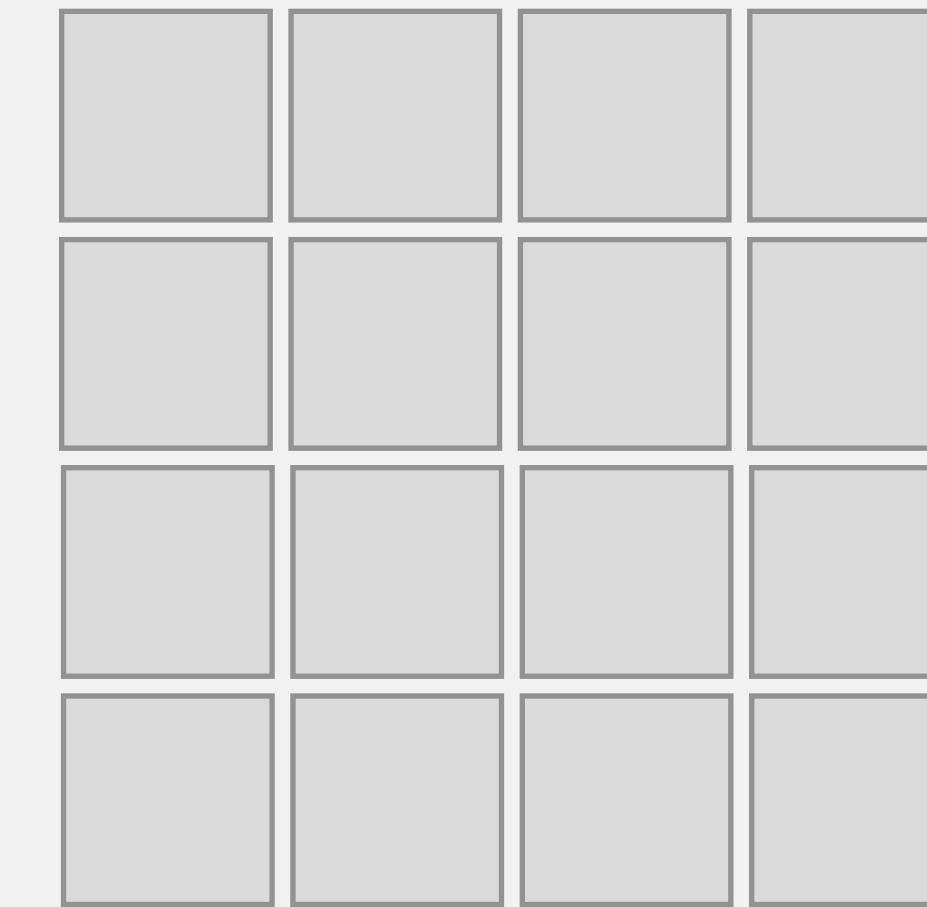
Tile size : 256

levelsOfDetail = 1

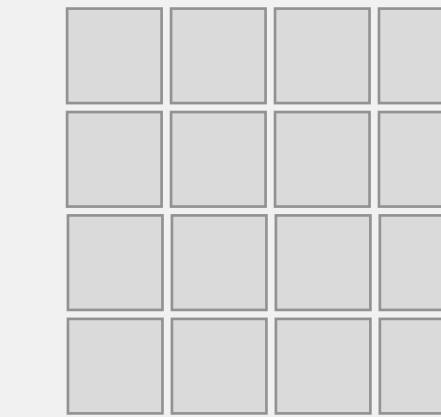
Levels of Detail



Scale – 1.0



Scale – 0.5



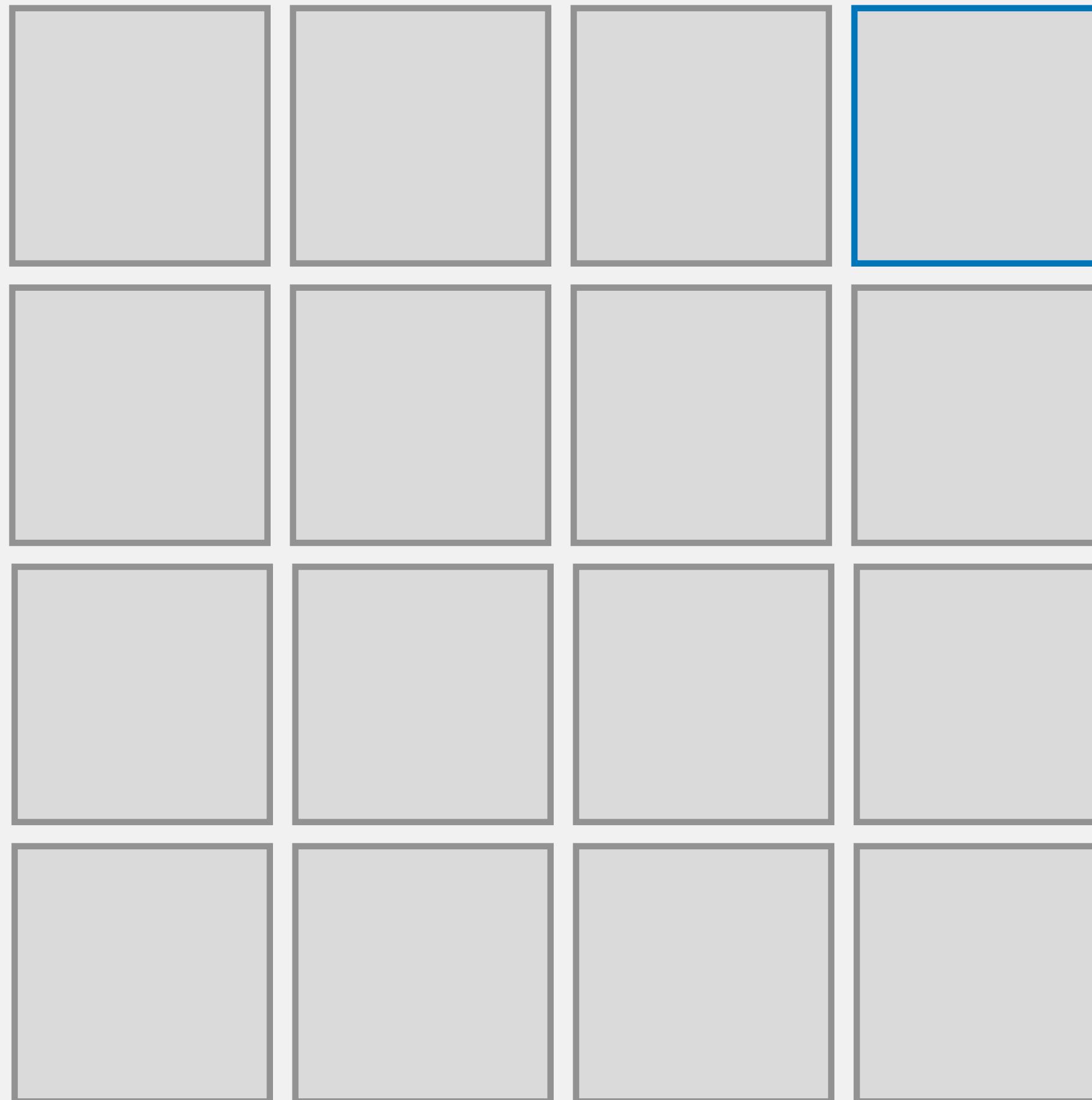
Scale – 0.25

Image size: 1024

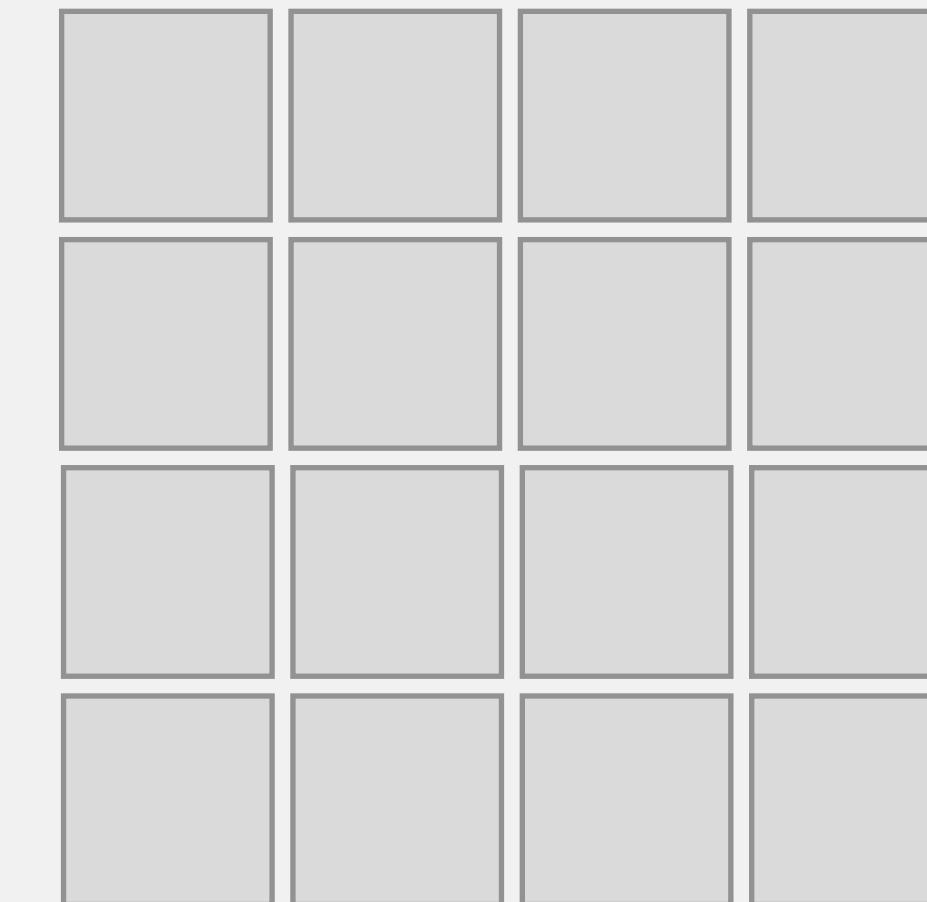
Tile size : 256

levelsOfDetail = 1

Levels of Detail

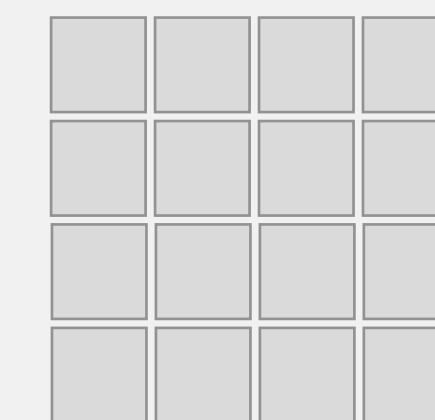


Scale – 1.0
LOD – 0



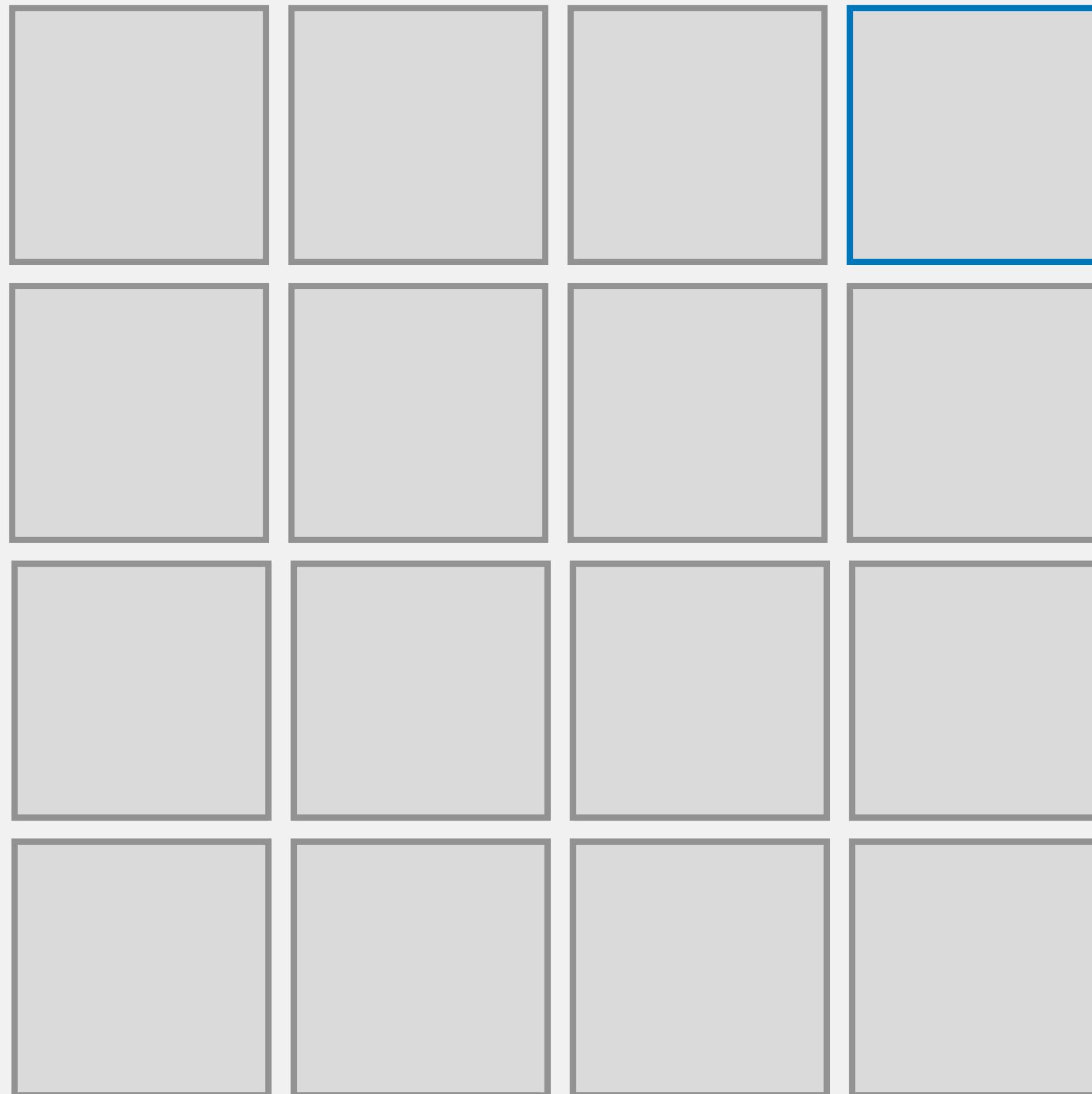
Scale – 0.5
LOD – 0

Image size: 1024
Tile size : 256
levelsOfDetail = 1



Scale – 0.25
LOD – 0

Levels of Detail



Scale – 1.0
LOD – 0



Scale – 0.5
LOD – 1



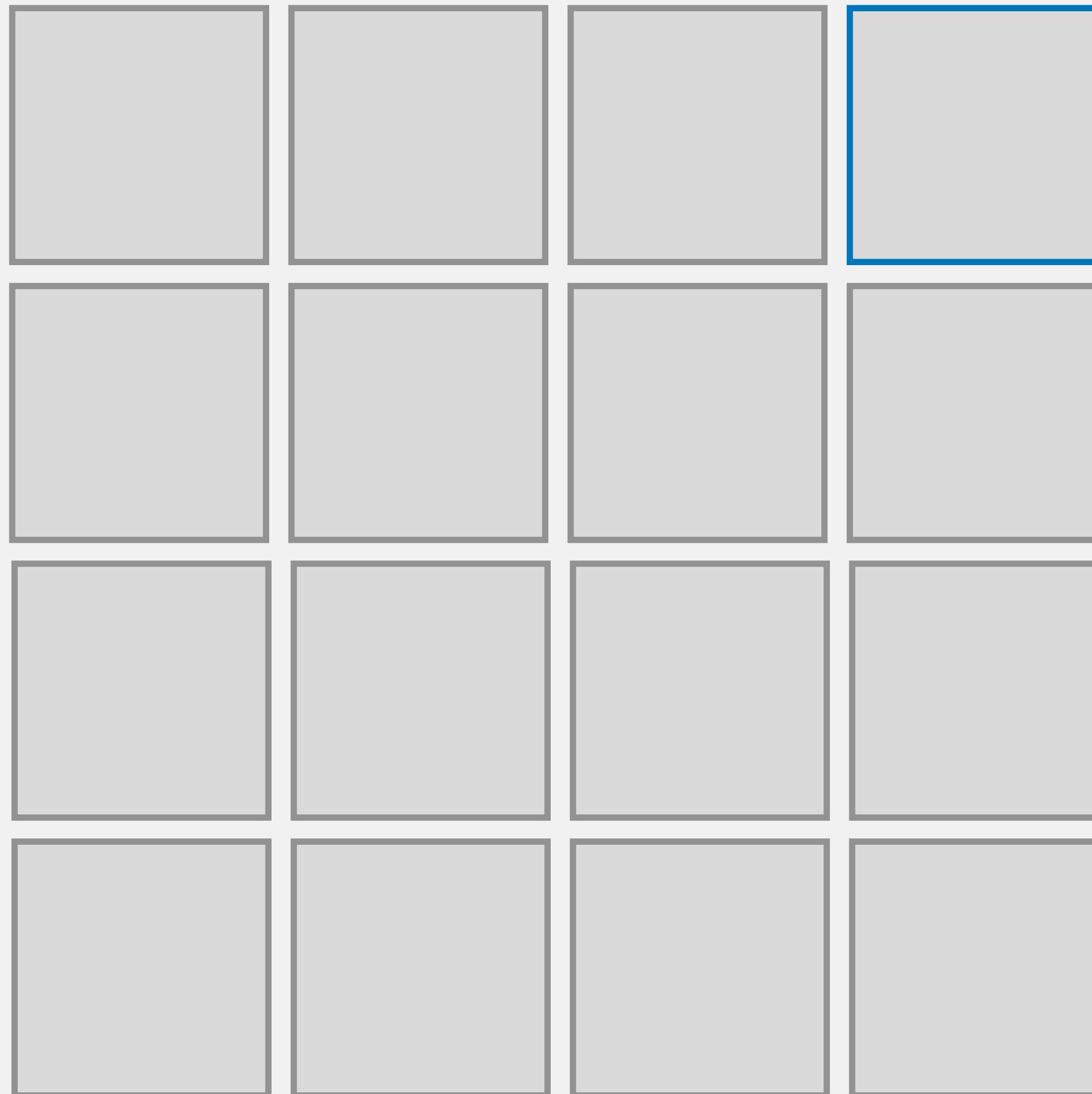
Scale – 0.25
LOD – 1

Image size: 1024

Tile size : 256

levelsOfDetail = 2

Levels of Detail



Scale – 1.0
LOD – 0



Scale – 0.5
LOD – 1



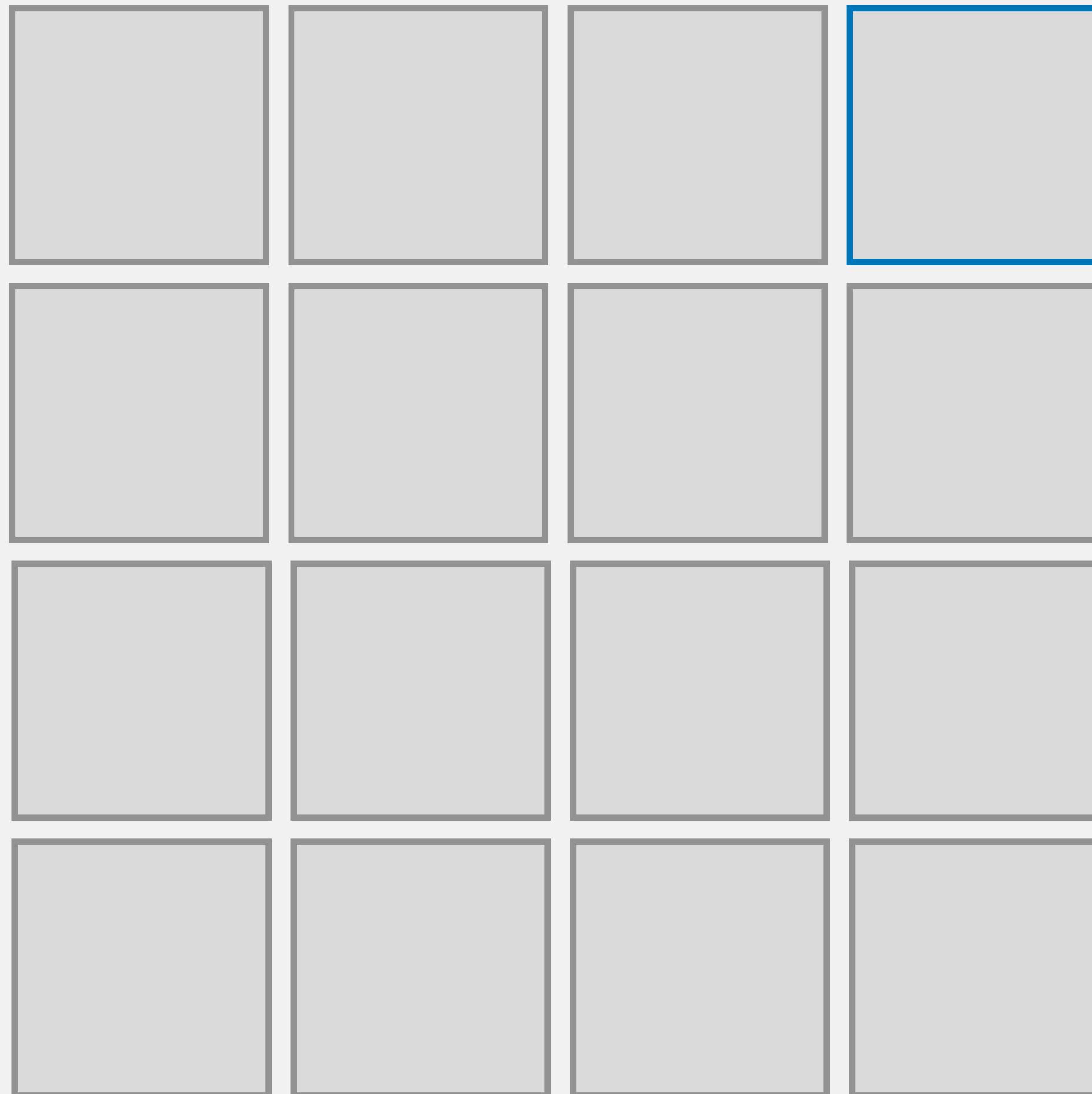
Scale – 0.25
LOD – 2

Image size: 1024

Tile size : 256

levelsOfDetail = 3

Levels of Detail



Scale – 1.0
LOD – 0



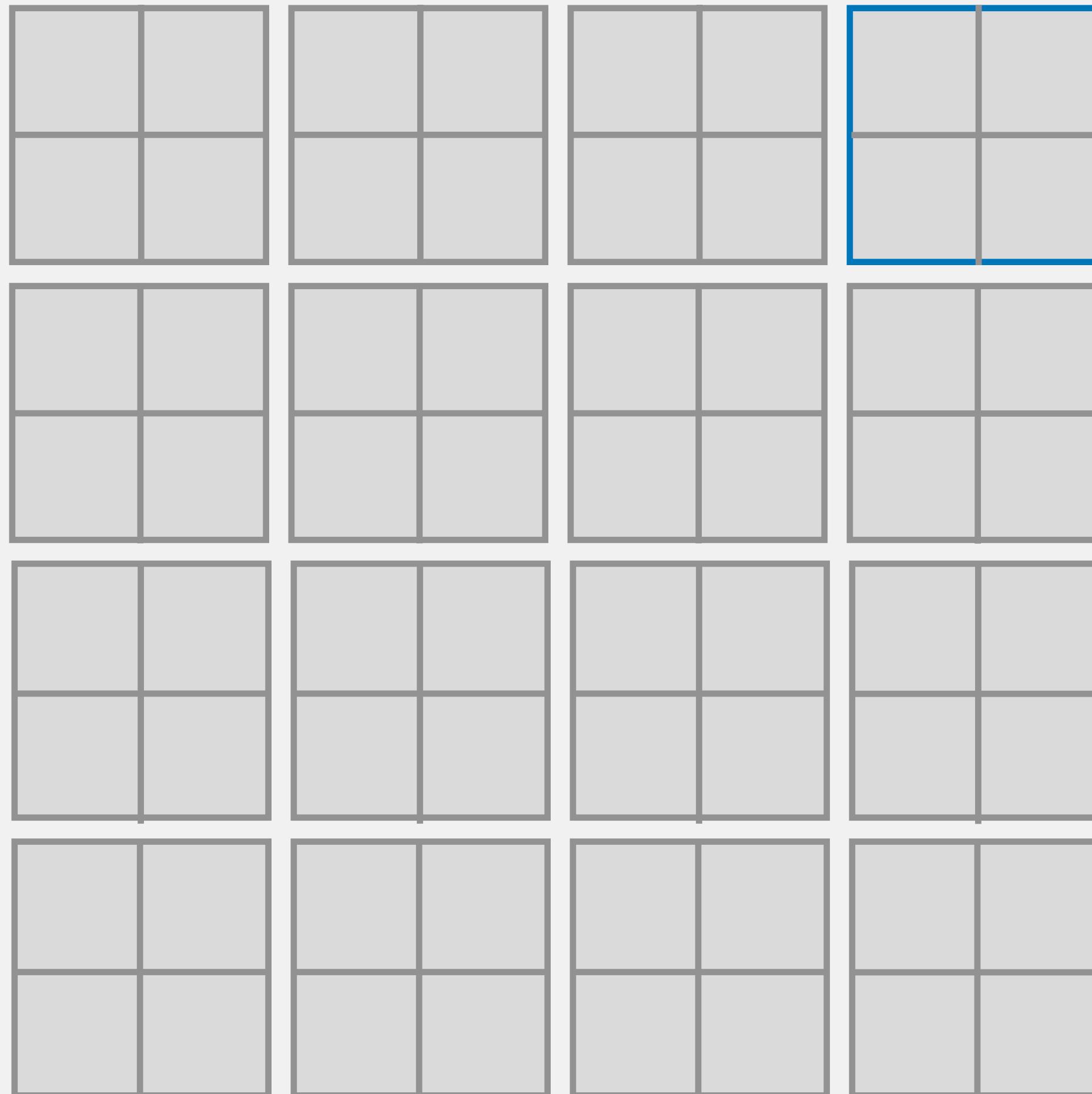
Scale – 0.5
LOD – 1



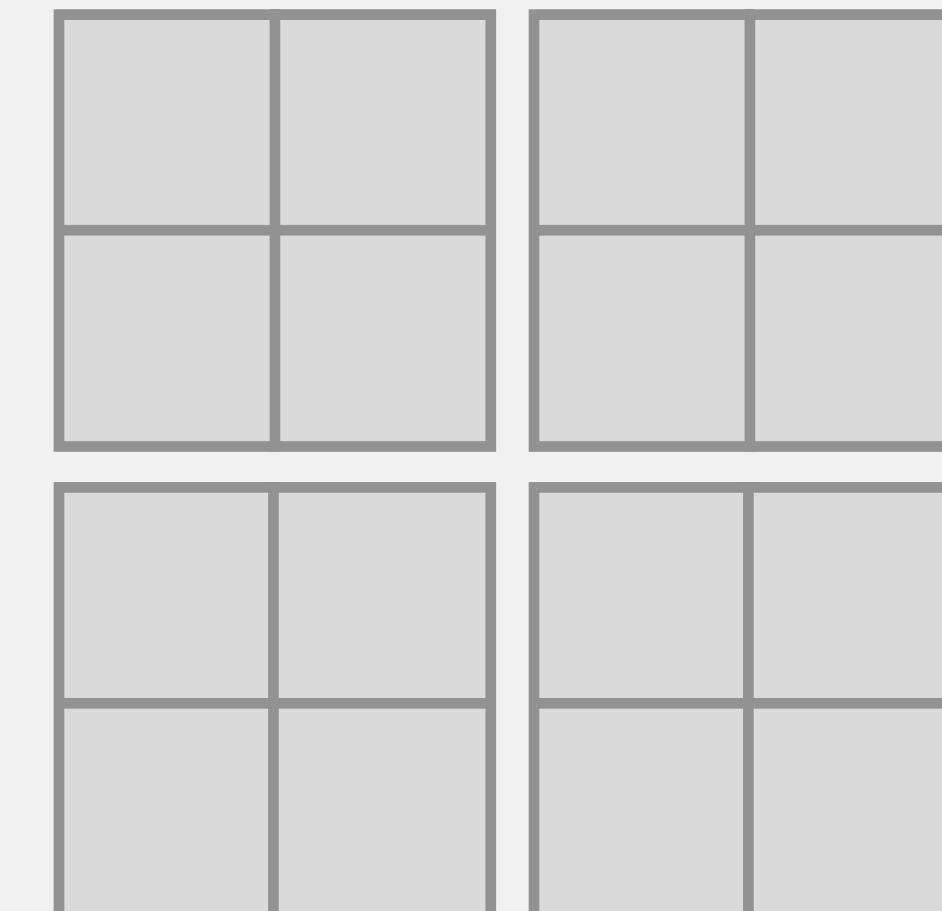
Scale – 0.25
LOD – 2

Image size: 1024
Tile size : 256
levelsOfDetail = 3
levelsOfDetailBias = 0

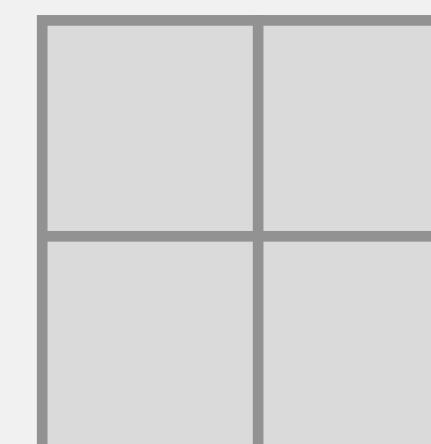
Levels of Detail



Scale – 1.0
LOD – 0



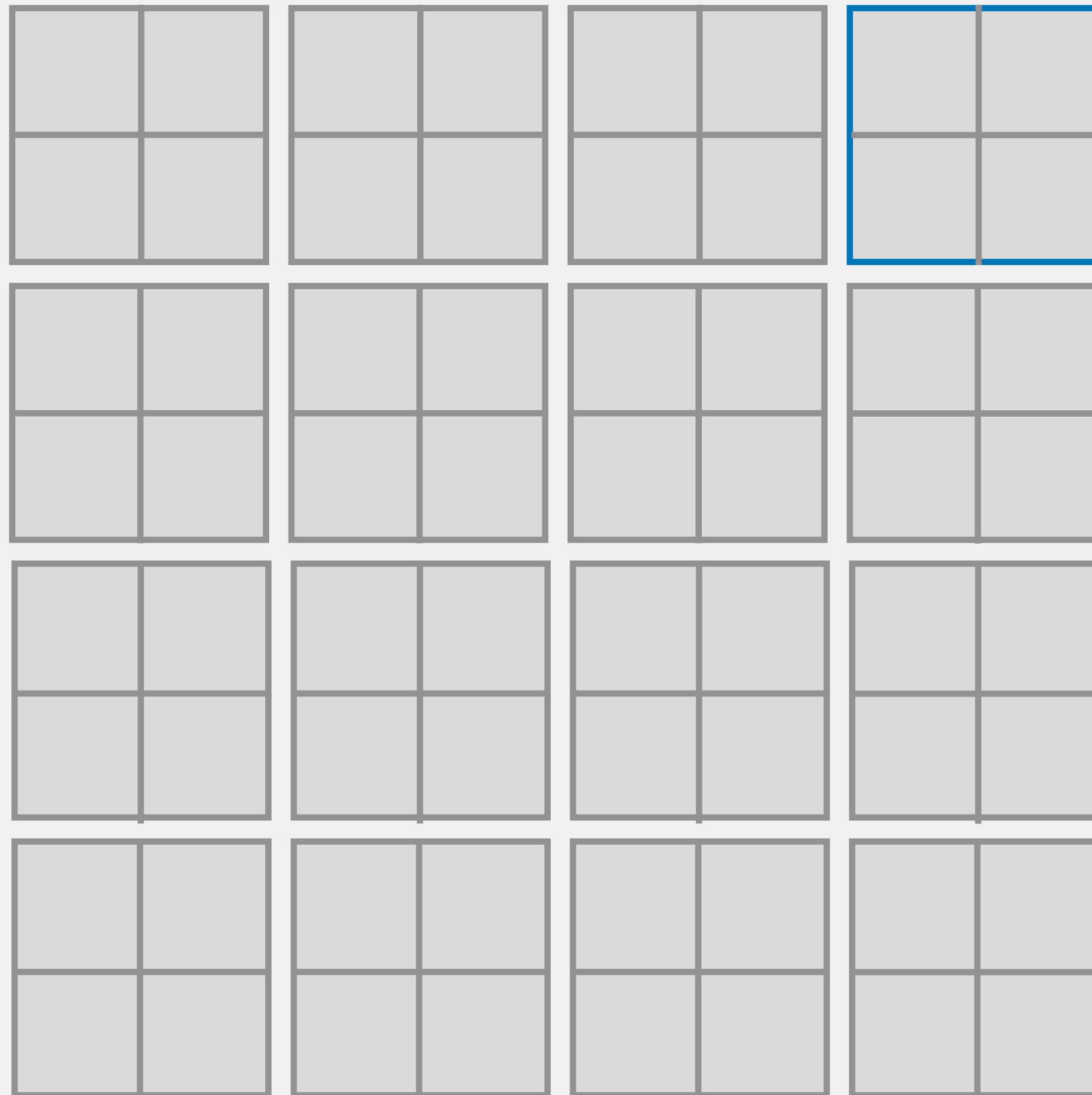
Scale – 0.5
LOD – 1



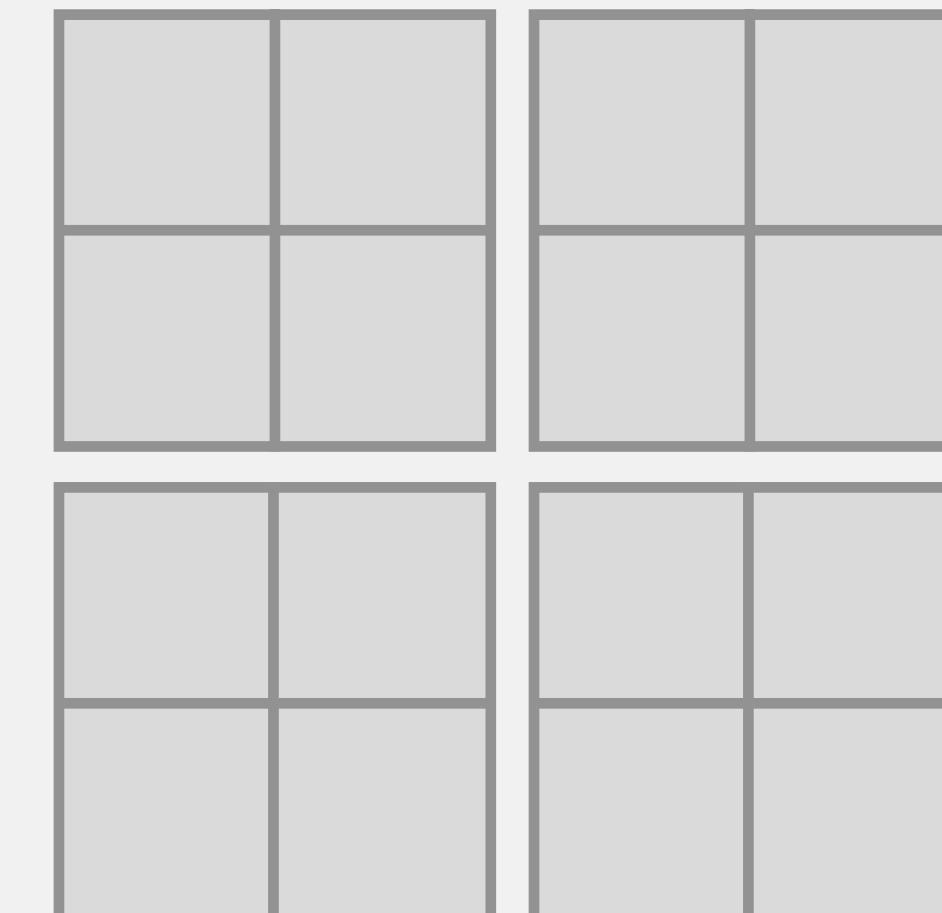
Scale – 0.25
LOD – 2

Image size: 1024
Tile size : 256
levelsOfDetail = 3
levelsOfDetailBias = 1

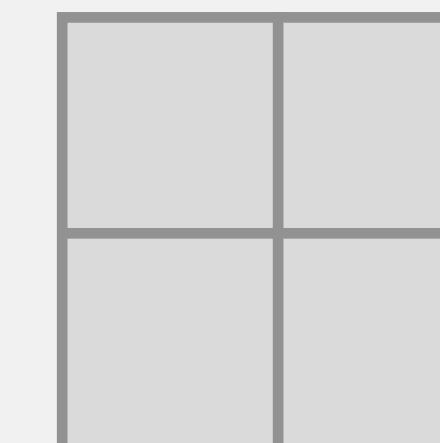
Levels of Detail



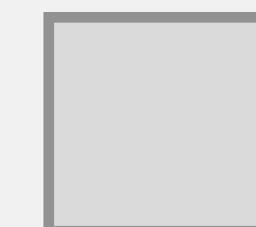
Scale – 1.0
LOD – 0



Scale – 0.5
LOD – 1



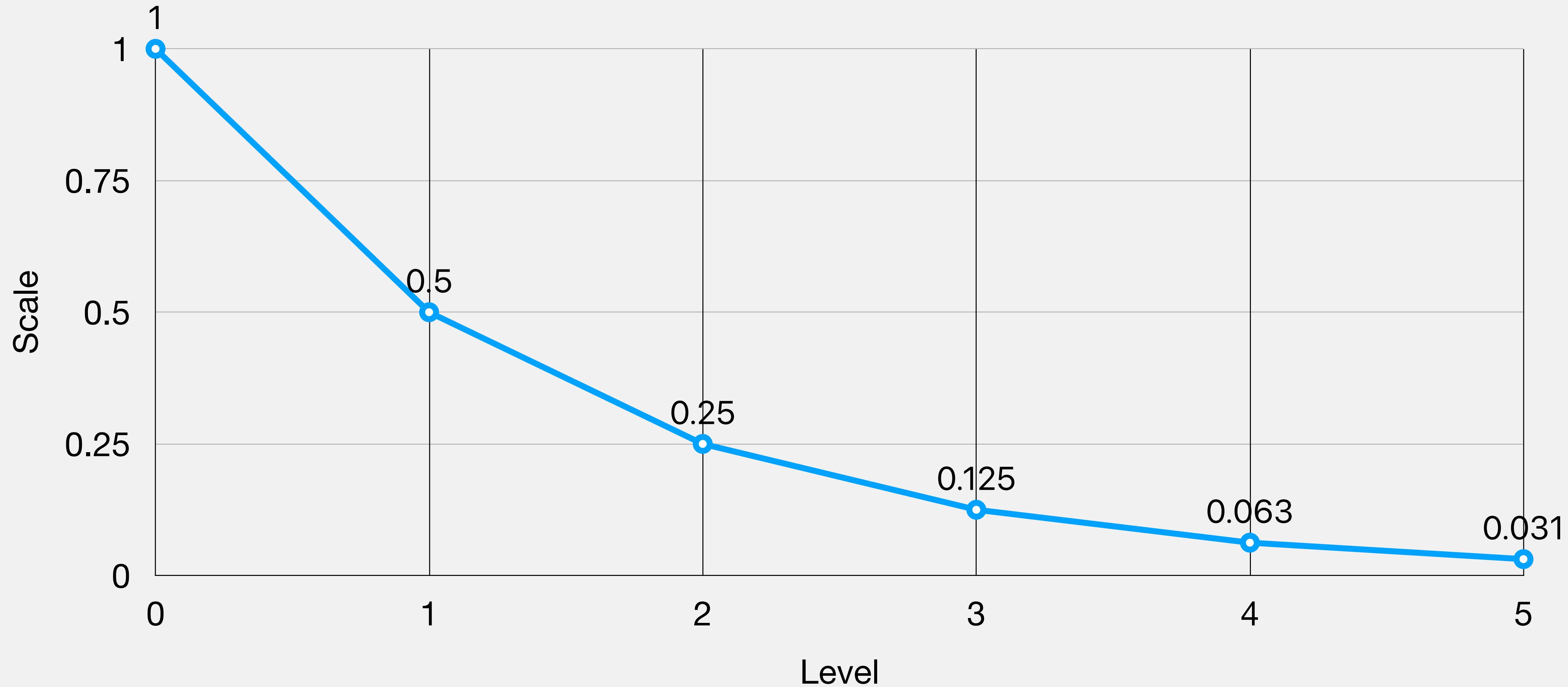
Scale – 0.25
LOD – 2



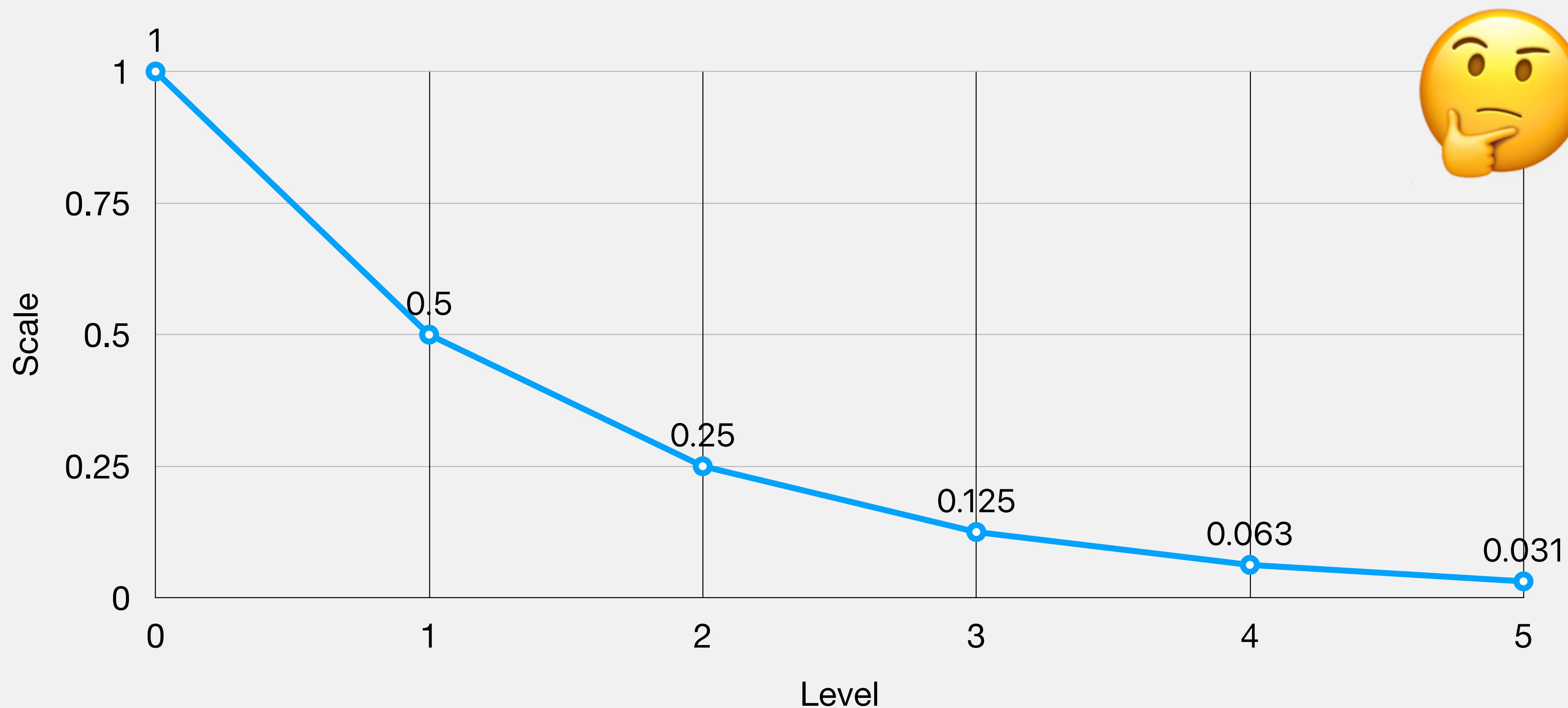
Scale – 0.125
LOD – 3

Image size: 1024
Tile size : 256
levelsOfDetail = 4
levelsOfDetailBias = 1

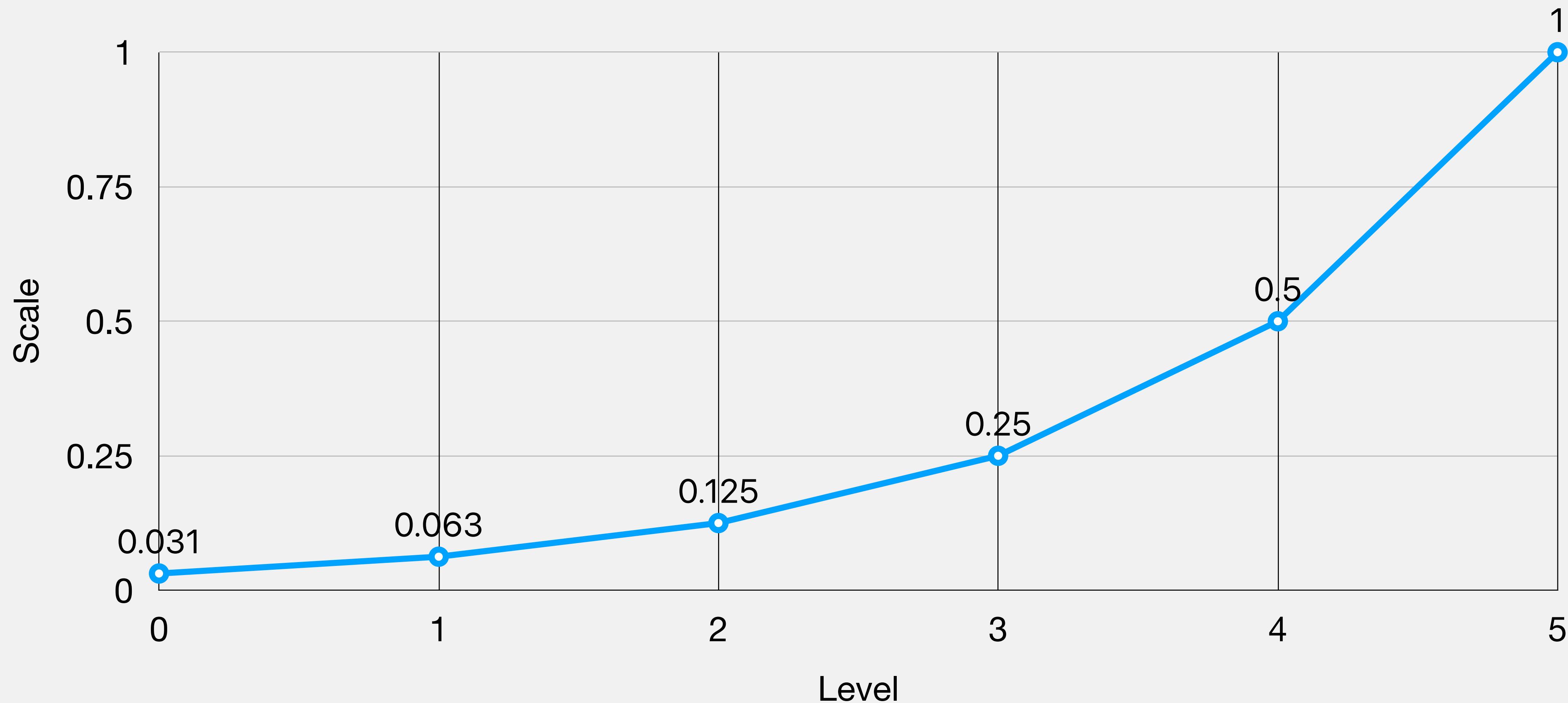
Scale and Level



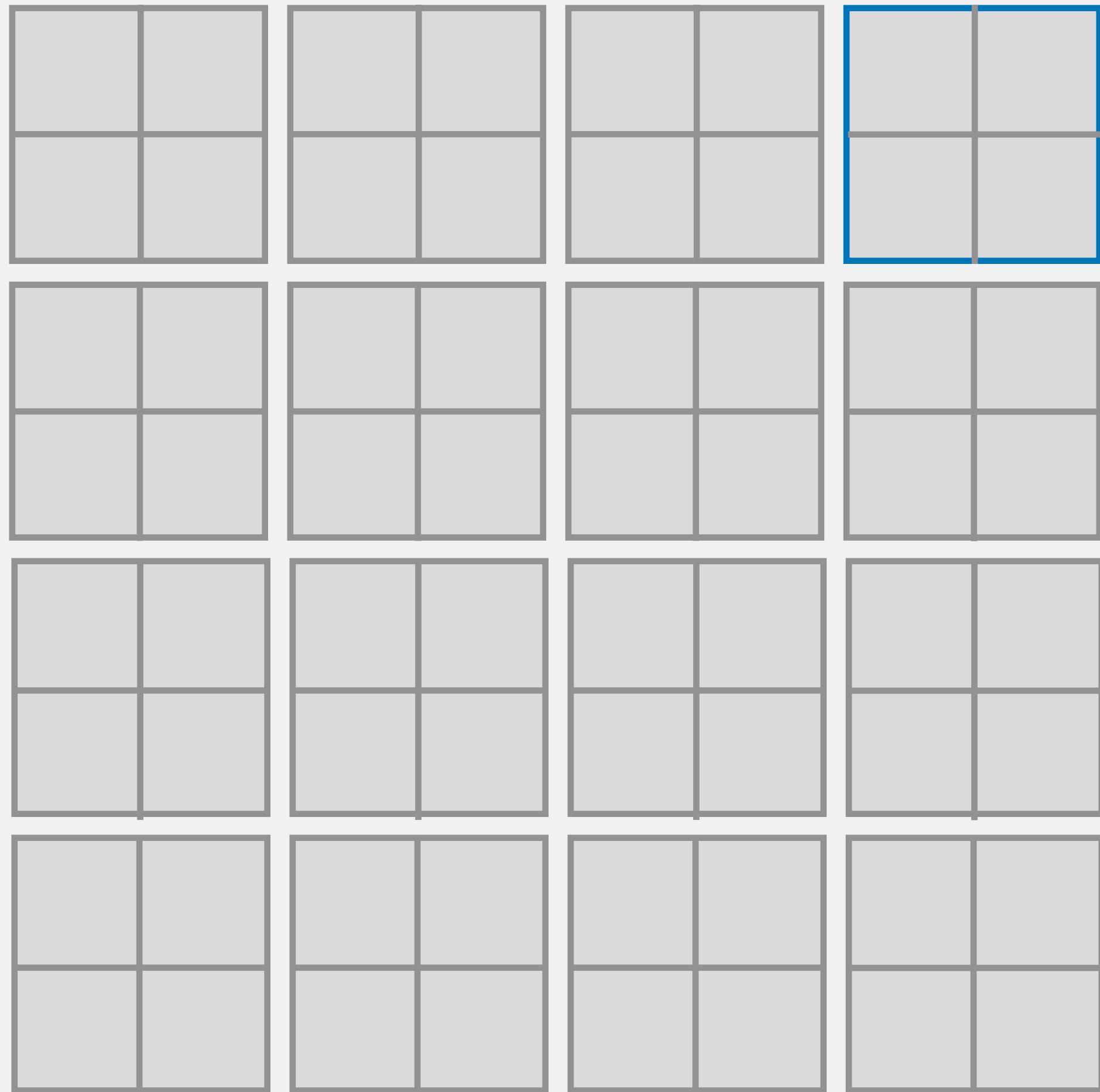
Scale and Level of Details



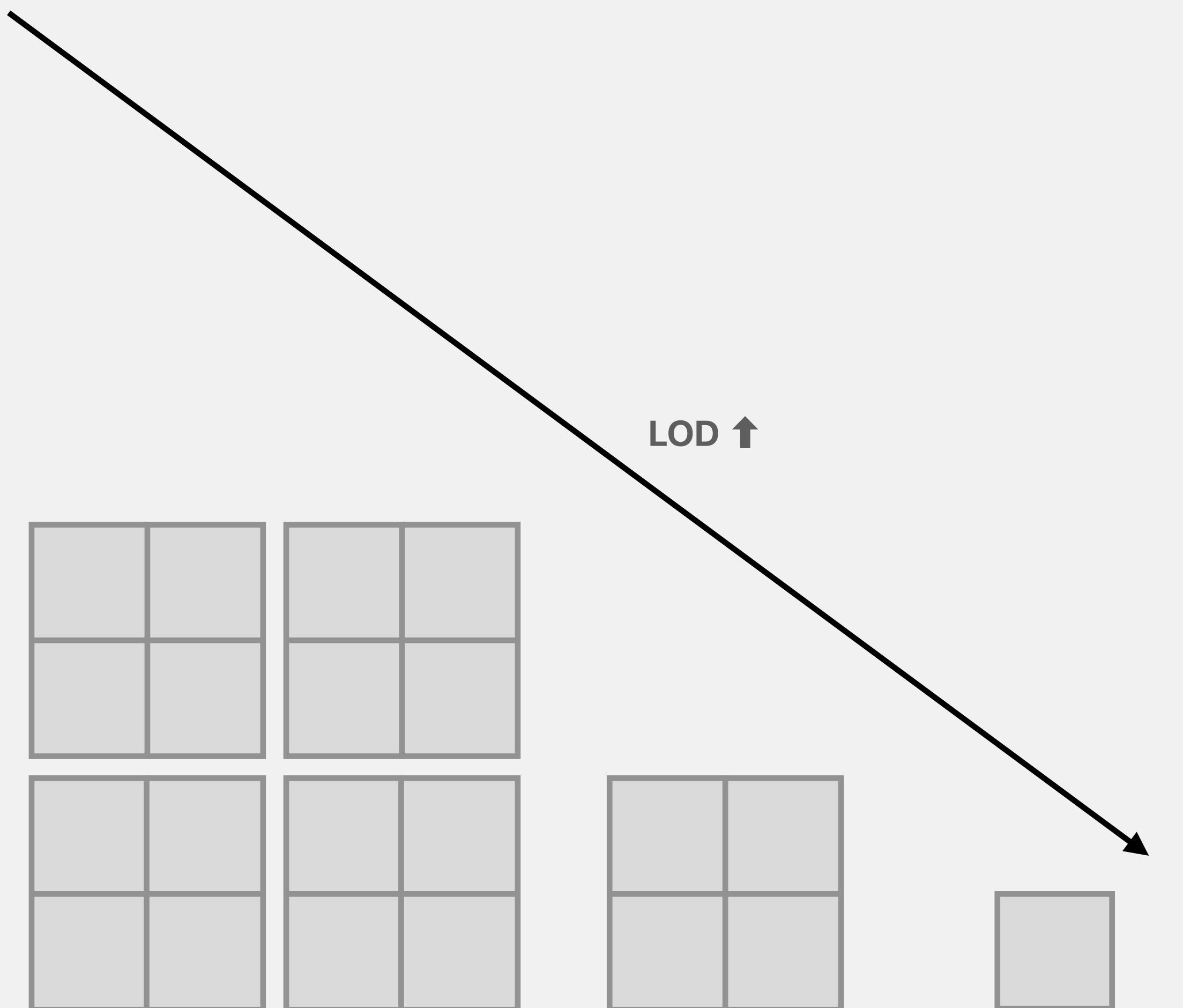
Scale and Level



Scale and Level



Scale – 1.0
LOD – 0

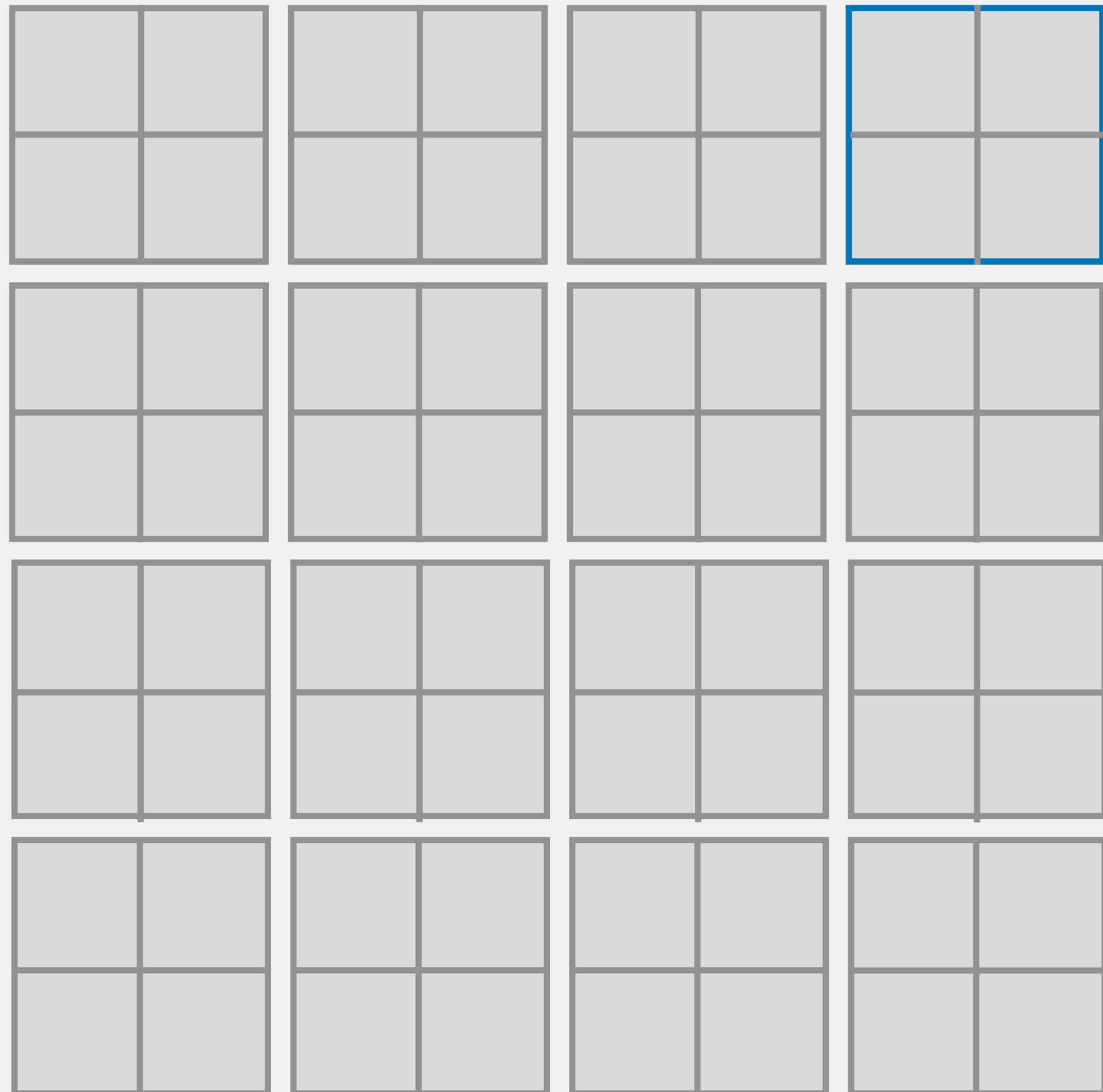


Scale – 0.5
LOD – 1

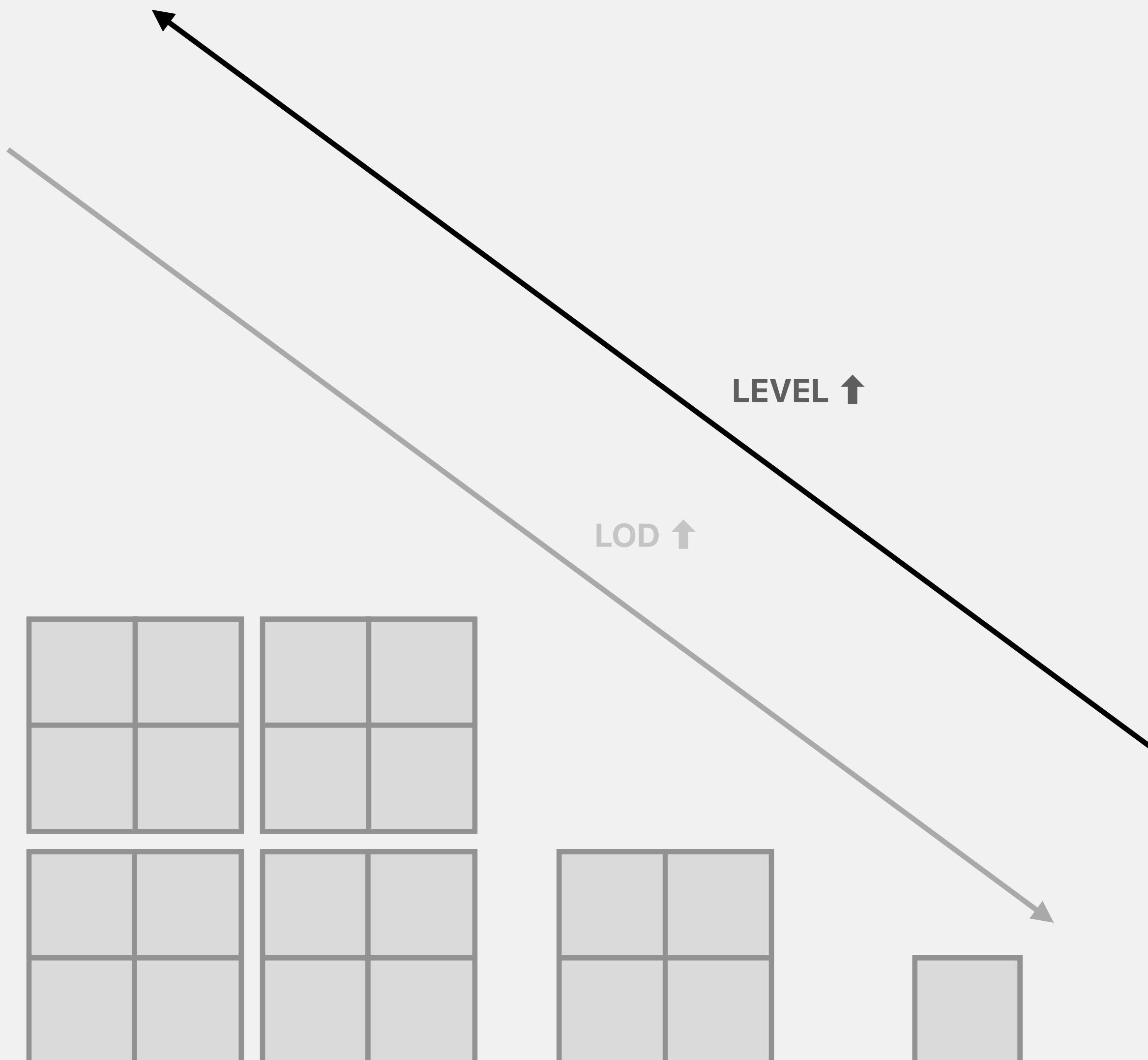
Scale – 0.25
LOD – 2

Scale – 0.125
LOD – 3

Scale and Level



Scale - 1.0
LOD - 0

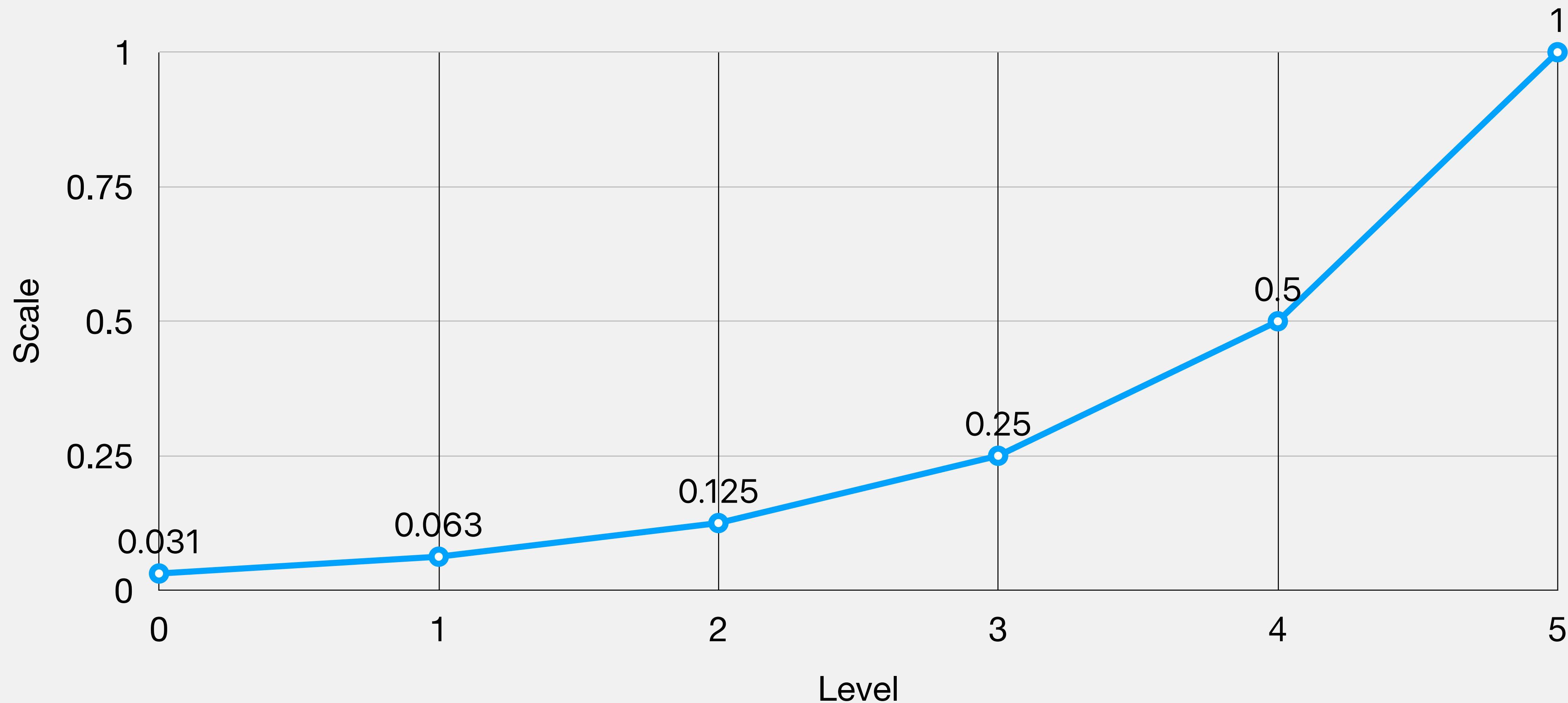


Scale - 0.5
LOD - 1

Scale - 0.25
LOD - 2

Scale - 0.125
LOD - 3

Scale and Level

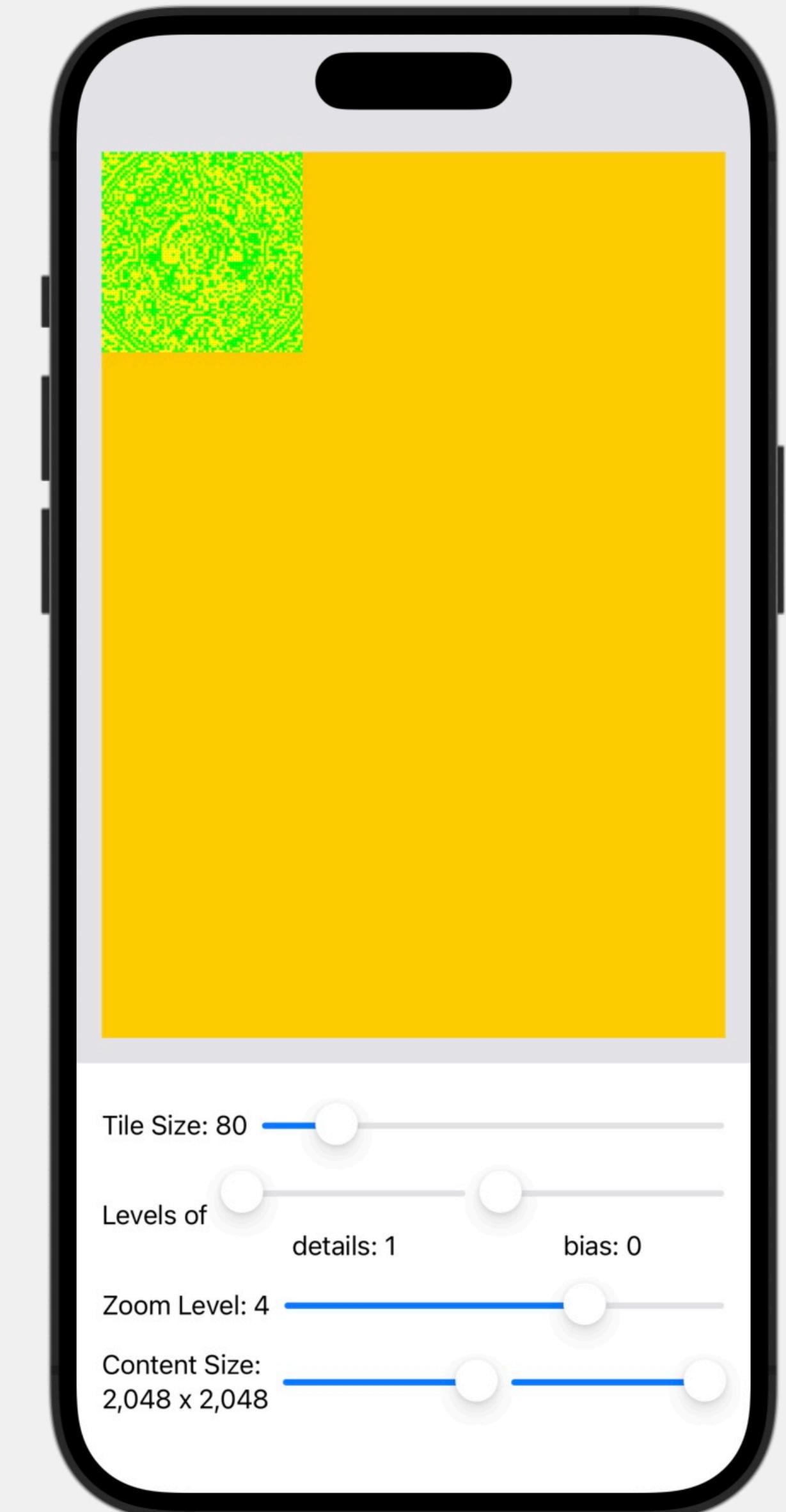


Demo 2

Zoooooomable CATiledLayer

Zoooooomable CATiledLayer Summary

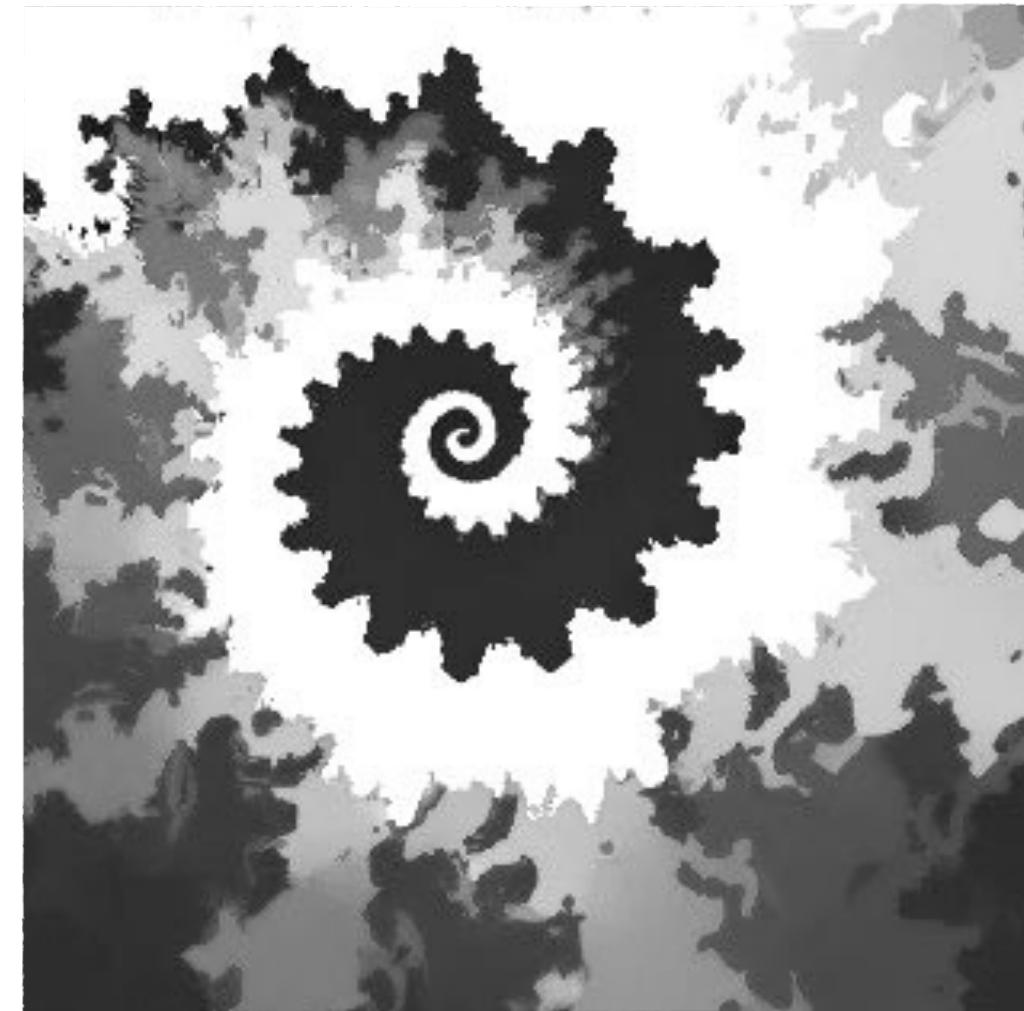
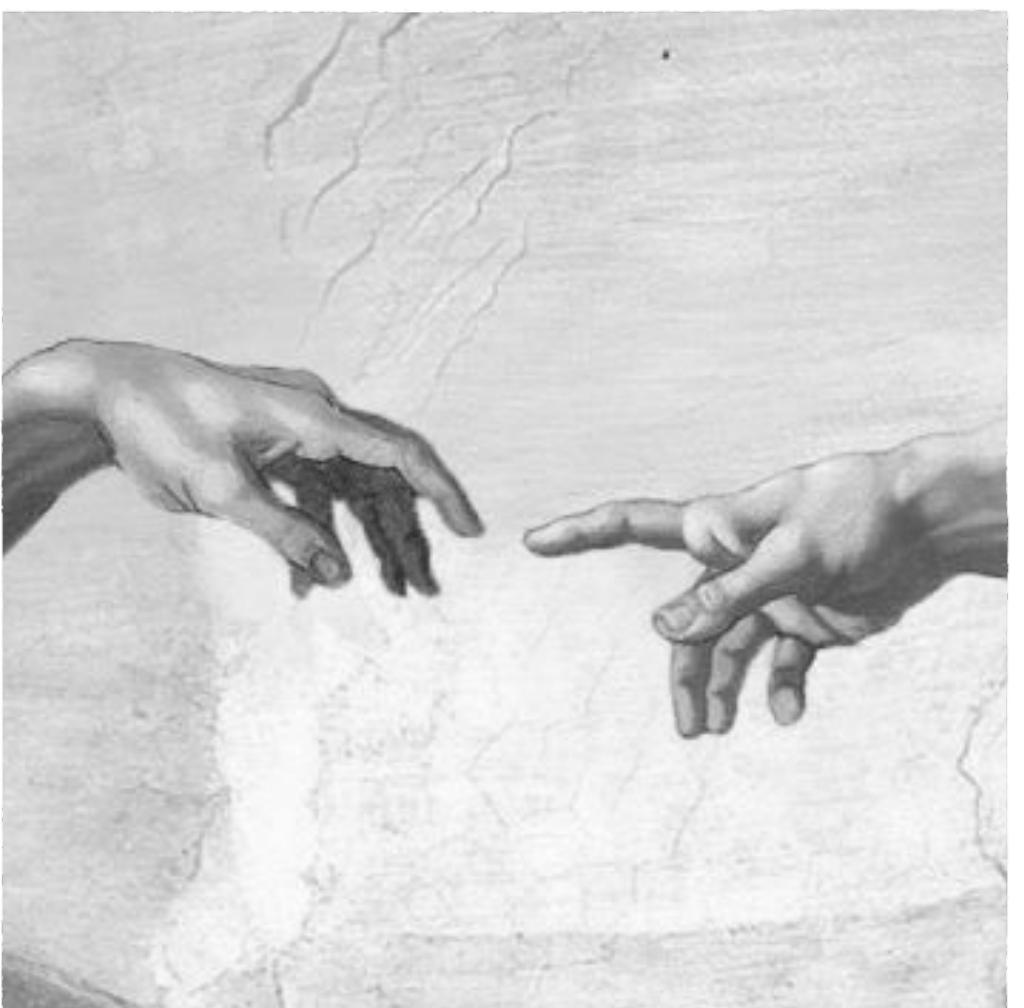
- Set up Zoom in ScrollView
- CATiledLayer-backed UIView
- Zoom Level and Scale
- Played with levelsOfDetails & levelsOfDetailsBias



CATiledLayer

When to use

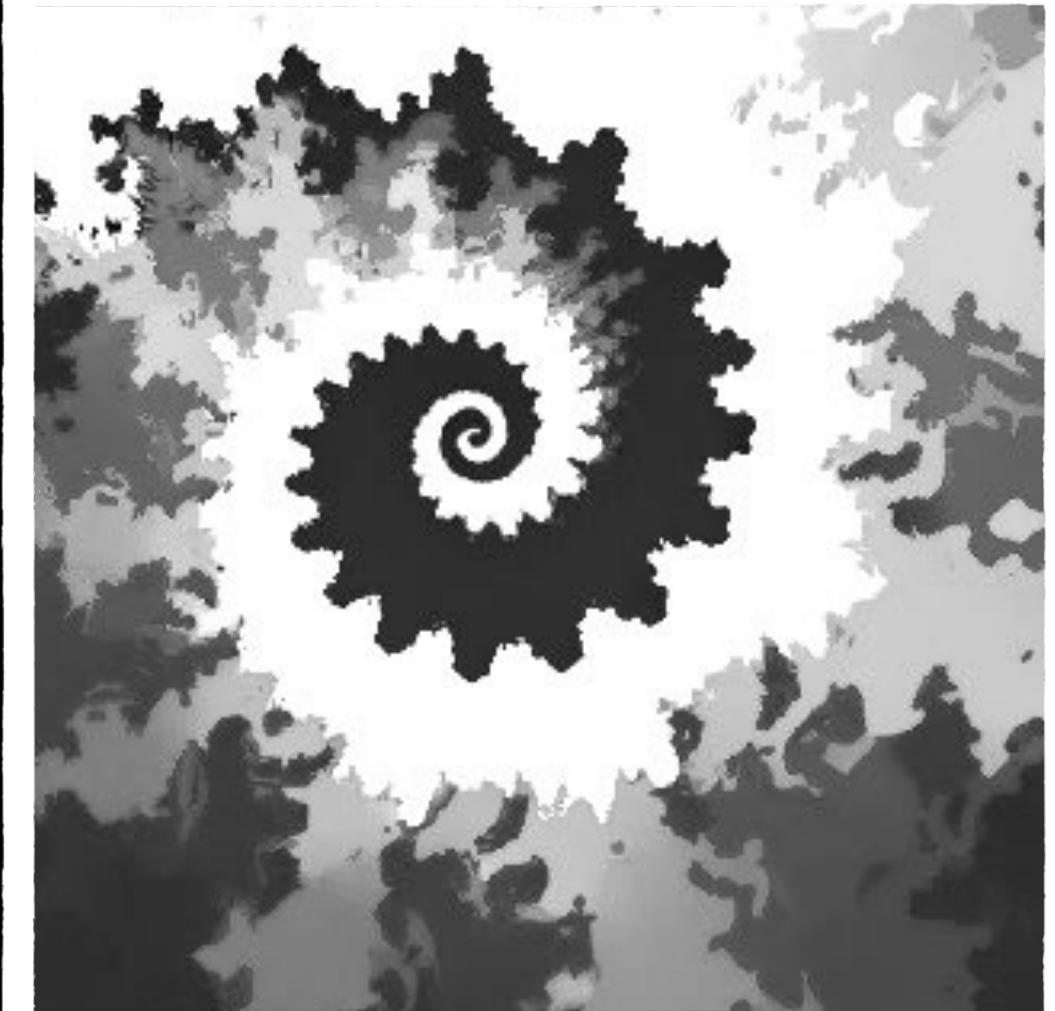
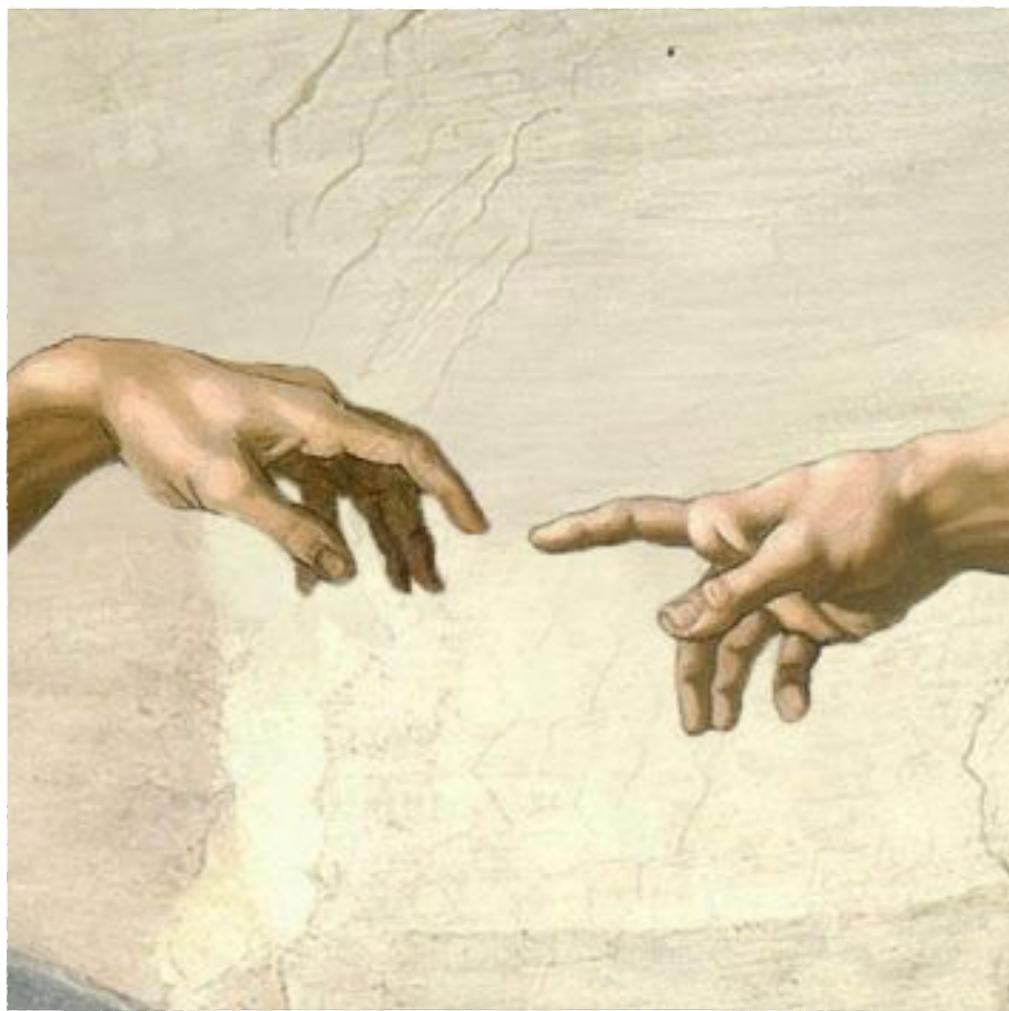
Once upon
midnight dreary,
I pondered, weak
er many a quaint an
forgotten lore, Whil
apping, suddenly there
some one gently rapping,
at my chamber door. "Tis
visitor," I muttered, "tap
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CATiledLayer

When to use

Once upon
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t my chamber door- Only thi
more." Ah, distinctly I rem
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Mega

GigaPixel Images

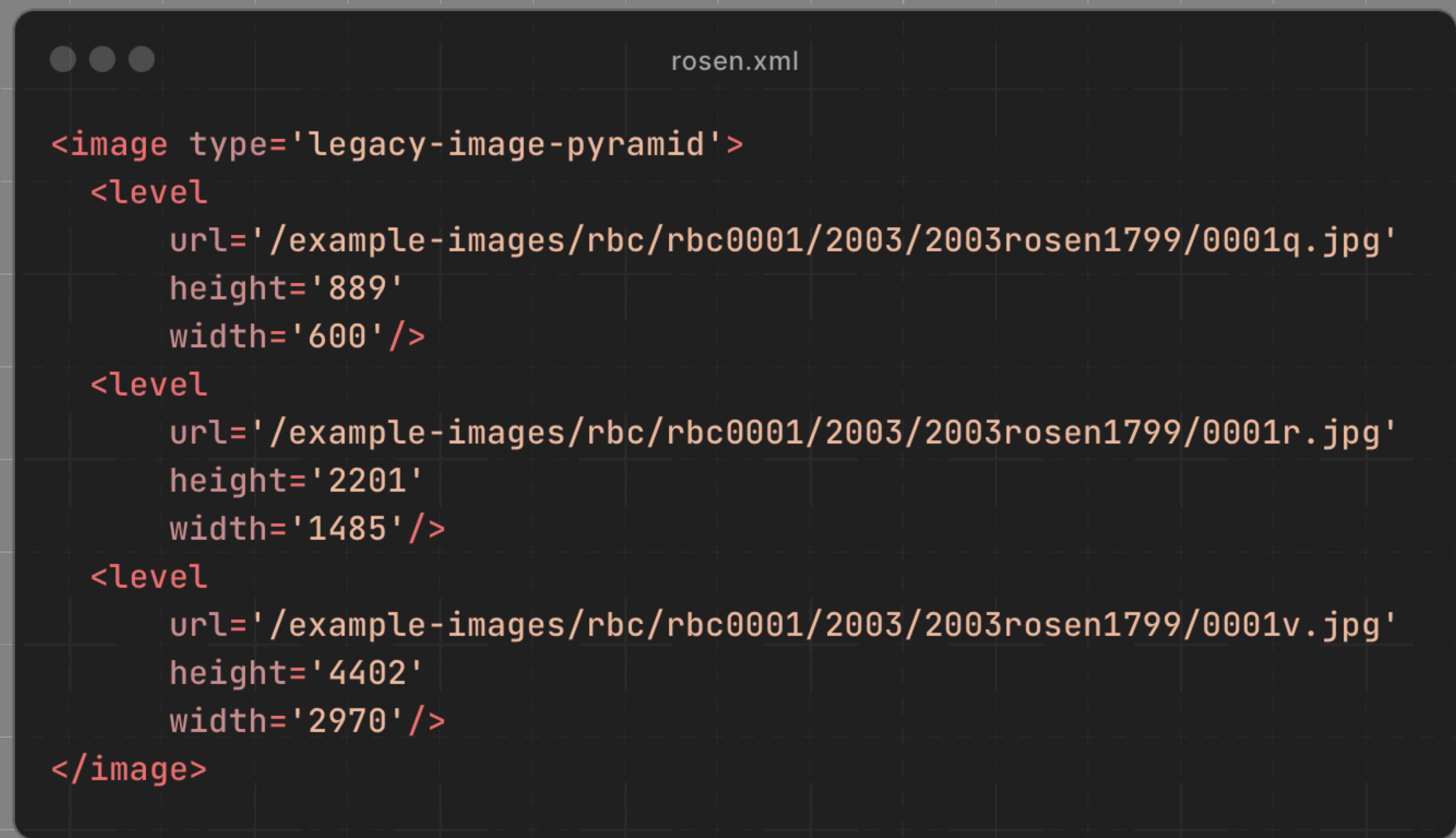
tera
peta

Formats

- **Full images**
 - Simple HTTP
 - Legacy Image Pyramid
- **Region based**
 - IIIF – International Image Interoperability Framework
- **Tile based**
 - Zoomify
 - DZI – Deep Zoom Image
 - TileMap Service
 - Custom

Legacy Image Pyramid Formats

<https://openseadragon.github.io/example-images/rbc/rbc0001/2003/rosen.xml>



Legacy Image Pyramid Formats

[https://openseadragon.github.io/example-images/
rbc/rbc0001/2003/2003rosen1799...](https://openseadragon.github.io/example-images/rbc/rbc0001/2003/2003rosen1799...)



.../0001q.jpg



.../0001r.jpg



.../0001v.jpg

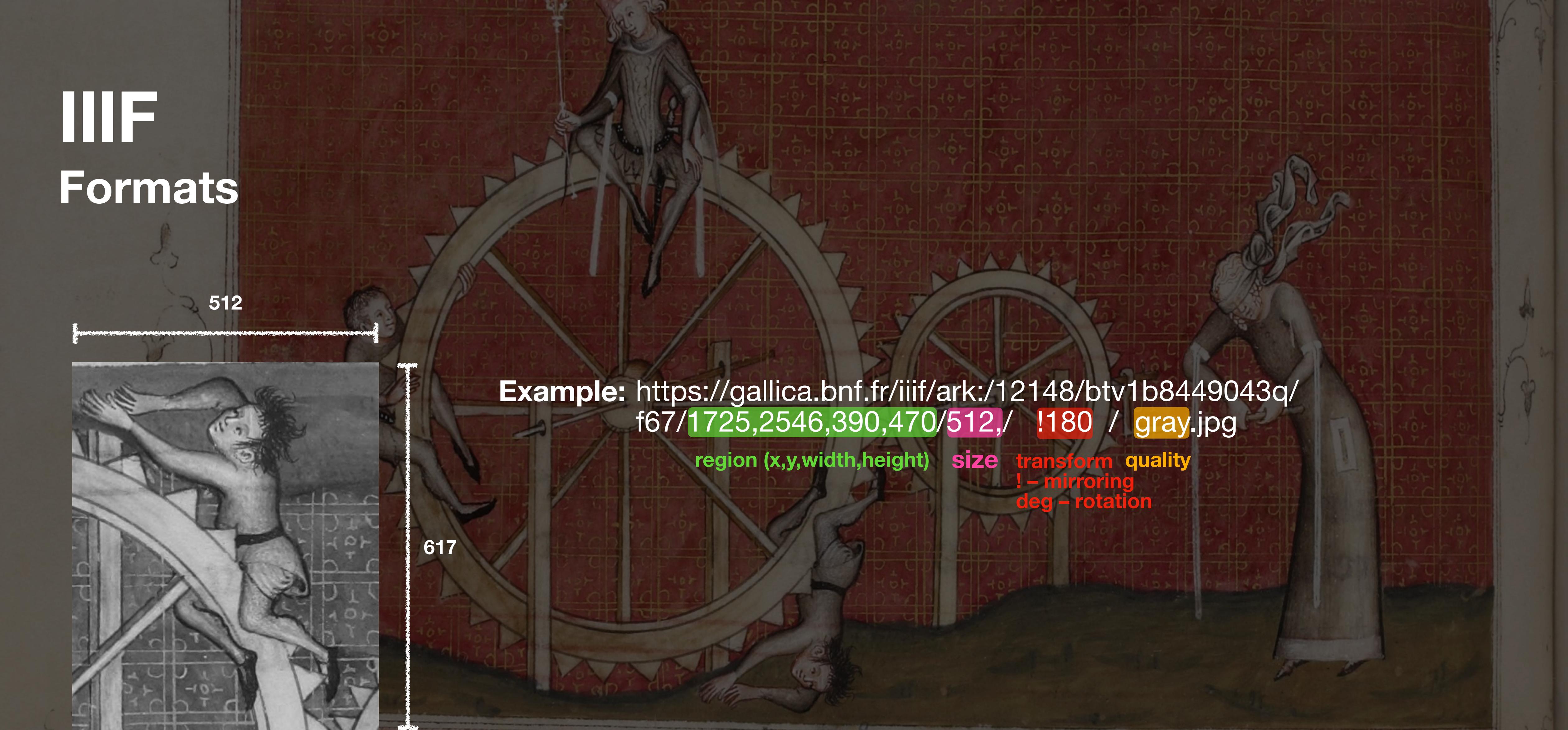
IIIF

Formats

512



617



Example: [https://gallica.bnf.fr/iiif/ark:/12148/btv1b8449043q/
f67/1725,2546,390,470/512,/ !180 / gray.jpg](https://gallica.bnf.fr/iiif/ark:/12148/btv1b8449043q/f67/1725,2546,390,470/512,/!180/gray.jpg)

region (x,y,width,height) size transform quality
! – mirroring
deg – rotation

IIIF: <https://iiif.io/api/image/3.0/>

Et elle n'est
ferme n'estable.

faistre poignant decevable.
Et quat oula au de amable.

64

MapTiles / OSM Formats



512

512

Example: <https://api.maptiler.com/tiles/satellite-v2/18/171392/112059.jpg>

zoom
level

x

y

Zoomify Formats



Zoomify Formats



Example: [https://www.supergigapixel.com/gigapx/607-115/img/
TileGroup1029/11-308-109.jpg](https://www.supergigapixel.com/gigapx/607-115/img/TileGroup1029/11-308-109.jpg)

tile tier col row
group

Size: 392,000 x 48,000

DZI Formats



256

Example: http://boschproject.org/dzi/00MCPVIS_files/17/141_22.jpg

Size: 156,547 x 89,116

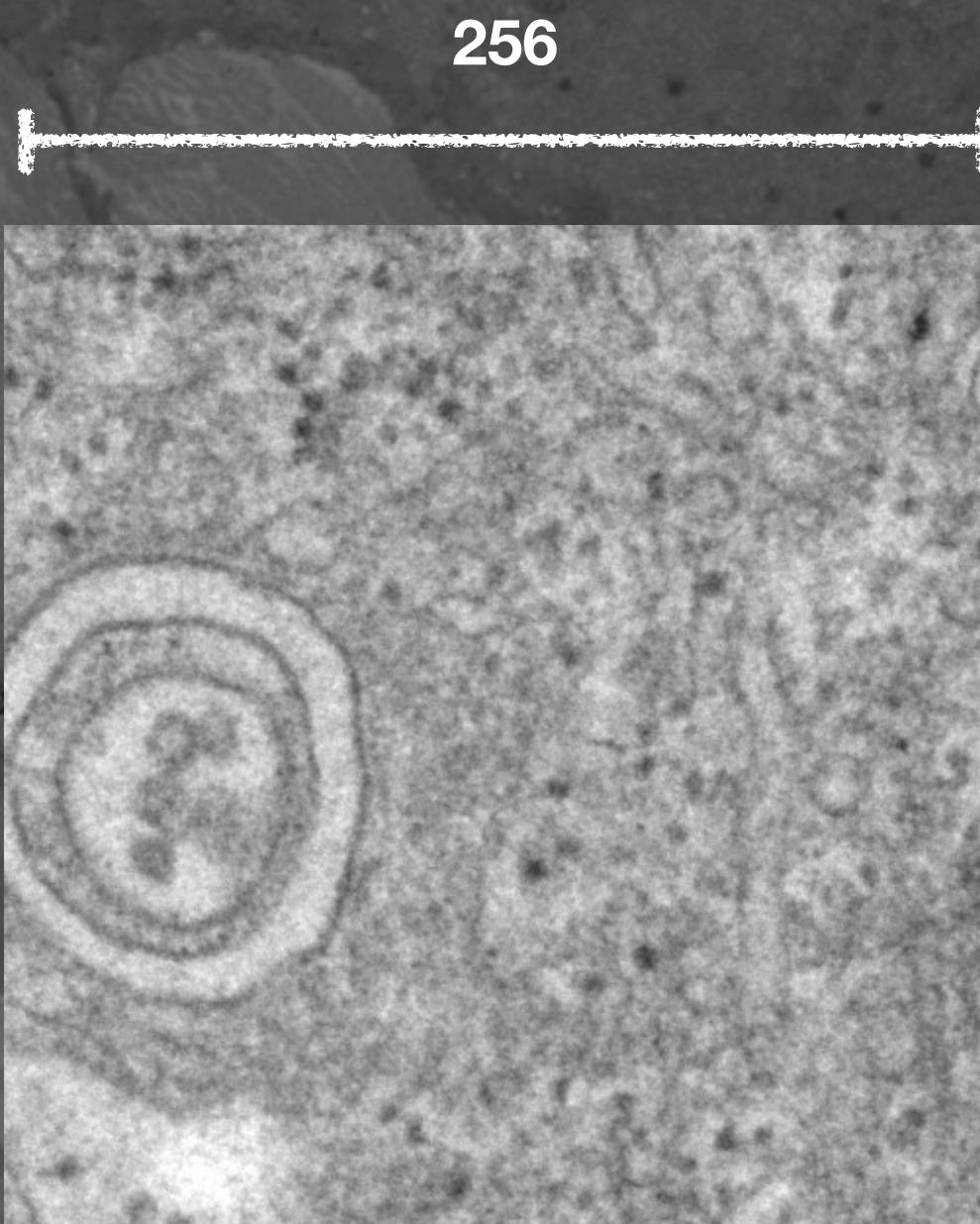
zoom x
level

Img Ref: <http://boschproject.org/view.html?i=00MCPVIS>

DZI: [https://learn.microsoft.com/en-us/previous-versions/windows/silverlight/dotnet-windows-silverlight/cc645077\(v=vs.95\)?redirectedfrom=MSDN](https://learn.microsoft.com/en-us/previous-versions/windows/silverlight/dotnet-windows-silverlight/cc645077(v=vs.95)?redirectedfrom=MSDN)

OMERO

Formats



Example: [https://idr.openmicroscopy.org/webgateway/
render_image_region/4495402/0/0/?tile=0,965,624,512,512&c=1](https://idr.openmicroscopy.org/webgateway/render_image_region/4495402/0/0/?tile=0,965,624,512,512&c=1)

zoom level x y tile size

Size: 921,600 x 380,928

Custom tiles

Formats



Example: [https://artuniverse.eu/media/zoom/
210513-milkyway2gp/5/x6_y32.jpg](https://artuniverse.eu/media/zoom/210513-milkyway2gp/5/x6_y32.jpg)

zoom **x** **y**
level

Size: 53,480 x 41,010

Tile Based Formats

Painting: The Night Watch

Size: 925,000 x 775,000



Img Ref: <https://www.rijksmuseum.nl/en/stories/operation-night-watch>

Tile Based Formats

L3

0

1

2

3

0

3-0-0

3-1-0

3-2-0

3-3-0

1

3-0-1

3-1-1

3-2-1

3-3-1

2

3-0-2

3-1-2

3-2-2

3-3-2

Tile Based Formats



Tile Based Formats



Formats

- **Full images**
 - Simple HTTP
 - Legacy Image Pyramid
- **Region based**
 - IIIF – International Image Interoperability Framework
- **Tile based**
 - Zoomify
 - DZI – Deep Zoom Image
 - TileMap Service
 - Custom

Formats

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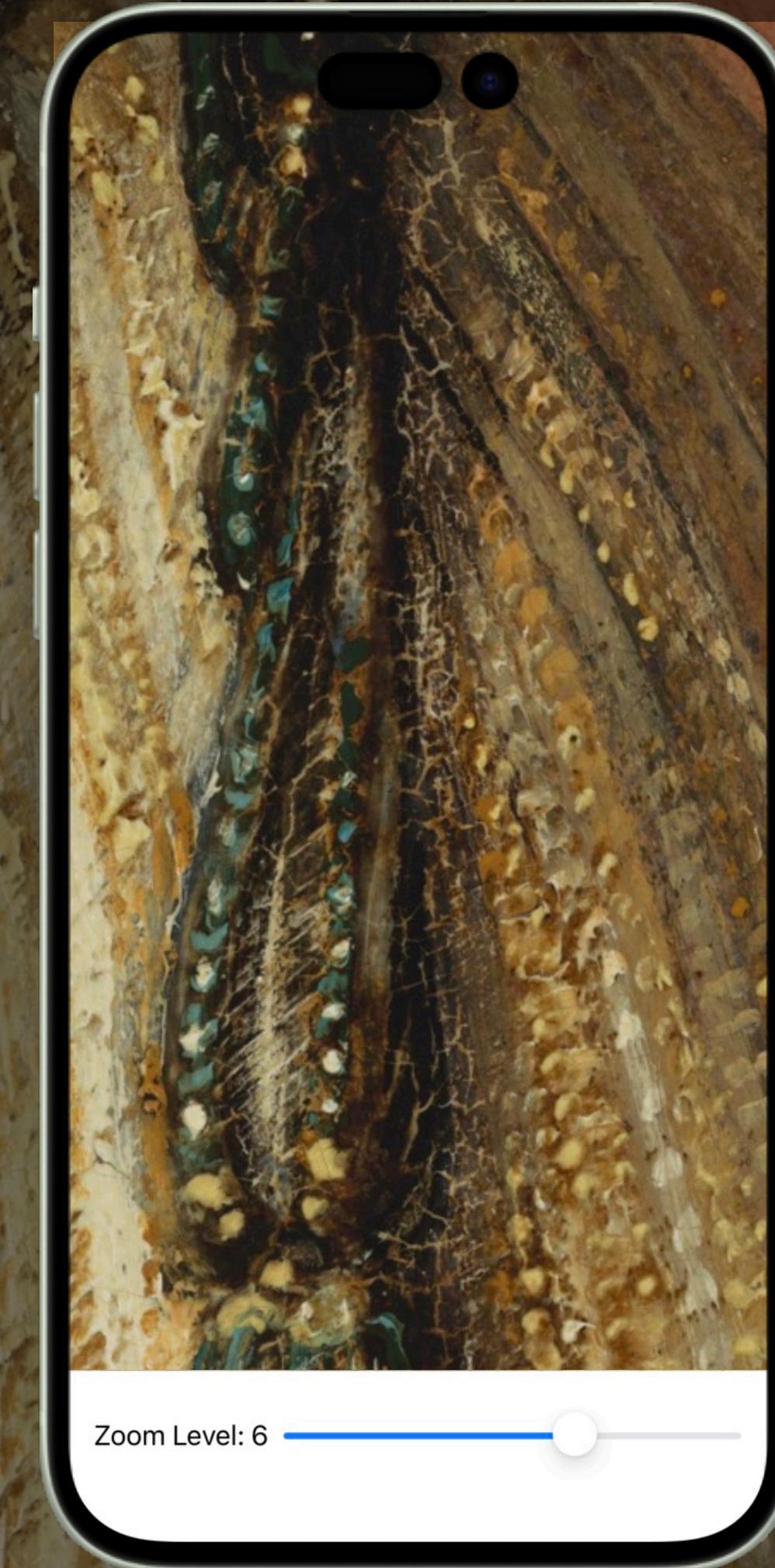
Demo 3

NightWatch Viewer

NightWatch Viewer

Summary

- Universal TileSource
 - Sample DZI implementation
 - Tile Caching mechanic



Summary

-  Covered CATiledLayer basics
-  Tried to use CATiledLayer
-  Met Giga-pixel images
-  Implemented a viewer for gigapixel images in DZI format