

Scrolling
Scrolling
Scrolling
Scrolling
Scrolling techniques for Flutter Desktop
Scrolling
Scrolling
Scrolling
Scrolling

\$ whoami

Renan Araujo

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Work: **OSS Engineer @ Very Good Ventures** 

Twitter: **@reNotANumber**

Site: **caraujo.me**

Packages: **flame**
photo **view**
bitmap
cached_value
swayze
flame **rive**



ME

Flutter
Beginners

I ❤️ User
interfaces

Rich text
Transitions
Gestures
Scrolling
Navigation
Responsiveness
Accessibility

Why it is so important

Scrolling can summarize the performance quality of an app's User interface.



We take things as granted

**There is a lot
going on inside
scroll views**

Gesture inputs
Constant layout changes
Scrolling physics
Lazy loading of content



But why do we take things for granted?

Flutter tackles that challenge gracefully

```
class MyListOfColors extends StatelessWidget {  
  @override  
  Widget build(BuildContext context) {  
    return ListView(  
      children: const [  
        ListItem(color: Colors.blueAccent),  
        ListItem(color: Colors.purpleAccent),  
        ListItem(color: Colors.yellow),  
        ListItem(color: Colors.orangeAccent),  
      ],  
    );  
  }  
}
```

Flutter is extensive as heck

APIs for customising scroll

Slivers

Lazy loading delegates

Scroll activity

Scroll notifications

Scroll physics

Scroll behavior

But why?

I like big tables,
and I cannot lie

A story of making a
Spreadsheet UI
using **Flutter Desktop**
to achieve smooth scrolling
even on **4K** screens

A1

Funding by Location

	A	B	C	D	E	F	G	H	I	J
20 Sub-Saharan Africa	0	0	0	0	0	0	0	0	0	0
21 Western Asia	0	0	0	0	0	0	0	0	0	0
22 Western Europe	0	0	0	0	0	0	0	0	0	0
23 World	0	0	0	0	0	0	0	0	0	0
24										
25 Country (M\$)	2015	2016	2017	2018	2019	2020	2021	Total		
26 Australia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
27 Bangladesh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
28 Belgium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
29 Brazil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
30 Canada	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
31 Chile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
32 China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
33 Colombia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
34 Costa Rica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
35 Denmark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
36 Egypt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
37 Estonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
38 Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
39 France	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
40 Germany	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
41 India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
42 Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
43 Ireland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
44 Israel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
45 Italy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
46 Kenya	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

Multiple tables per page

Scroll in two axis

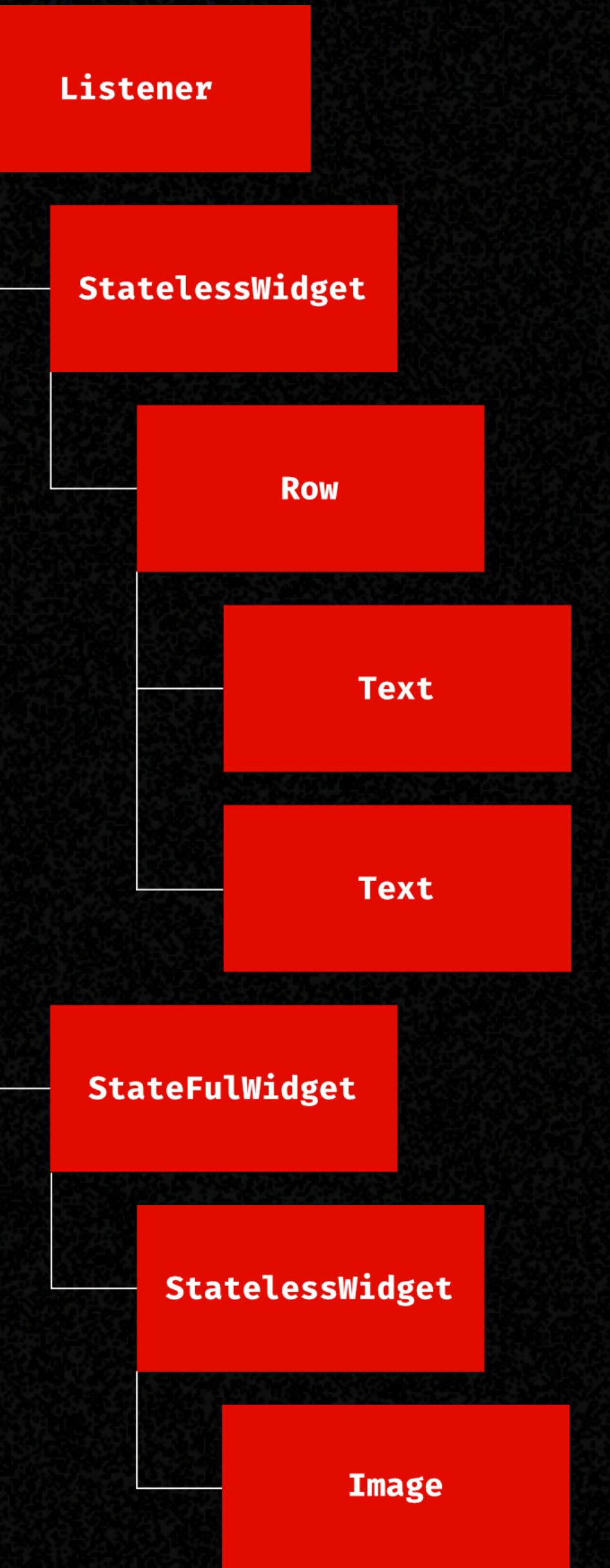
Millions of data units

Continuous scroll during selection



Slivers

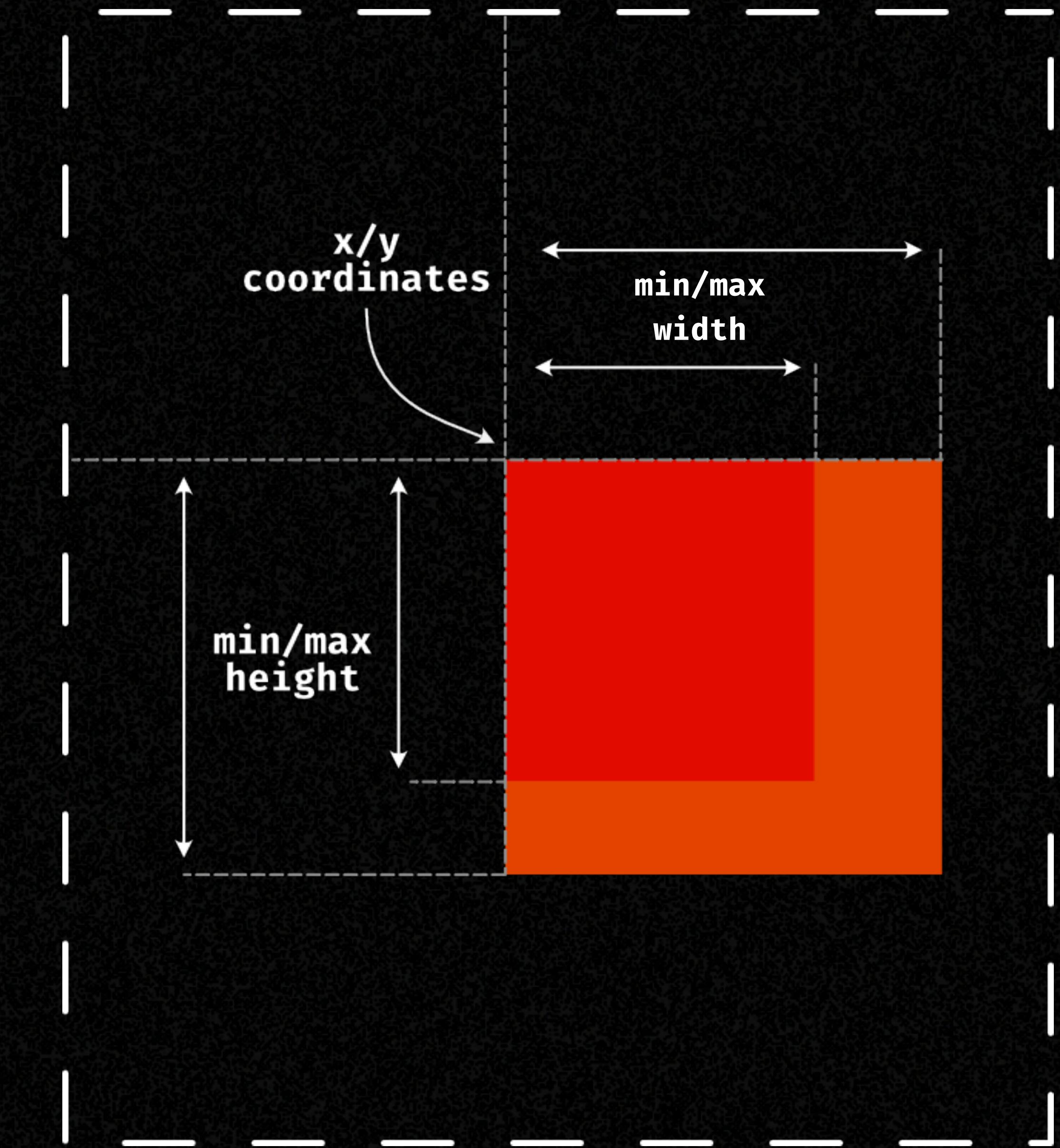
Widget tree



Render Object tree

The box protocol:

**Constraints go down.
Sizes go up.
Parent sets position.**



Explaining like you are a 5 yrs old

Sliver Constraints go down.
Sliver Geometry goes up.
Viewport sets position.



Sliver Constraints

Questions a sliver can ask to a constraint:

Which direction the user is scrolling to?

How many pixels do the slivers before me occupy?

How big is the viewport in the scrolling axis?

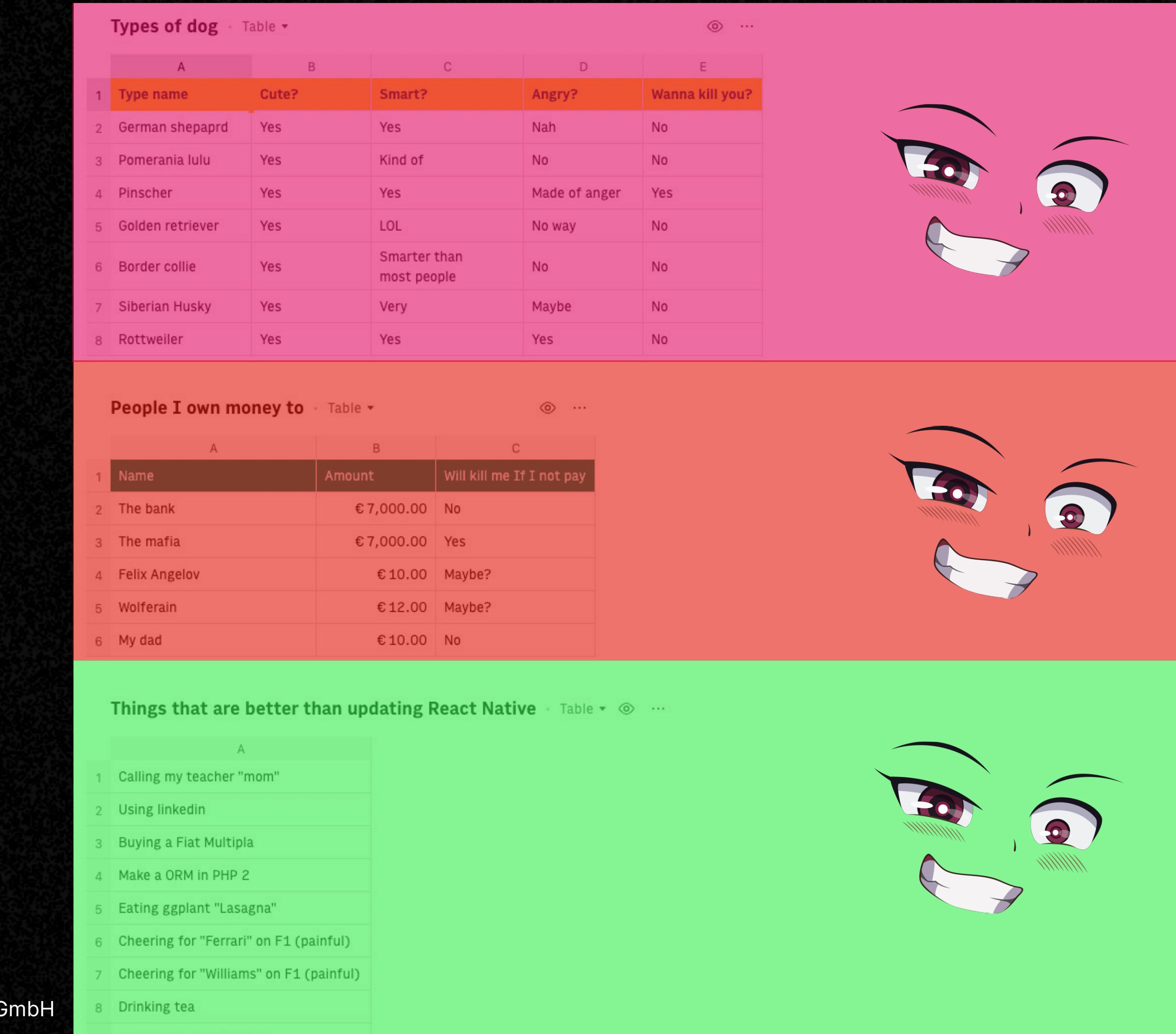
Am I in the viewport?



Each table is a sliver!

```
CustomScrollView(  
  slivers: [  
    SliverTable(/* ... */),  
    SliverTable(/* ... */),  
    SliverTable(/* ... */),  
  ],  
)
```

*illustrative code



The image shows three horizontal rows of tables, each with a different background color and a corresponding cartoon face to its right. The top row has a pink background and features a pink-faced character with purple eyes and a wide smile. The middle row has an orange background and features an orange-faced character with purple eyes and a more neutral expression. The bottom row has a green background and features a green-faced character with purple eyes and a slight smile. Each row contains a table with a header and several data rows.

A	B	C	D	E
1 Type name	Cute?	Smart?	Angry?	Wanna kill you?
2 German shepard	Yes	Yes	Nah	No
3 Pomerania lulu	Yes	Kind of	No	No
4 Pinscher	Yes	Yes	Made of anger	Yes
5 Golden retriever	Yes	LOL	No way	No
6 Border collie	Yes	Smarter than most people	No	No
7 Siberian Husky	Yes	Very	Maybe	No
8 Rottweiler	Yes	Yes	Yes	No

A	B	C
1 Name	Amount	Will kill me If I not pay
2 The bank	€ 7,000.00	No
3 The mafia	€ 7,000.00	Yes
4 Felix Angelov	€ 10.00	Maybe?
5 Wolferain	€ 12.00	Maybe?
6 My dad	€ 10.00	No

A
1 Calling my teacher "mom"
2 Using linkedin
3 Buying a Fiat Multipla
4 Make a ORM in PHP 2
5 Eating ggplant "Lasagna"
6 Cheering for "Ferrari" on F1 (painful)
7 Cheering for "Williams" on F1 (painful)
8 Drinking tea

~~Multiple tables per page~~

Scroll in two axis

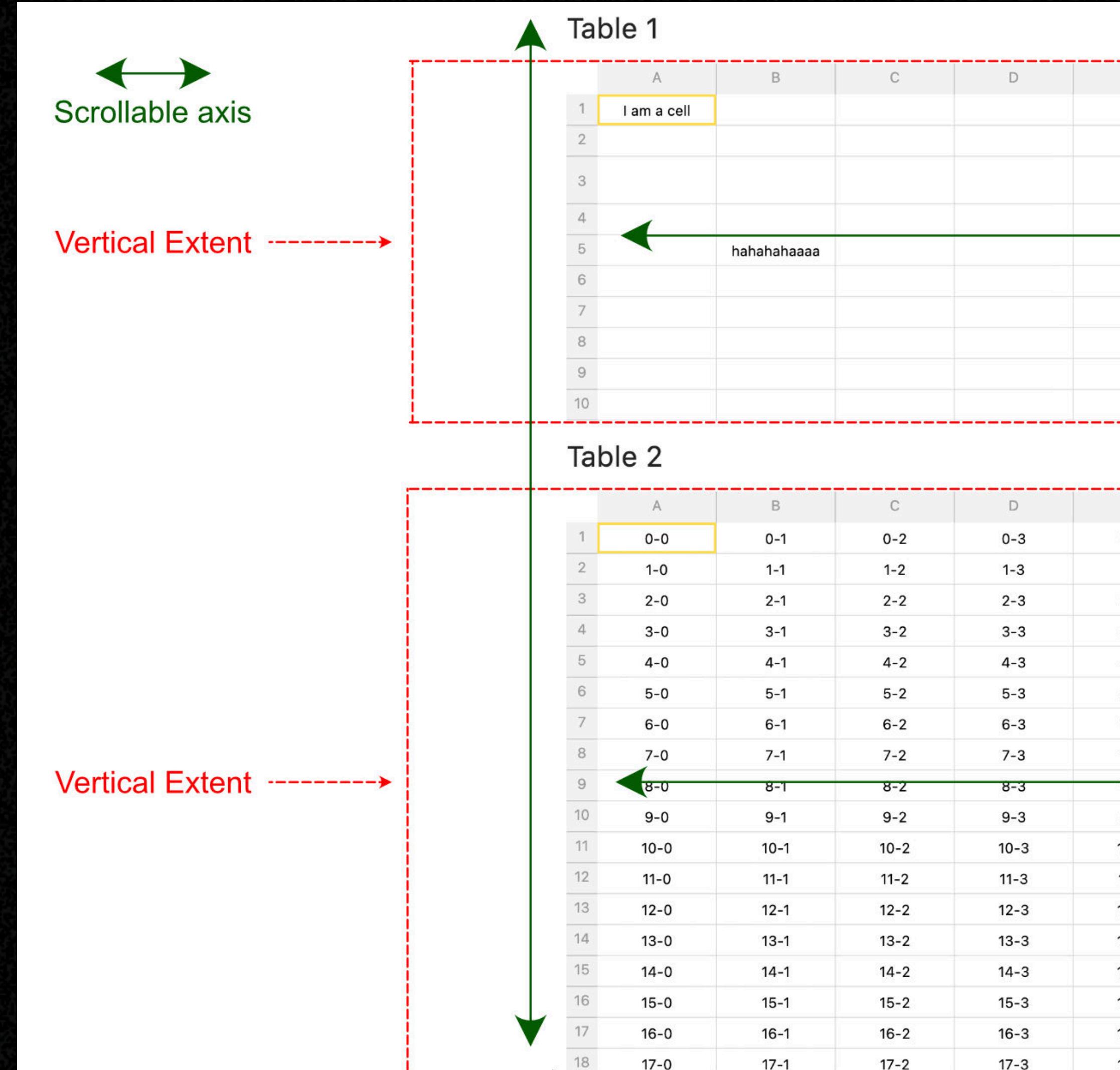
Millions of data units

Continuous scroll during selection

Solving Horizontal scroll

```
/*General View*/
CustomScrollView(
  slivers: [
    SliverToBoxAdapter(
      child: CustomScrollView(
        scrollDirection: Axis.horizontal,
        slivers: [
          InternalContent(/*...*/),
        ],
      ),
    ),
  /*...*/
]
```

*illustrative code



~~Multiple tables per page~~

~~Scroll in two axis~~

Millions of data units

Continuous scroll during selection

A1

Funding by Location

	A	B	C	D	E	F	G	H	I	J	...
20 SUB-Saharan Africa	0	0	0	0	0	0	0	0	0	0	
21 Western Asia	0	0	0	0	0	0	0	0	0	0	
22 Western Europe	0	0	0	0	0	0	0	0	0	0	
23 World	0	0	0	0	0	0	0	0	0	0	
24											
25 Country (M\$)	2015	2016	2017	2018	2019	2020	2021		Total		
26 Australia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
27 Bangladesh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
28 Belgium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
29 Brazil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
30 Canada	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
31 Chile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
32 China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
33 Colombia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
34 Costa Rica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
35 Denmark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
36 Egypt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
37 Estonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
38 Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
39 France	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
40 Germany	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
41 India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
42 Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
43 Ireland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
44 Israel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
45 Italy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
46 Kenya	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

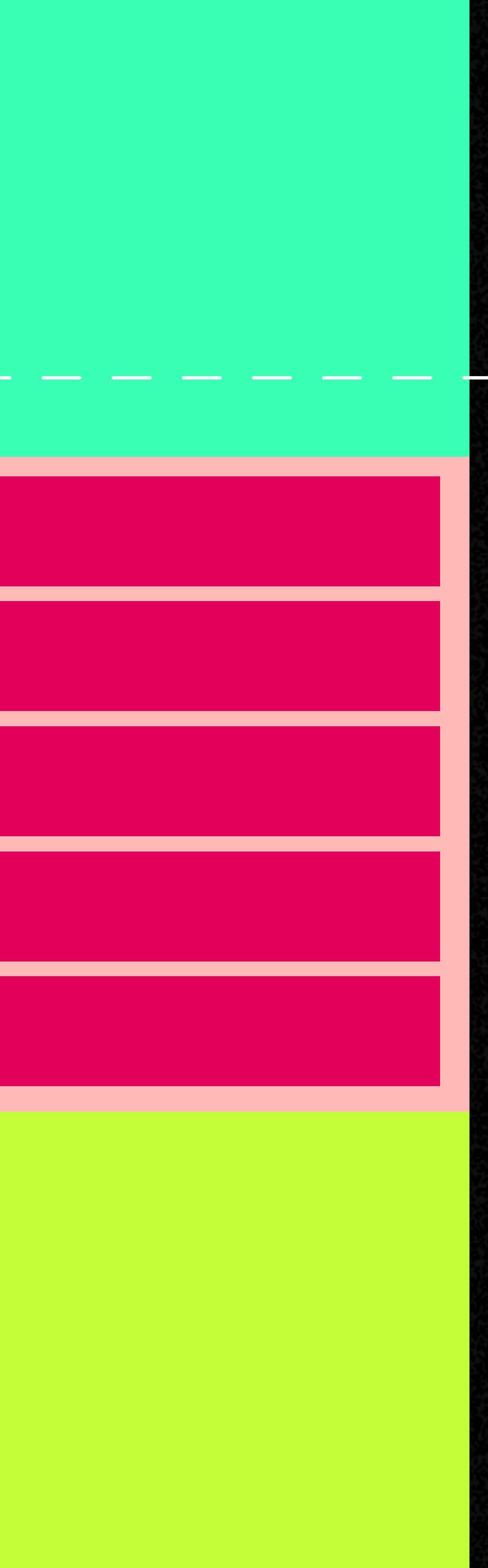
Lazy loading FTW

Understanding how lazy load works

Flutter has some built-in widgets & slivers that are capable of lazy loading

Lazy loading FTW

```
CustomScrollView(  
  slivers: [  
    SomeCyanSliver(),  
    SliverList(  
      delegate: SliverChildBuilderDelegate(  
        (context, index) {  
          return SomePinkRectangleWidget(index: index);  
        },  
        childCount: 1000,  
      ),  
    ),  
    SomeGreenSliver(),  
  ],  
)
```



	A	B	C	D	E
8 Rottweiler	Yes	Yes	Yes	No	

	A	B	C
1	Name	Amount	Will kill me If I not paid
2	The bank	€ 7,000.00	No
3	The mafia	€ 7,000.00	Yes
4	Felix Angelov	€ 10.00	Maybe?
5	Wolferain	€ 12.00	Maybe?
6	My dad	€ 10.00	No

Table 1 • Table ▾

```
CustomScrollView(  
  slivers: [  
    SliverLayoutBuilder(  
      builder: (context, verticalConstraints) { // ← We got one!  
        return SliverToBoxAdapter(  
          child: CustomScrollView(  
            scrollDirection: Axis.horizontal,  
            slivers: [  
              SliverLayoutBuilder(  
                builder: (context, horizontalConstraints) { // ← We got the other  
                  // Booya! we got constraints from both axis!!!  
                  return InternalContent(/* ... */)  
                },  
                ),  
              ],  
              ),  
            );  
          }  
        ),  
      ],  
    )
```

Sliver constraints are the secret sauce

Combining all information we have to achieve lazy loading

“With Constraints from both axis plus the information from the backend regarding columns and rows sizes, it is possible to define exactly which cells to load”

A large grid of squares, likely representing a board or a map. The grid is composed of numerous small squares, some of which are highlighted in a darker shade of brown. A prominent feature is a dashed rectangular border that encloses a cluster of squares in the upper-left quadrant. This dashed border is approximately one-third of the way from the top-left corner to the center of the grid. The overall pattern suggests a game board or a strategic planning tool.

FoodTech Startups											
A1											
Funding by Location											
... List of Startups											
TOP											
Funding by Location											
Employees											
Food Delivery											
Tables											
This page is empty.											
Feedback											
Leave your comments:											
Feedback - Answers											
Support											
Months&Countries											
Fundings											
List of Startups from C...											
+ New page											
63 Portugal											
64 Russia											
65 Saudi Arabia											
66 Singapore											
67 South Korea											
68 Spain											
69 Sweden											
70 Switzerland											
71 TAN											
72 Thailand											
73 Turkey											
74 Ukraine											
75 United Arab Emirates											
76 United Kingdom											
77 United States											
78 World											
79 World Funding											
80 2015 2016 2017 2018 2019 2020 2021 Total											
81 Values in M\$ 4,221.9 7,330.6 10,241.4 10,046.1 7,177.4 8,843.8 28,837.6 70,698.8											
Employees											
... # Employees # Startups											
1 1-10 57											
2 11-50 113											
3 51-100 45											
4 101-250 42											
5 251-500 23											
6 501-1k 17											
7 1k+ 48											
8 5-10k 11											
9 10k+ 14											
11 Total 370											
Food Delivery											
A B C D E F G H I J K L M N O											
1 Logo Website Company Status Founded Country Sub-Region Region (M\$) Total Last Funding per year Number of Description Crunchbase LinkedIn URL											
2 On Funding Funding since 2015 (M\$) Employees URL LinkedIn URL											
3 &pizza andpizza.com &pizza operating Jan 2012 United States Northern America Americas 79.2 Oct 2017 251-500 &pizza is a pizza and craft beverage brand crunchbase.com/organization/pizza-& pizza linkedin.com/company/&pizza											
4 2ndKitchen 2ndKitchen operating Jan 2017 United States Northern America Americas 4.4 Feb 2019 1-10 2ndKitchen enables businesses without a kitchen to serve food seamlessly using a custom menu from ne crunchbase.com/organization/2ndkitchen linkedin.com/company/2ndkitchen/											
5 fortyeighteast 48East acquired Aug 2016 India Southern Asia Asia 0.8 Feb 2017 51-100 48East is online food delivery startup crunchbase.com/organization/48east linkedin.com/company/48-east											
6 abokado abokado.com Abokado operating Jan 2002 United Kingdom Northern Europe Europe 4.1 May 2018 251-500 Abokado owns and operates a chain of food bars and restaurants in the United Kingdom. crunchbase.com/organization/abokado linkedin.com/company/abokado/											
7 africajuice africajuice.com africajuice operating Jan 2009 Netherlands Western Europe Europe 3.5 Jan 2010 1001-5000 africajuice is a producer and exporter of tropical fruit juices based in Africa. crunchbase.com/organization/africajuice linkedin.com/company/beta/252288/											
8 akivastore akivastore.com Akiva Superfoods operating Jan 2016 India Southern Asia Asia 2.5 Jul 2019 101-250 Akiva Superfoods is one of the fastest growing wellness food FMCG companies in india. crunchbase.com/organization/akivastore linkedin.com/company/akivastore/?originalSubdomain=in											
9 alacouch alacouch.com à la couch operating Jan 2018 United States Northern America Americas 1.3 Oct 2018 1-10 à la couch is a delivery-focused restaurant group crunchbase.com/organization/alacouch linkedin.com/company/alacouch/											
10 AlbertsonsCompanies Albertsons Companies IPO Jul 1939 United States Northern America Americas 1,750.0 May 2020 10000+ Albertsons Companies is one of the food and drug retailers in the United States. crunchbase.com/organization/AlbertsonsCompanies linkedin.com/company/AlbertsonsCompanies											

~~Multiple tables per page~~

~~Scroll in two axis~~

~~Millions of data units~~

Continuous scroll during selection

Some spreadsheet

- Page1
 - Types of dog
 - People I own money to
- Table 1
- Things that are better t
- Table 2

+ New page

J3 Content

People I own money to • Table ▾

	A	B	C
4	Felix Angelov	€ 10.00	Maybe?
5	Wolferain	€ 12.00	Maybe?
6	My dad	€ 10.00	No

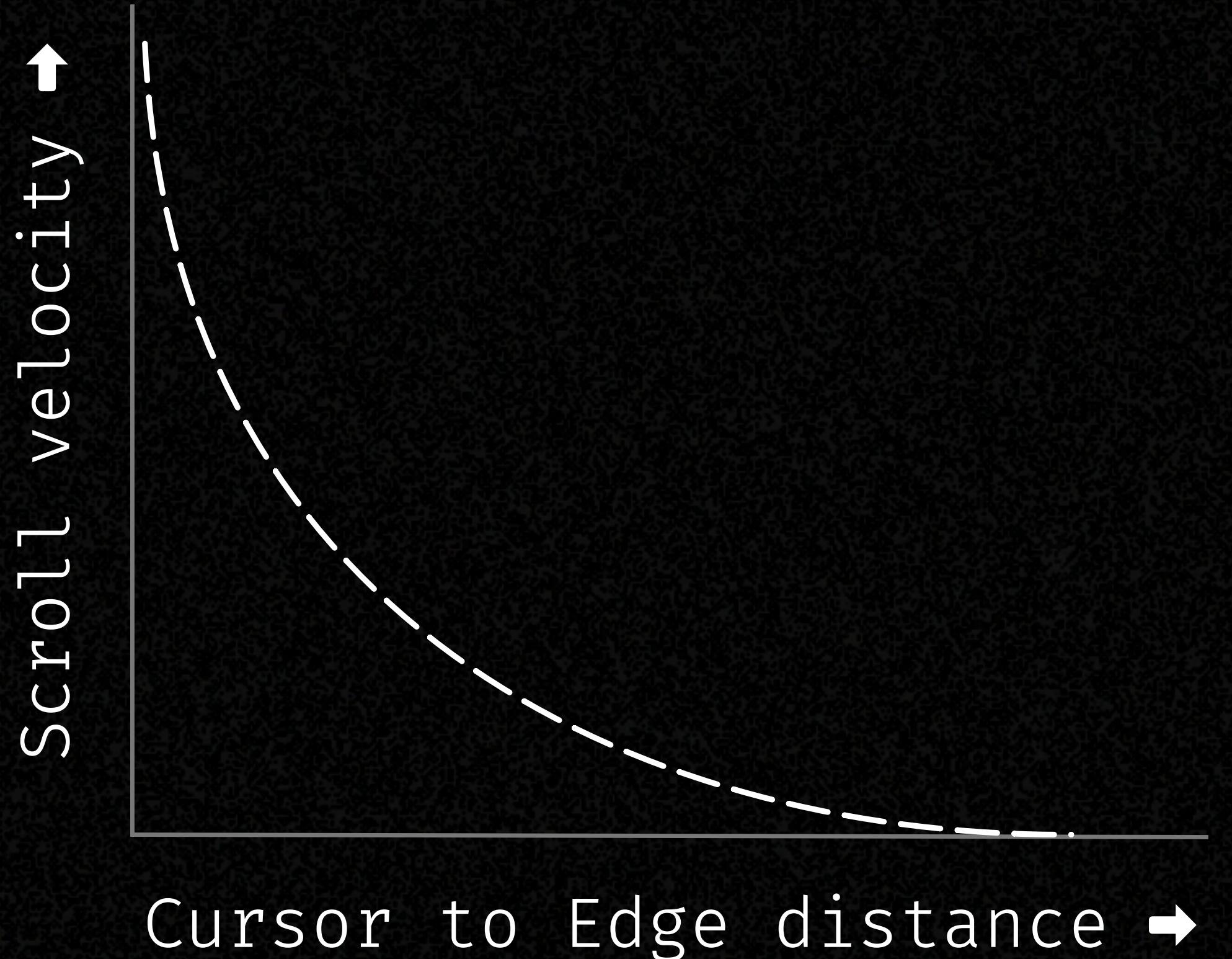
Table 1 • Table ▾

H	I	J	K	L	M	N
1 ent	Content	Content	Content	Something	Something	Something
2 ent	Content	Content	Content	Something	Something	Something
3 ent	Content	Content	Content	Something	Something	Something
4 ent	Content	Content	Content	Something	Something	Something
5 ent	Content	Content	Content	Something	Something	Something
6 ent	Content	Content	Content	Something	Something	Something
7 ent	Content	Content	Content	Something	Something	Something

The screenshot shows a spreadsheet application interface. On the left, a sidebar lists several items: 'Page1' (with 'Types of dog' and 'People I own money to' under it), 'Table 1' (selected and highlighted in grey), 'Things that are better t', 'Table 2', and '+ New page'. The main workspace contains two tables. The top table is titled 'People I own money to' and has 4 rows and 3 columns. The bottom table is titled 'Table 1' and has 7 rows and 7 columns. The cell at row 3, column 5 of 'Table 1' is highlighted with a yellow box and has a circular arrow icon over it, indicating it is selected or being edited.

Formula to convert pointer position proximity to edge of the screen into scrolling velocity

Velocity is constant while a pointer is close to the edge of the viewport



Scroll Activities

Describing a ephemeral state of a scroll view

ScrollPosition:

- Scrolled pixels
- Scroll gesture started
- Is the user performing the drag
- Is it scrolling after the user dragged (fling)?



Custom ScrollActivity

+ the game loop

```
class AutoScrollActivity extends ScrollActivity {
    /// ...

    late _ScrollTicker ticker = _ScrollTicker(onTick);

    @visibleForTesting
    void onTick(double deltaTime) {
        if (scrolledAccumulator >= maxToScroll) {
            delegate.goIdle();
            return;
        }
        var distance = deltaTime * velocity;
        final deltaDistance = direction == GrowthDirection.forward ? -distance : distance;
        if (deltaDistance == 0) {
            return;
        }
        delegate.applyUserOffset(deltaDistance);
    }

    @override
    double get velocity {
        final distanceRatio = pointerDistance / kAutoScrollTriggerThreshold;
        final powerVelocity = pow(3.0, distanceRatio).toDouble() - 1;
        return min<double>(powerVelocity, _kMaxVelocity);
    }

    @override
    void dispose() {
        ticker.dispose();
        super.dispose();
    }
}
```

Some spreadsheet

- Page1
 - Types of dog
 - People I own money to
- Table 1
- Things that are better t
- Table 2

+ New page

J3 Content

People I own money to • Table ▾

	A	B	C
4	Felix Angelov	€ 10.00	Maybe?
5	Wolferain	€ 12.00	Maybe?
6	My dad	€ 10.00	No

Table 1 • Table ▾

H	I	J	K	L	M	N
1 ent	Content	Content	Content	Something	Something	Something
2 ent	Content	Content	Content	Something	Something	Something
3 ent	Content	Content	Content	Something	Something	Something
4 ent	Content	Content	Content	Something	Something	Something
5 ent	Content	Content	Content	Something	Something	Something
6 ent	Content	Content	Content	Something	Something	Something
7 ent	Content	Content	Content	Something	Something	Something

The screenshot shows a spreadsheet application window with a dark theme. On the left, there's a sidebar with a tree view of the document structure. The main area displays two tables. The top table, titled "People I own money to", has columns A, B, and C. The bottom table, titled "Table 1", has columns from H to N. The cell at row 3, column K is highlighted with a yellow box and circled with a red marker.

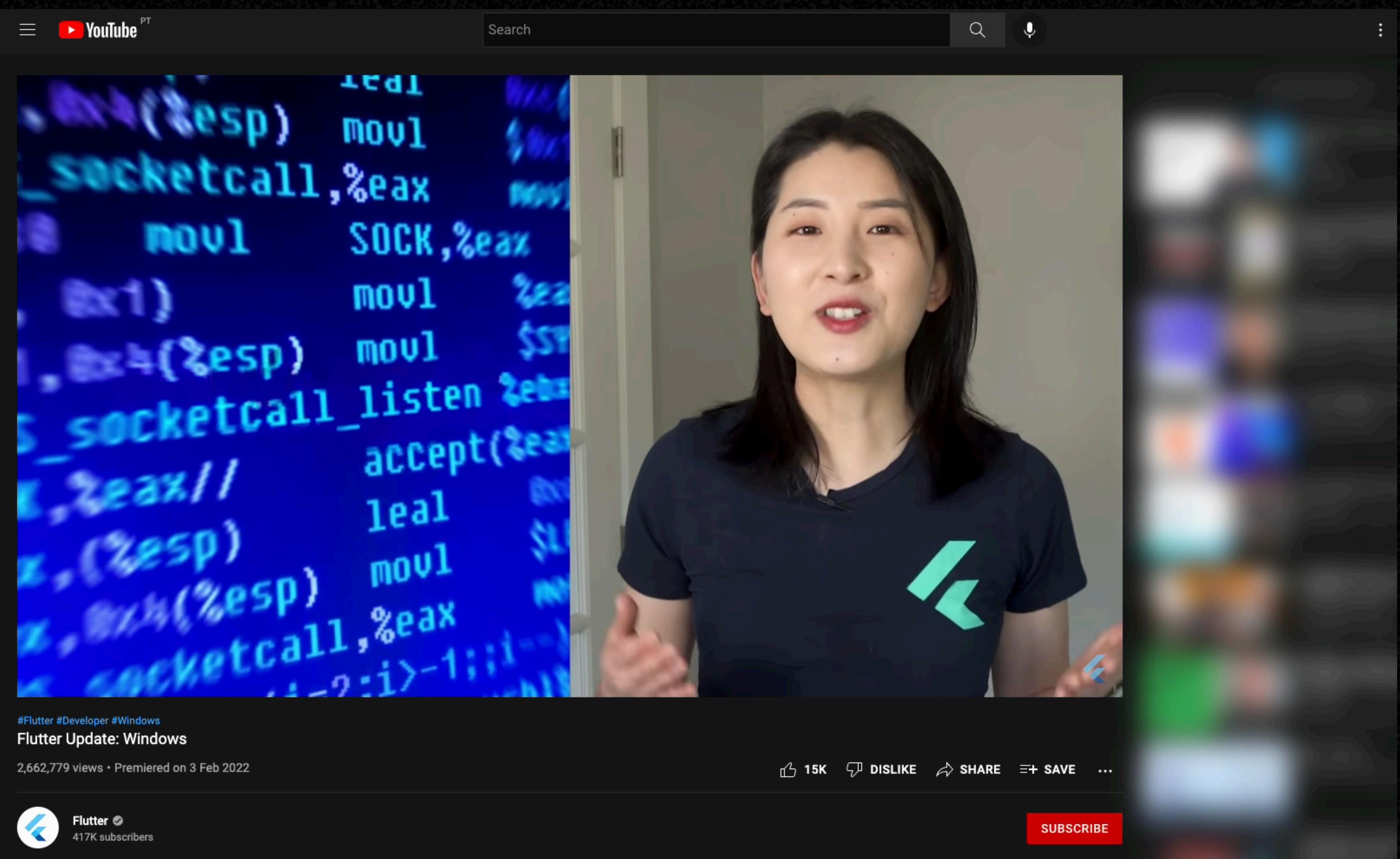
~~Multiple tables per page~~

~~Scroll in two axis~~

~~Millions of data units~~

~~Continuous scroll during selection~~

Happy end



"Flutter update: Windows" by **Flutter** on **YouTube**

Life sucks

pub.dev/packages/swayze
github.com/rows/swayze

swayze 1.1.0

Published 3 months ago • [rows.com](#)  Null safety

SDK FLUTTER PLATFORM ANDROID IOS LINUX MACOS WINDOWS

[Readme](#) [Changelog](#) [Installing](#) [Versions](#) [Scores](#)

Rows

The spreadsheet with superpowers ✨!

pub v1.1.0 Styled by Rows

Swayze

A set of widgets and controllers to display very large tables on flutter apps.

It exports a sliver that renders a table with scroll virtualization in two axis. This means that only visible widgets are built, only the visible render objects go through layout and painting.

Retrospective time

We learned some scroll techniques

Slivers

SliverToBoxAdaptor

SliverChildBuilderDelegate

SliverLayoutBuilder

ScrollActivity



Photo by [@elijahhail](#) on Unsplash

Future

All built in!

LazyTable + Scrollable InteractiveViewer

Lazy Table #87370

[Open](#) goderbauer opened this issue on 30 Jul 2021 · 6 comments

goderbauer commented on 30 Jul 2021

Member

Tracking issue to provide a lazy table widget that only builds the content that's currently shown on screen. Similar to ListView.builder, but scrollable and lazy in horizontal and vertical direction.

Other issues asking for similar things:

- [DataTable - make scrollable, set background colour and fix/freeze header row and first column #30770](#)

Assignees

- goderbauer
- Piinks

Labels

- customer: crowd
- f: scrolling
- framework

InteractiveViewer should support mouse scrolling #64210

[Open](#) creativecreatorormaybenot opened this issue on 20 Aug 2020 · 25 comments

creativecreatoro... commented on 20 Aug 2020

Contributor

Use case

We use @justinmc's [InteractiveViewer](#) widget for vertical lists that can have an arbitrary width (the items can have

Assignees

- Piinks

Labels

- f: material design
- f: scrollviews
- new feature

Bonus round

Let us dare

Lets get out of the box one more time

Scroll notifications + Shader post processing

Honorable mentions

Honorable mentions

Scroll behaviour

API to customize how a scrollable behaves:

- Over scroll
- Scrollbar
- Default scroll physics
- ...

Honorable mentions

Scroll physics

BouncingScrollPhysics

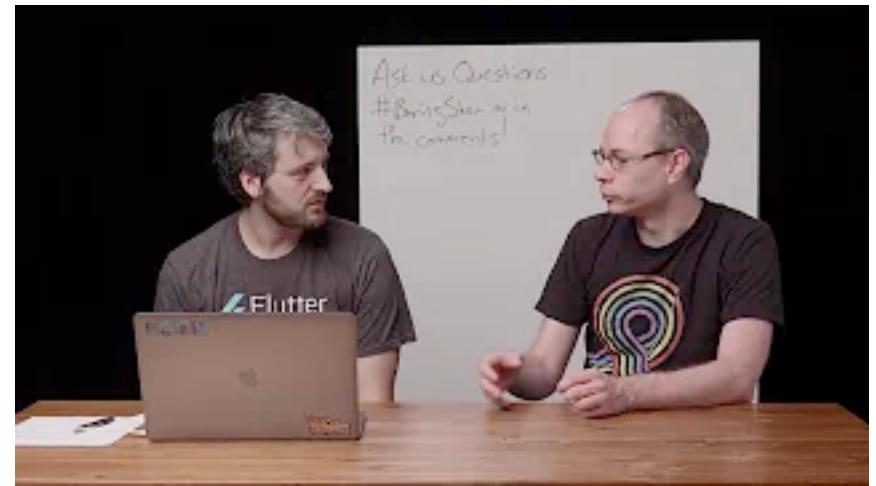
PageScrollPhysics

NeverScrollableScrollPhysics

...

To keep up...

“Understanding constraints” - flutter.dev tutorial



“Slivers Explained” - Boring show episode



“A definitive guide to RenderObjects in Flutter”

- by creativecreatorormaybenot on YouTube

github.com/wolfenrain/umbra - Repository for the shader toolset

Thanks

@reNotANumber