

Bringing Notebook Experiences to Modern IDEs Mark Sujew – LangDev '24





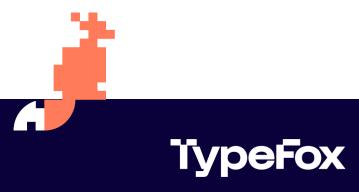








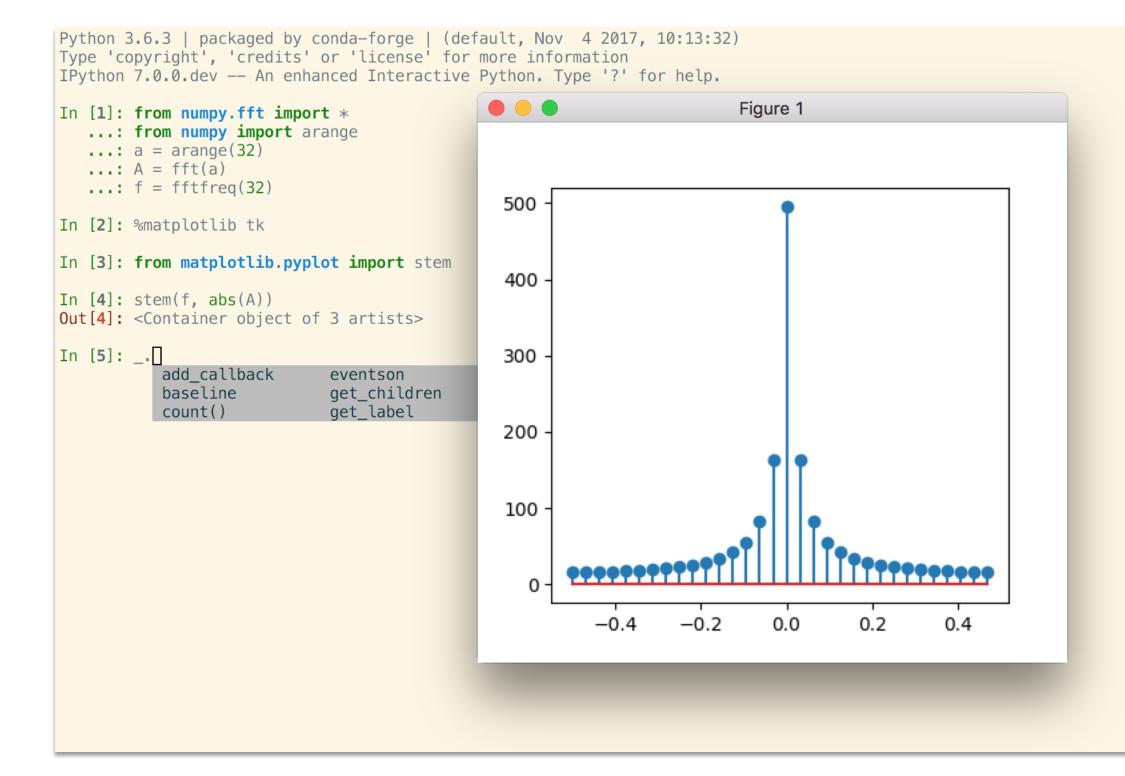
- 5. Demo



1. Explaining Notebooks 2. Initial IDE Integrations 3. Theia IDE Project

4. Native IDE Integration

Explaining Notebooks Interactive Python (IPython)

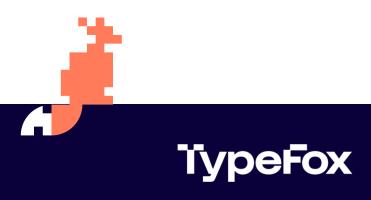


Туре Бох

- Started in 2001
- Execute Python code snippets
- Multimedia Output

Python Notebooks

ІР[у]	Notebook Modulation Last Checkpoint: Jan 05 11:01 (autosaved)
File	Edit View Insert Cell Kernel Help
8	Code J Cell Toolbar: None J
-	odulated signal generally can be written as $(2 - f(t)) = f(t)$
	$cos(2\pi f_c t + \phi(t))$ nodulated (PM) system, the phase is proportional to the message
$\phi(t) = k_p$	m(t)
	$k_f m(t) = rac{1}{2\pi} rac{d}{dt} \phi(t)$
$J_i(\iota) - J_c$	$=\kappa_f m(t) = \frac{1}{2\pi} \frac{1}{dt} \phi(t)$
In [12]:	<pre>from numpy.fft import fft,fftfreq</pre>
	t = arange(-0.1, 0.1, 0.0001) m = sinc(100*t)
	$int_m = empty(len(t))$
	<pre>for k in range(len(t)): int_m[k] = trapz(m[0:k],t[0:k])</pre>
	u = cos(2*pi*250*t + 2*pi*100*int_m) subplot(211)
	<pre>plot(t,m) subplot(212)</pre>
	plot(t,u)
)ut[12]:	<pre>[<matplotlib.lines.line2d 0xd3a490c="" at="">]</matplotlib.lines.line2d></pre>
	12
	-0.4 -0.10 -0.05 0.00 0.05 0.10 1.0 -0.05 0.10
	0.5
	0.0 -
	-0.5 -





- Main Features from IPython
- Code and documentation
- Presented as web app

Jupyter Notebook

File Edit	View Run Kernel Settings Help
a + %	C □ □ ► ■ C → Markdown ~ Int
	Running Code
	First and foremost, the Jupyter Notebook is an interactive environment for writing and running code. The notebook is capable of running code in However, each notebook is associated with a single kernel. This notebook is associated with the IPython kernel, therefore runs Python code.
	Code cells allow you to enter and run code
	Run a code cell using Shift-Enter or pressing the 🕨 button in the toolbar above:
[1]:	a = 10
[2]:	print(a)
	10
	There are two other keyboard shortcuts for running code:
	Alt-Enter runs the current cell and inserts a new one below.
	Ctrl-Enter run the current cell and enters command mode.
	Managing the Kernel
	Code is run in a separate process called the Kernel. The Kernel can be interrupted or restarted. Try running the following cell and then hit the 🗖 above.
[3]:	<pre>import time time.sleep(10)</pre>

If the Kernel dies you will be prompted to restart it. Here we call the low-level system libc.time routine with the wrong argument via ctypes to segfault the Python interpreter:



	ę	þ
Interface	Python 3 (ipykernel)	0
	range of languages.	
•		
e 🔳 button	in the toolbar	
to seafault th	ne Python	

- Split off in 2014
- Language agnostic
- Uses IPython as a Kernel
- Hugely popular

Theia IDE Project

EXPLORER	cor	me	READ	ME my	d 🛛 💀 sidebar-menu-widget.tsx	split-panels.ts	Bobrowser-menu-plugir	ts 3 • F
							•	
> OPEN EDITORS			> cor		rc > browser > menu > 🖬 browser	r-menu-plugin.ts > ។	BrowserMainMenuFactory	> 🗘 shov
✓ THEIA		80		});				And the second s
> 🖻 .browser_modules		81 82		cons	<pre>st keybindingListener = this.k</pre>			IN THE REPORT OF T
> 臼 .github		82			<pre>const preference = this.corePi this.showMenuBar(menuBar, pre-</pre>		w.menuBarvisiDility	NOT STREET, AND STREET, STREET
> 🖻 .theia		84		});	tits.snownenubal (menubal, pre	Terence),		Contraction of the second seco
> 🖻 .vscode		85			<pre>Bar.disposed.connect(() => {</pre>			Contraction of the second
> 🖻 configs		86			<pre>preferenceListener.dispose();</pre>			, Trans.
> 🖻 dev-packages		87			<pre>keybindingListener.dispose();</pre>			
> 🖻 doc		88		});				Thermones
> 🖻 examples		89		reti	ırn menuBar;			
		90						
		91						EES enc.
> 🔁 node_modules				eferen			Commence and the second	, s The second s
✓ ☐ packages	•	92 93	pro		ed showMenuBar(menuBar: Dynami			Sector Sector
> 🖻 bulk-edit		93		(<pre>(preference && ['classic', 'vi menuBar.clearMenus();</pre>	sible J.Includes(preference)) [A DESCRIPTION OF THE OWNER OWNER OF THE OWNER OWNE OWNER
> 🖻 callhierarchy		95			menuBar.acti			And the second s
> 🖻 collaboration		96	•		this.fillMen 🔗 activate	(method)	Widget.activate(): void	
> 🖻 console		97			lse {			
✓ E core	•	98			menuBar.clea 🔗 activeIndex			International In
> 🖻 electron-shared		99			🔗 activeMenu			
> ☐ i18n		100			🗇 openActiveMenu			NAMES OF TAXABLE PARTY AND ADDRESS OF TAXABLE PARTY.
> 臼 lib		101			async function			
> 🖻 node_modules		400		referen				The second
> 🖻 scripts		102 103	pro		ed fillMenuBar(menuBar: MenuBa st menuModel = this.menuProvid			
> 🖻 shared		103			st menuCommandRegistry = this.			barrent.
 ✓ □ snarcu ✓ □ src 		105			(const menu of menuModel.child		(egroef) (mentalloader))	
 ✓ ☐ browser 		106			<pre>if (CompoundMenuNode.is(menu)</pre>			
	•	107			<pre>const menuWidget = this.c</pre>		enu, { commands: mer	State of Grants
> 🖻 breadcrumbs		108			menuBar.addMenu(menuWidge			in the second se
> 🖻 dialogs	-	100			1			"Chilles and an and an and an a
> 户 i18n	Δ	Problem	IS 3	× C:\	WINDOWS\System32\cmd.exe	Output 🔒 Deb	ug Console	₽፤
> 🖻 icons	\sim	🖬 brows	er-mer	nu-plug	jin.ts packages/core/src/browser/menu 3			
> 🛅 keyboard		🛞 Expe	cted ar	n assigr	ment or function call and instead saw a	n expression. eslint(no-	unused-expressions) [Ln 95,	Col 13]
> 🛅 markdown-rendering				_	s not exist on type 'DynamicMenuBarWi			
∼ 🖻 menu	•				. eslint(@typescript-eslint/semi) [Ln 95,			
browser-context-menu-renderer.ts		0 11133	ing sen	lindonom	esint(etypesenpt esint(senii) [en so,	001201		
browser-menu-module.ts								
browser-menu-plugin.ts	3							
context-menu-context.ts								
> 🖻 messaging								
> NPM SCRIPTS								
> TIMELINE								
မှု huebner/terminalURI 🕂 🛞 3 🛆 0								



Туре Гох

nuBarWidge context contextKeyService ootMenuPath /serMainMenuFactor contextKeyService commandRegistry nuCommandExecuto corePreference enuBar reateContextMenu reate Menu Command Registr aet) services namicMenuBarWidge previousFocusedFlemen constructor ctivateMenu contextKeyService ontext uWidgetFactory VidaetFactor constructor 25 CRLF UTF-8 Spaces: 4 {} TypeScript 🚨 🗖

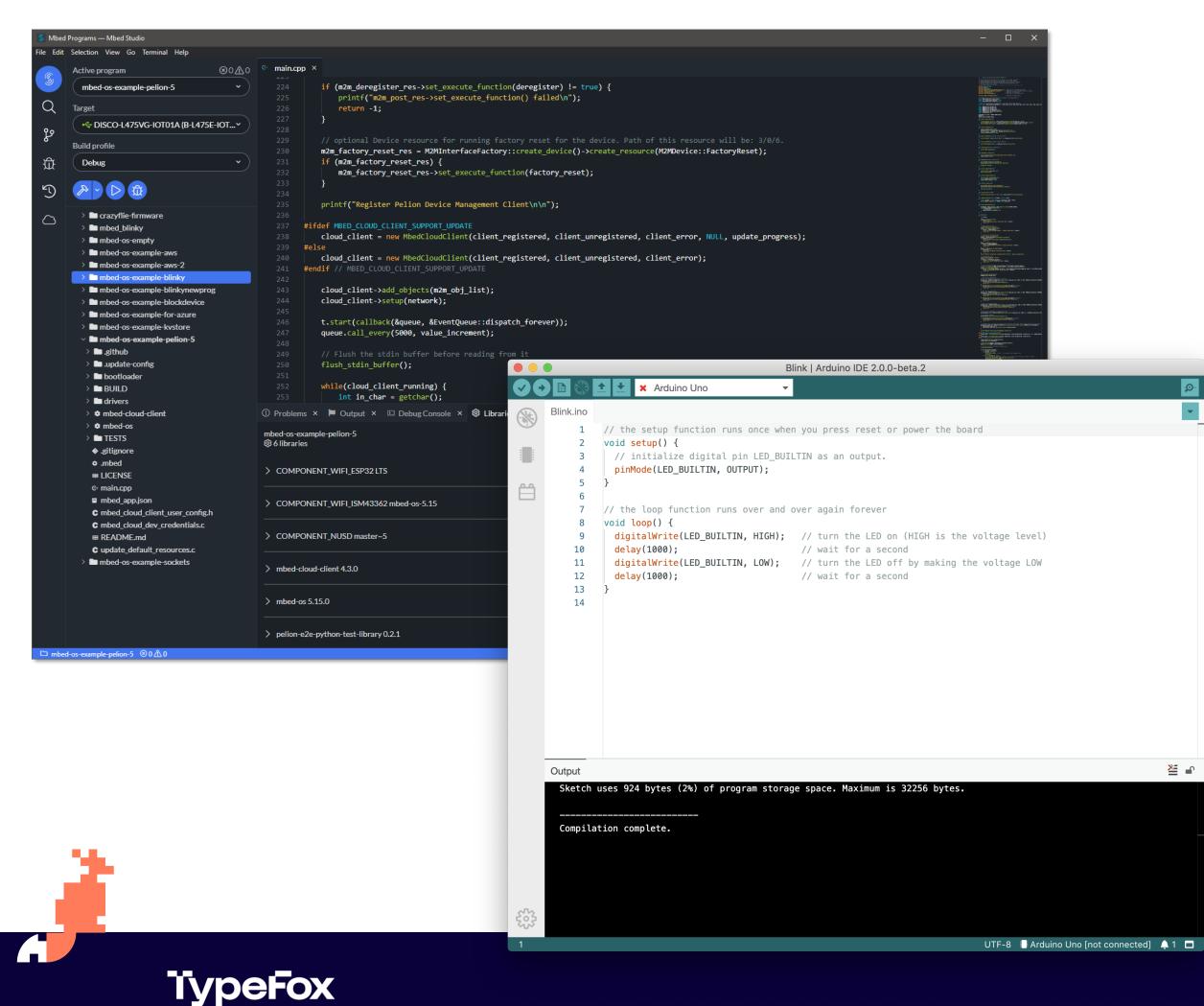
- Created in 2017 by TypeFox
- Designed as a successor to

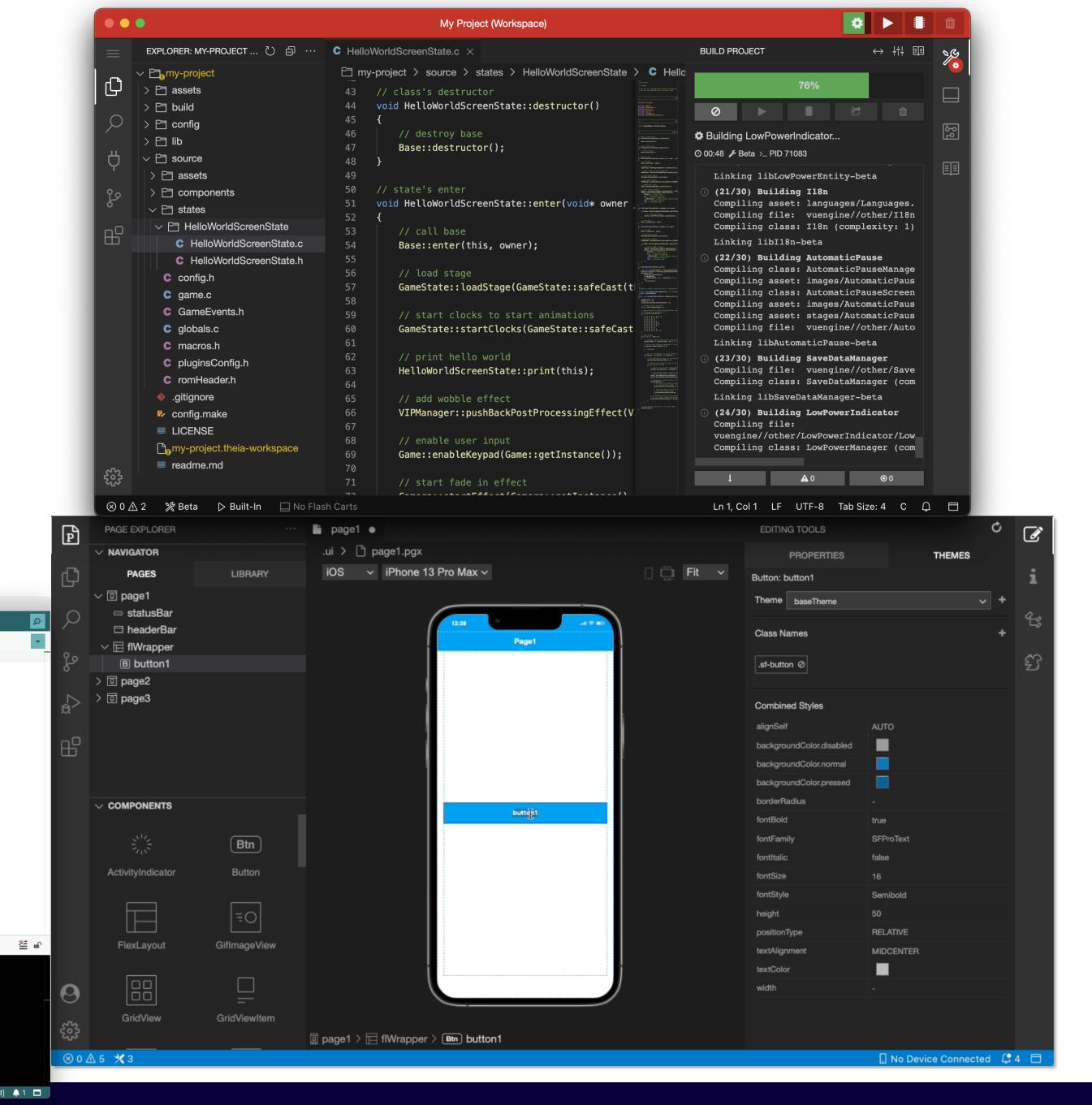
Eclipse Rich Client Platform (RCP)

- Custom extension mechanism
- Support for VS Code plugins



Theia IDE Project Popular Usage





Nintendo Virtual Boy IDE built on Theia

● ● ●	My Project (Workspace)	🔹 🕨 🔳	Û
EXPLORER: MY-PROJECT 🕐 🗗 …	C HelloWorldScreenState.c ×	BUILD PROJECT ↔ ╂┆ III	26
∽ ⊟₀my-project	T my-project > source > states > HelloWorldScreenState > C Hello		*
 → □ assets → □ build → □ config → □ lib 	<pre>43 // class's destructor 43 void HelloWorldScreenState::destructor() 45 { 46 // destroy base 47 Base::destructor(); </pre>	76%	53
	48 }	⊙ 00:48	
 > I assets > I components > I states 	46 // destroy base 1 47 Base::destructor(); 1 48 } 1 49 1 1 50 // state's enter 1 51 void HelloWorldScreenState::enter(void* owner 1 52 {	Linking libLowPowerEntity-beta () (21/30) Building I18n Compiling asset: languages/Languages. Compiling file: vuengine//other/I18n	
→ → HelloWorldScreenState ↓ C HelloWorldScreenState.c	53 // call base 54 Base::enter(this, owner);	Compiling class: I18n (complexity: 1) Linking libI18n-beta	
C HelloWorldScreenState.h C config.h C game.c	<pre>55 56 // load stage 57 GameState::loadStage(GameState::safeCast(t) 58</pre>	(22/30) Building AutomaticPause Compiling class: AutomaticPauseManage Compiling asset: images/AutomaticPaus Compiling class: AutomaticPauseScreen	
C GameEvents.h C globals.c	50 // start clocks to start animations 60 GameState::startClocks(GameState::safeCast	Compiling asset: images/AutomaticPaus Compiling asset: stages/AutomaticPaus Compiling file: vuengine//other/Auto Linking libAutomaticPause-beta	
C macros.h C pluginsConfig.h C romHeader.h	61 62 // print hello world 63 HelloWorldScreenState::print(this); 64 1 65 // add wohble effect	Compiling file: vuengine//other/Save Compiling class: SaveDataManager (compiling class: SaveDataManager (
 gitignore config.make LICENSE 	65 // add wobble effect 66 VIPManager::pushBackPostProcessingEffect(V 67	Linking libSaveDataManager-beta () (24/30) Building LowPowerIndicator Compiling file:	
my-project.theia-workspace readme.md	<pre>68 // enable user input 69 Game::enableKeypad(Game::getInstance()); 70</pre>	vuengine//other/LowPowerIndicator/Low Compiling class: LowPowerManager (com	
	71 // start fade in effect	↓ ▲ 0 ⊚0	
🛞 0 \land 2 🏾 🎇 Beta 🕞 Built-In 🛛 🗔 No Flas		Ln 1, Col 1 LF UTF-8 Tab Size: 4 C 🗘	

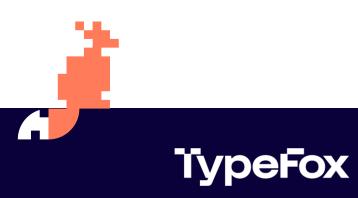


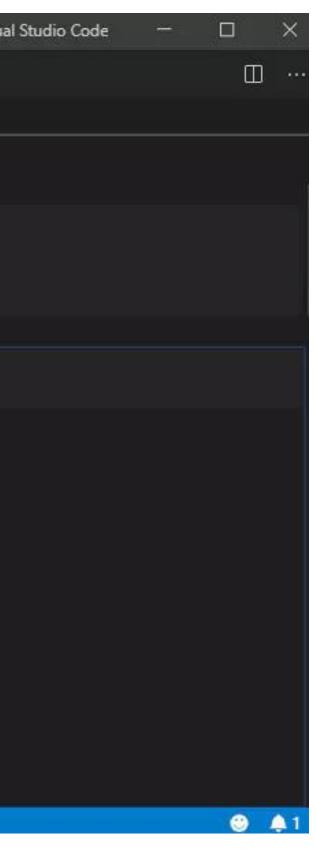




Jupyter Extension for VS Code

*	File Edit Selection View	Go Debug Terminal Help DataScienceIsCool.ipynb* - connect-petdetector - Visi
Ð	EXPLORER	test.py
_	\vee open editors	5 🗖 + № 🖀 🖻 📲
Q	🍘 test.py	
	× ≣ DataScienceIsCoo	+ hel: world
₽°5	✓ CONNECT-PETDETECTOR	[1] import numpy as np
0 5		▷ import pandas as pd
逫	> images > scripts 0	import matplotlib.pyplot as plt
x	 scripts .gitignore 	<pre>p = np.linspace(0,20,100)</pre>
₿	Isinghore Isinghore Isinghore Isinghore Isinghore Isinghore	
Ш	E DataScienceIsCo U	<pre>^ [3] plt.plot(p,np.sin(p)) </pre>
	demo_completed.py	
	≣ demo.ipynb M	N. N. 🗊
	🔒 LICENSE	
	! myenv.yml	0.75 / / / / / /
	 README.md 	0.50 / / / / / / /
	🌸 score.py	0.25 / / / / / / /
	≡ setup.ipynb	
	≣ test.ipynb U	-0.25 -
	🍨 test.py	-0.50 -
		-0.75
		-1.00 V V V
5		0.0 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0
~~~	> OUTLINE	
🦞 ma	aster* 🧿 Python 3.7.3 64-bit	⊗ 0 <u>∧</u> 0

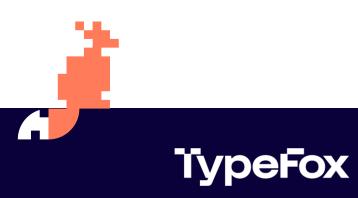


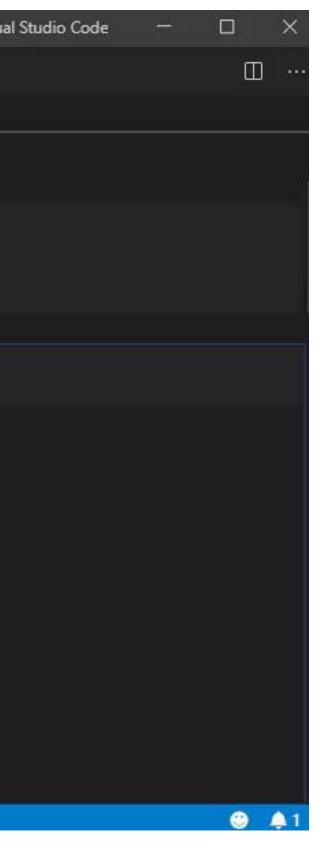


- Created by Microsoft in 2019
- Displays as a Webview
- Complicated Python support
- Fairly slow

## Jupyter Extension for VS Code + Theia

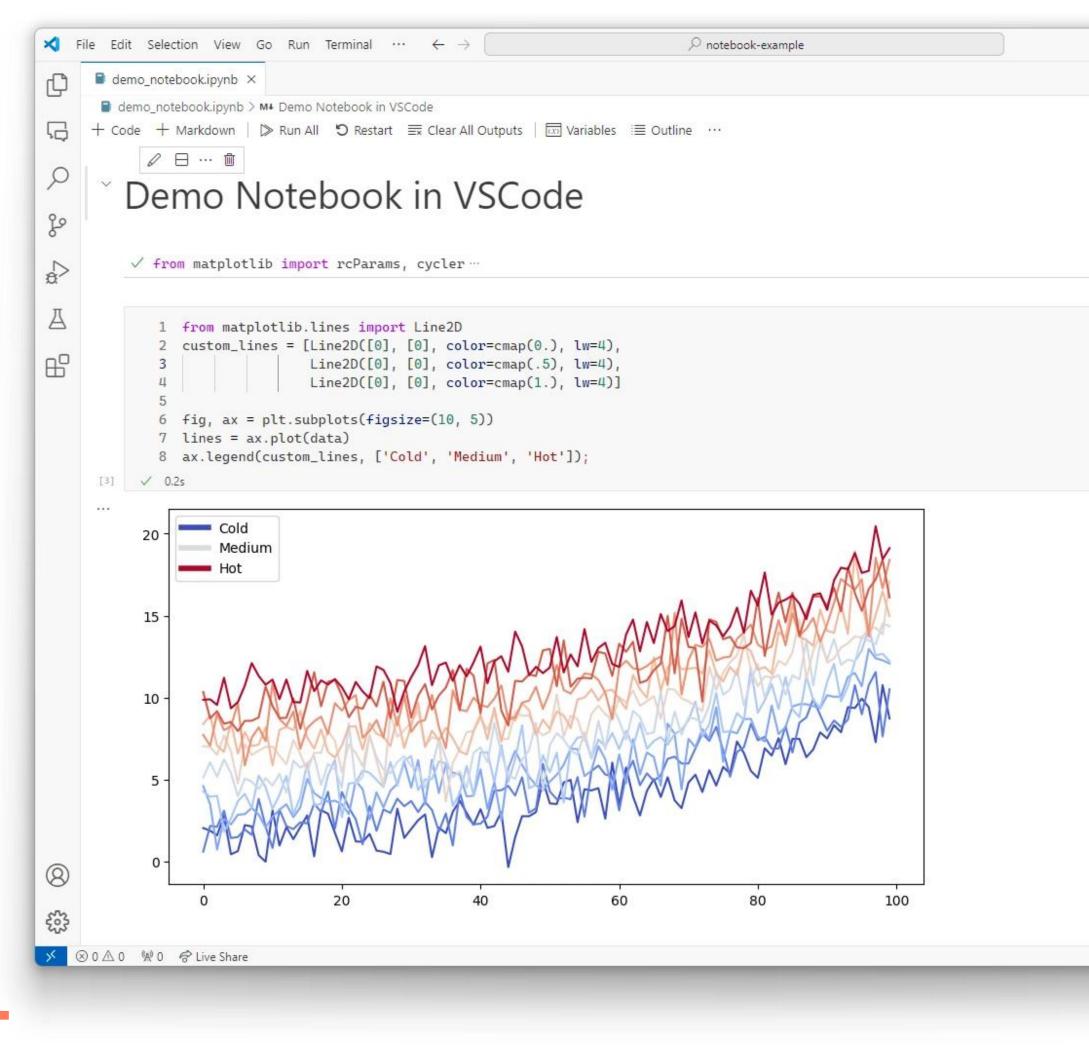
×	File Edit Selection View	Go Debug Terminal Help DataScienceIsCool.ipynb* - connect-petdetector - Visi
Ð	EXPLORER	test.py
_	$\vee$ open editors	5 🗖 + № 🖀 🖻 📲
Q	🍘 test.py	
	× ≣ DataScienceIsCoo	+ hel: world
₽°s	✓ CONNECT-PETDETECTOR	[1] import numpy as np
0 5		▷ import pandas as pd
逫	> images > scripts 0	import matplotlib.pyplot as plt
x	<ul> <li>scripts</li> <li>.gitignore</li> </ul>	<pre>p = np.linspace(0,20,100)</pre>
₿	Isinghore Isinghore Isinghore Isinghore Isinghore Isinghore	
Ш	E DataScienceIsCo U	<pre>^ [3] plt.plot(p,np.sin(p)) </pre>
	demo_completed.py	
	≣ demo.ipynb M	N. N. 🗊
	🔒 LICENSE	
	! myenv.yml	0.75 / / / / / /
	<ol> <li>README.md</li> </ol>	0.50 / / / / / / /
	🌸 score.py	0.25 / / / / / / /
	≡ setup.ipynb	
	≣ test.ipynb U	-0.25 -
	🍨 test.py	-0.50 -
		-0.75
		-1.00 V V V
5		0.0 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0
~~~	> OUTLINE	
🦞 ma	aster* 🧿 Python 3.7.3 64-bit	⊗ 0 <u>∧</u> 0





- Created by Microsoft in 2019
- Displays as a Webview
- Complicated Python support
- Fairly slow
- Works in Theia out-of-the-box

Native Notebooks in VS Code



ТуреFox

		8 —		×	
			€3 [0	
		L	Python	3.11.5	
			Pj	/thon	
	Cell	1 of 1 <mark>1</mark> 6	50) {}	

- New UI feature in 2021
- Language agnostic
- Support for custom kernels
- VS Code API

Notebook Editor

Frontend

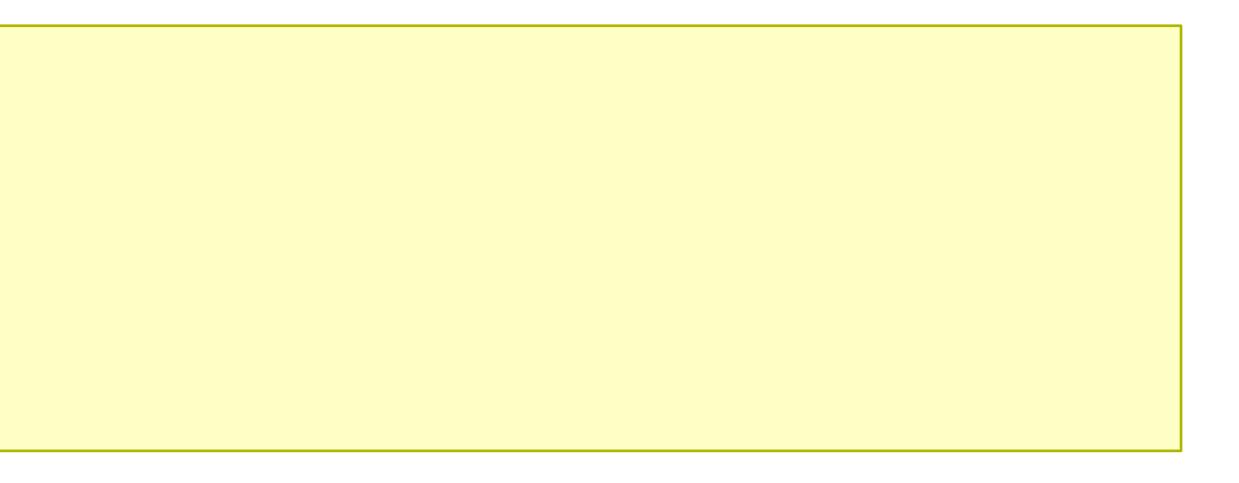
(Python) Notebook Kernel

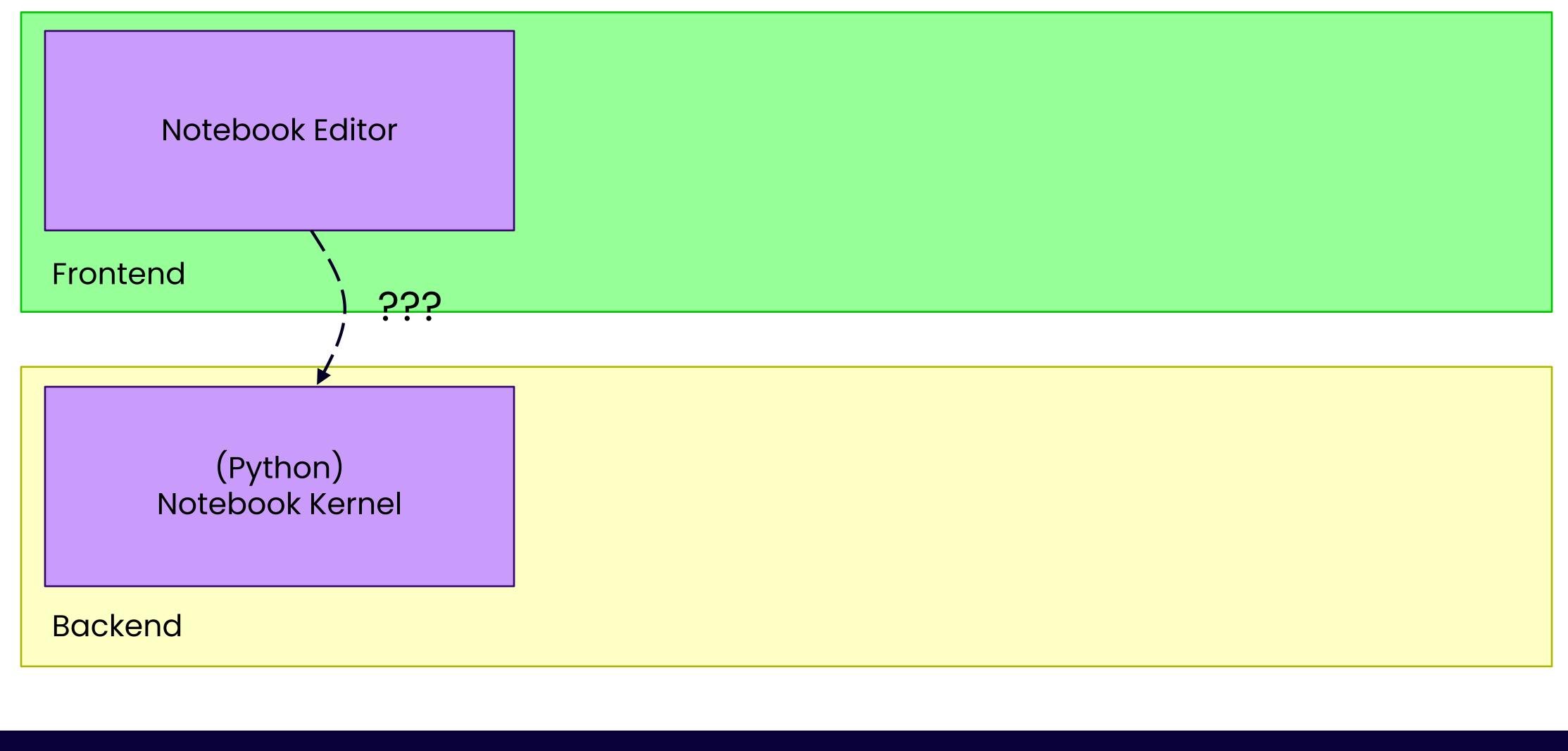
Backend





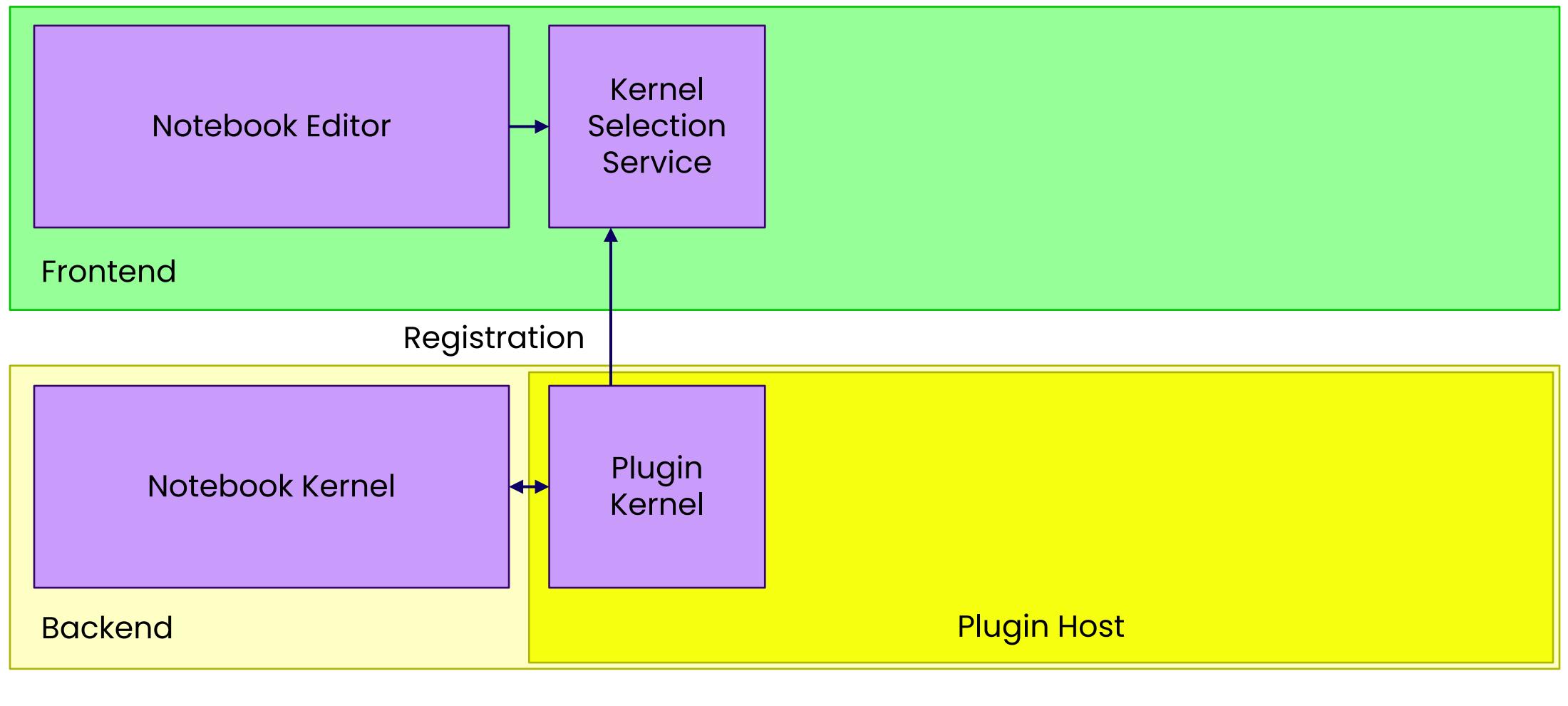






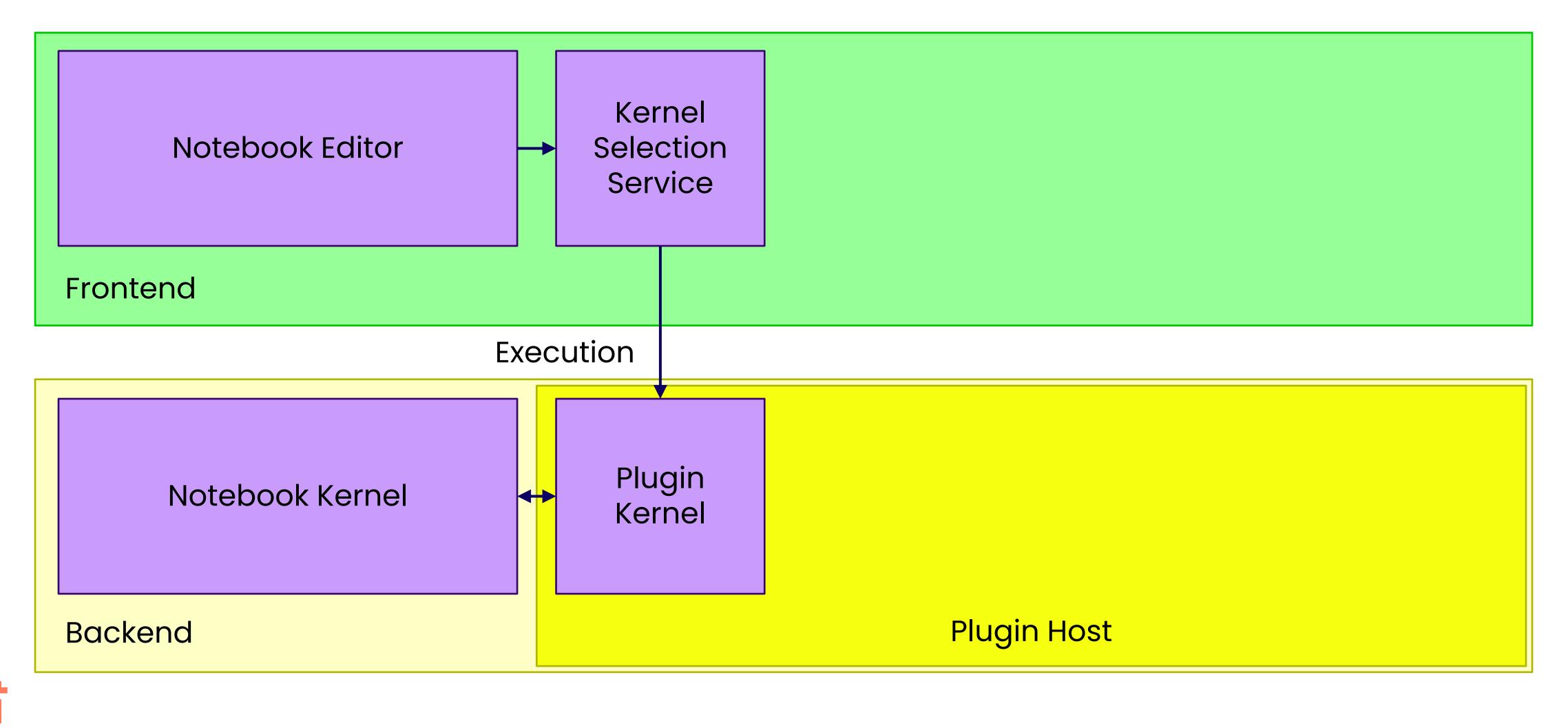


A

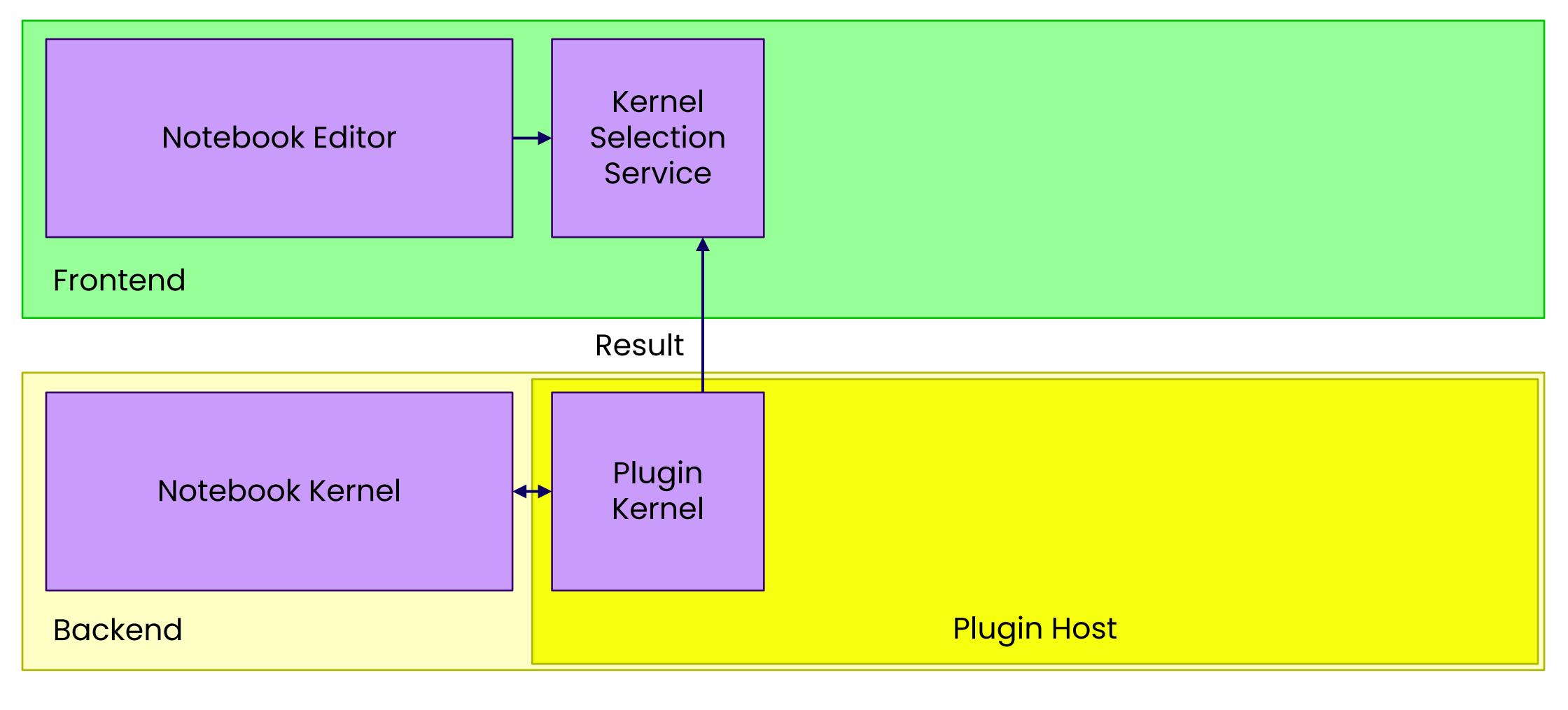






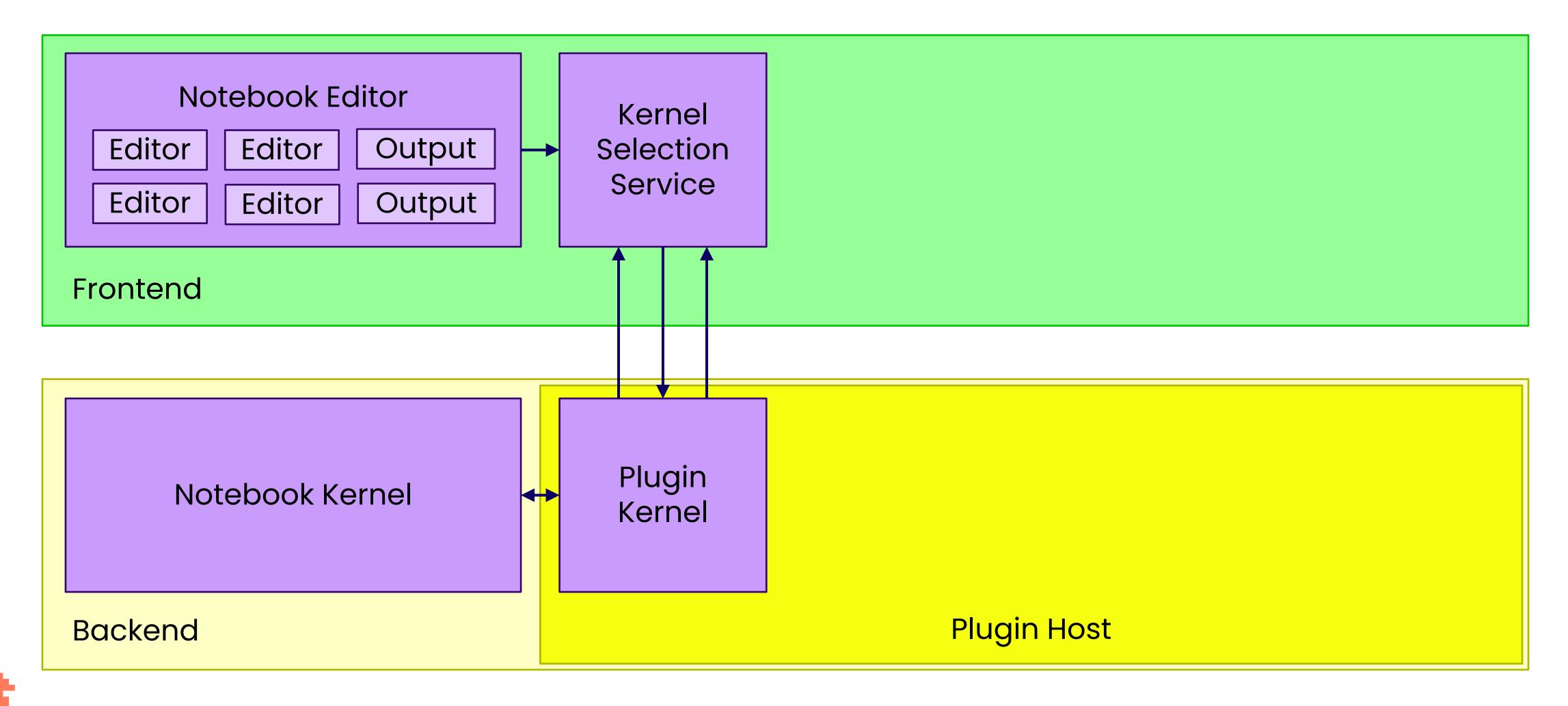






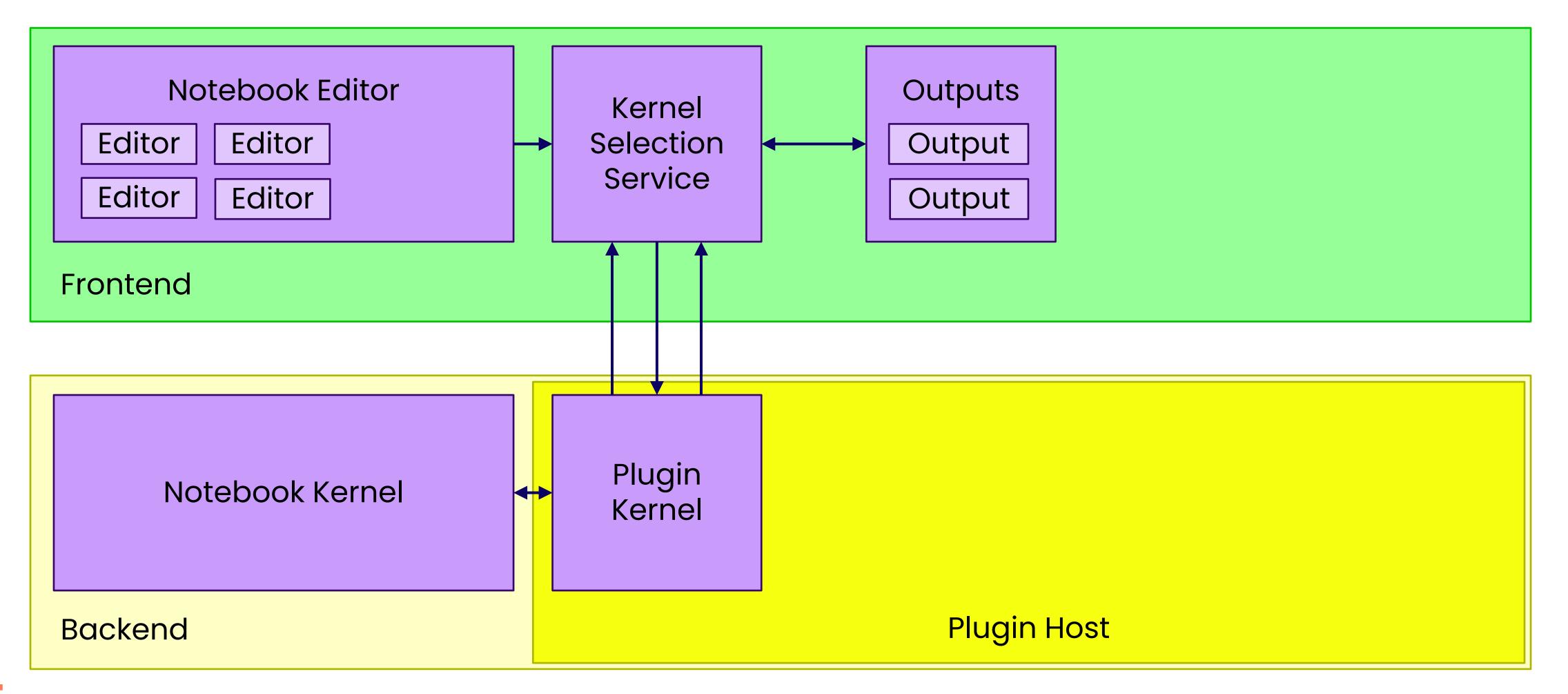






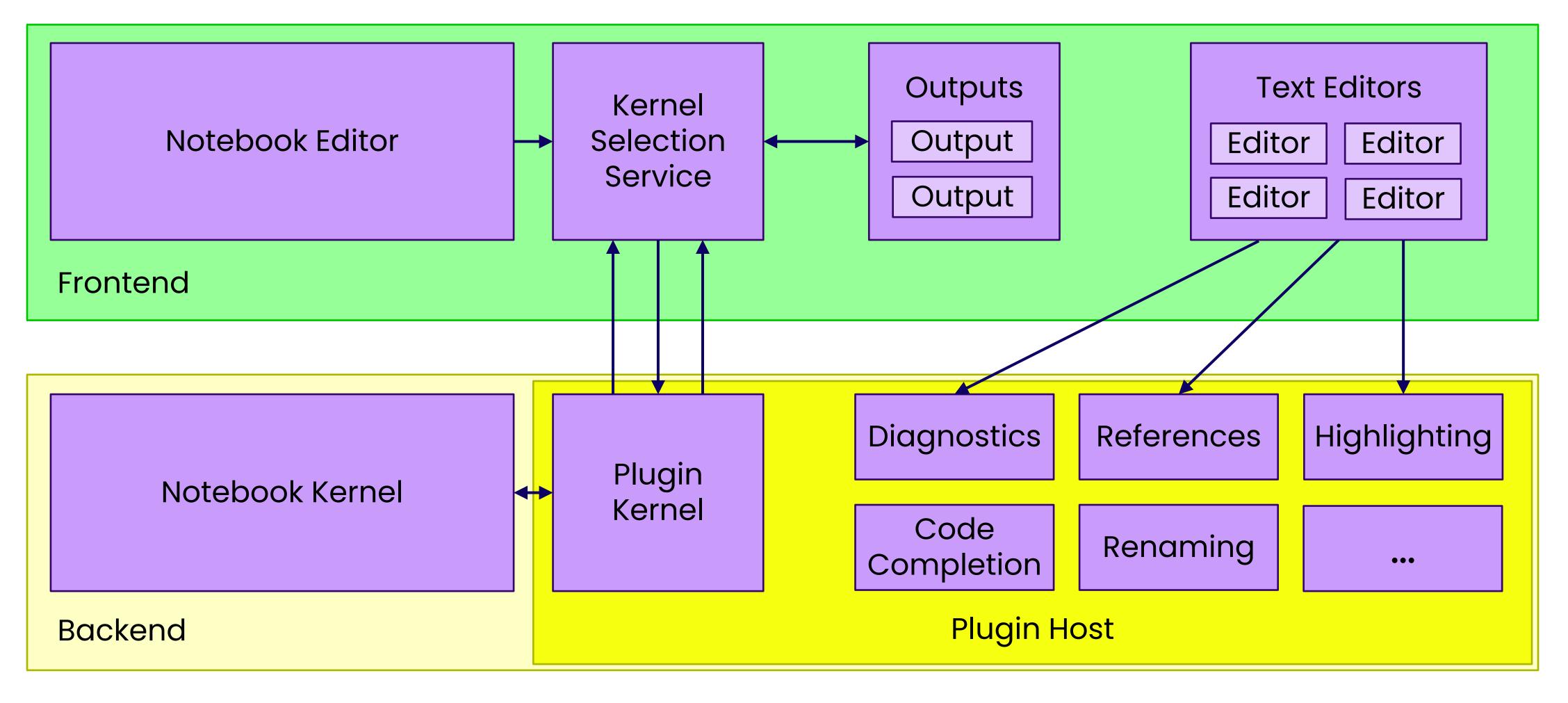
















~20 000 LoC

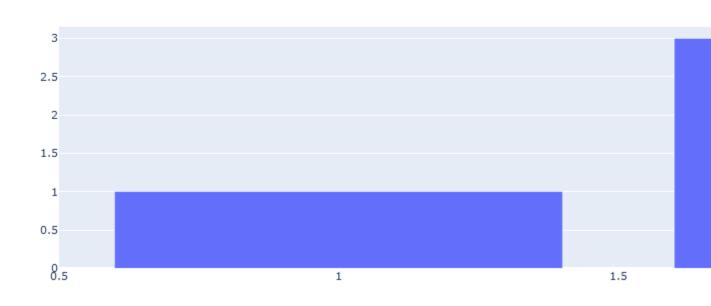
Notebook Layouting

\triangleright	1 pop_dict
[3]	
	{'Hovedstaden': 1.84,
	'Sjælland': 0.84,
	'Syddanmark': 1.22,
	'Midtjylland': 1.32,
	'Nordjylland': 0.59}
\triangleright	<pre>1 pop_series = pd.Series(pop_dict)</pre>
	2 pop_series
5]	
	Hovedstaden 1.84
	Sjælland 0.84
	Syddanmark 1.22
	Midtjylland 1.32
	Nordjylland 0.59
	dtype: float64
\triangleright	1 import plotly.graph_objects as go
	2
	3 fig = go.Figure(
	4 data=[go.Bar(x=[1, 2, 3], y=[1, 3, 2])],
	+ aaca-[gorbar (x-[1] 2) 5]) y-[1] 5) 2]/])
	<pre>5 layout=dict(title=dict(text="A Figure Specified By A Graph Object"))</pre>
	<pre>5 layout=dict(title=dict(text="A Figure Specified By A Graph Object"))</pre>
	<pre>5 layout=dict(title=dict(text="A Figure Specified By A Graph Object")) 6)</pre>
[3]	<pre>5 layout=dict(title=dict(text="A Figure Specified By A Graph Object")) 6) 7</pre>

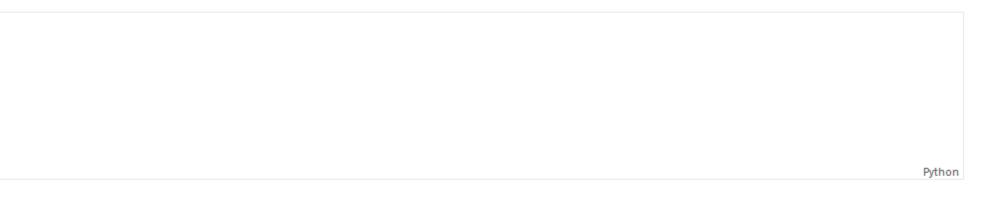


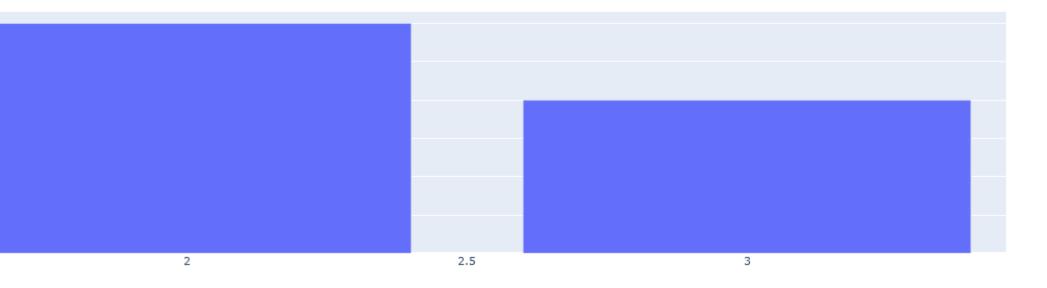
A

ТуреFох



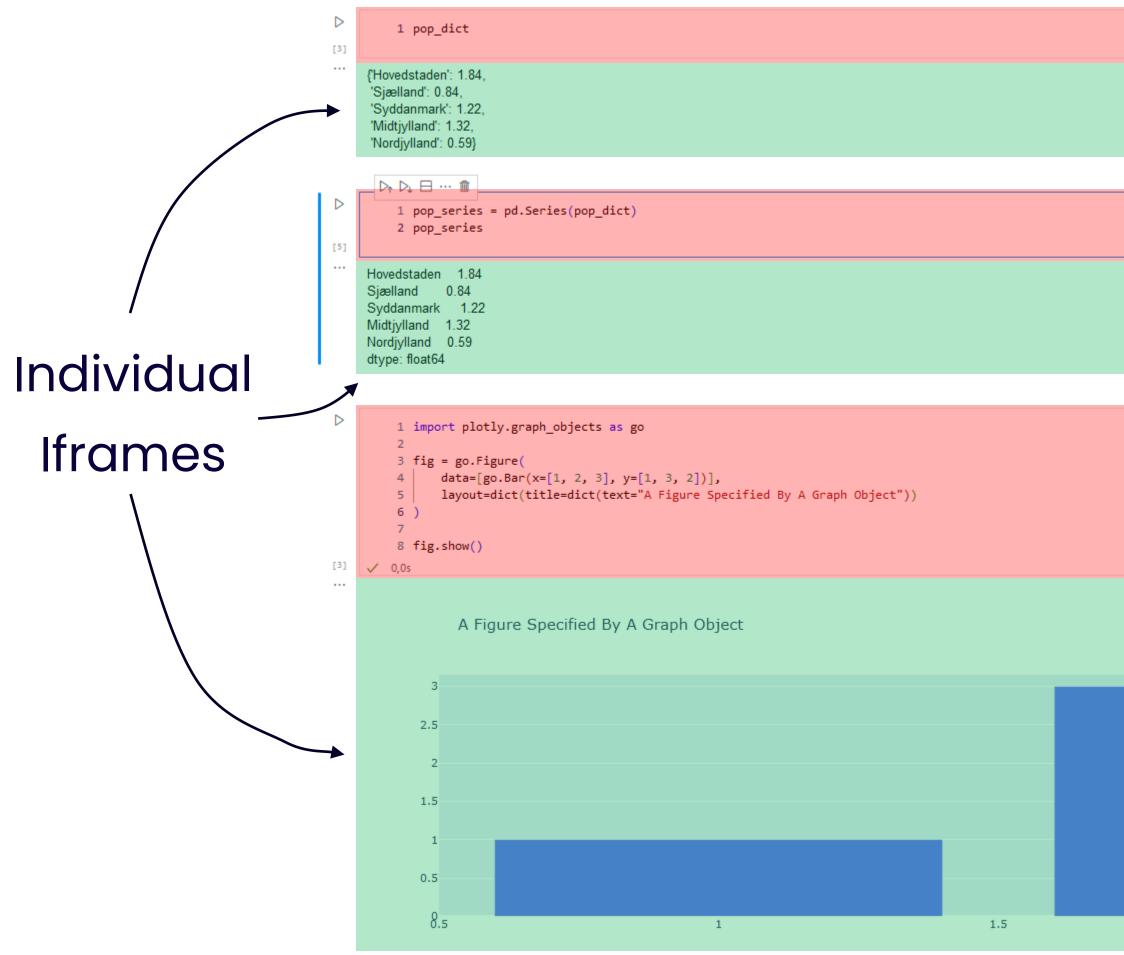






Python

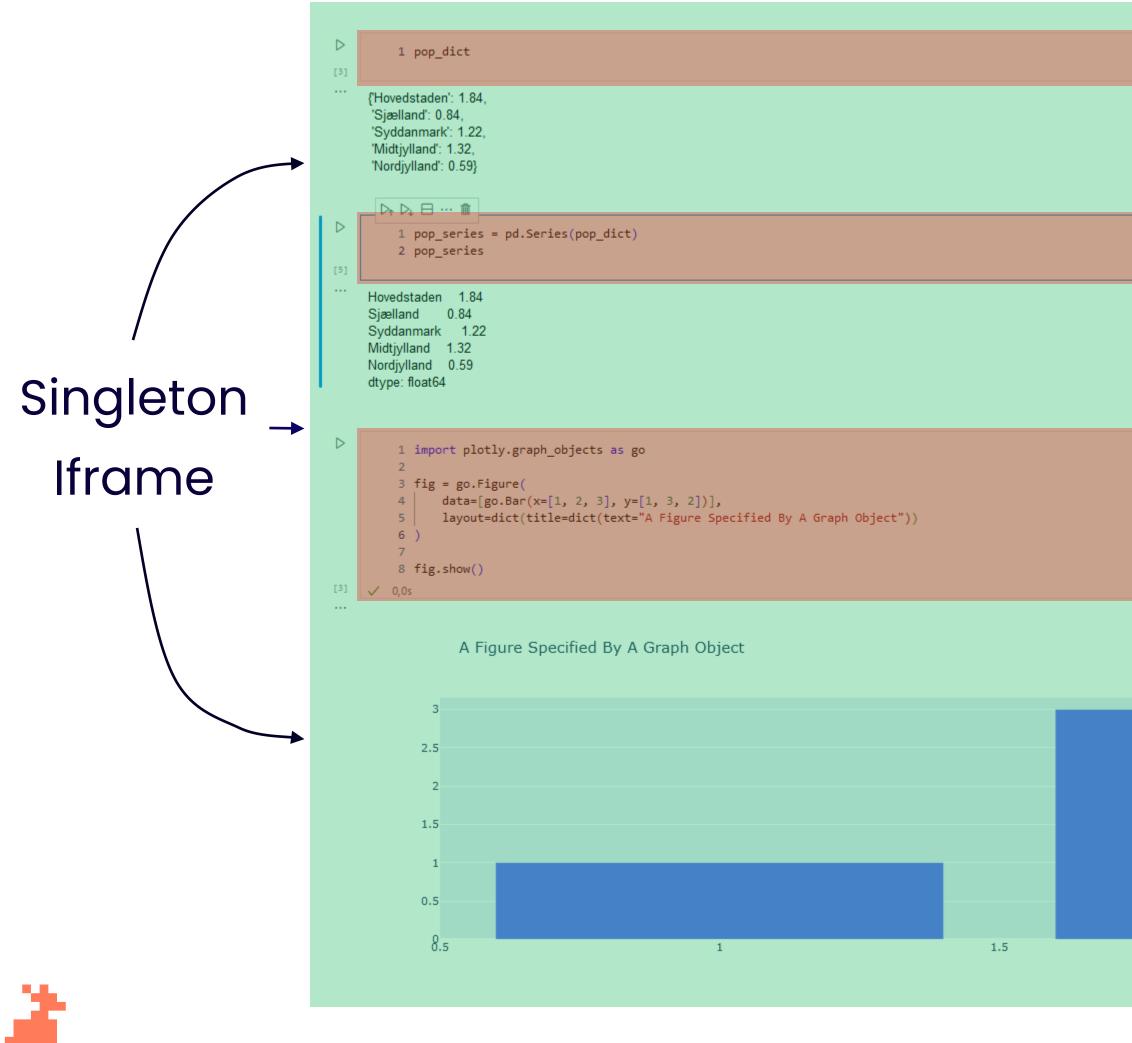
Notebook Layouting – Naive View





			Python
			Python
			Dathara
			Python
2	2.5	3	

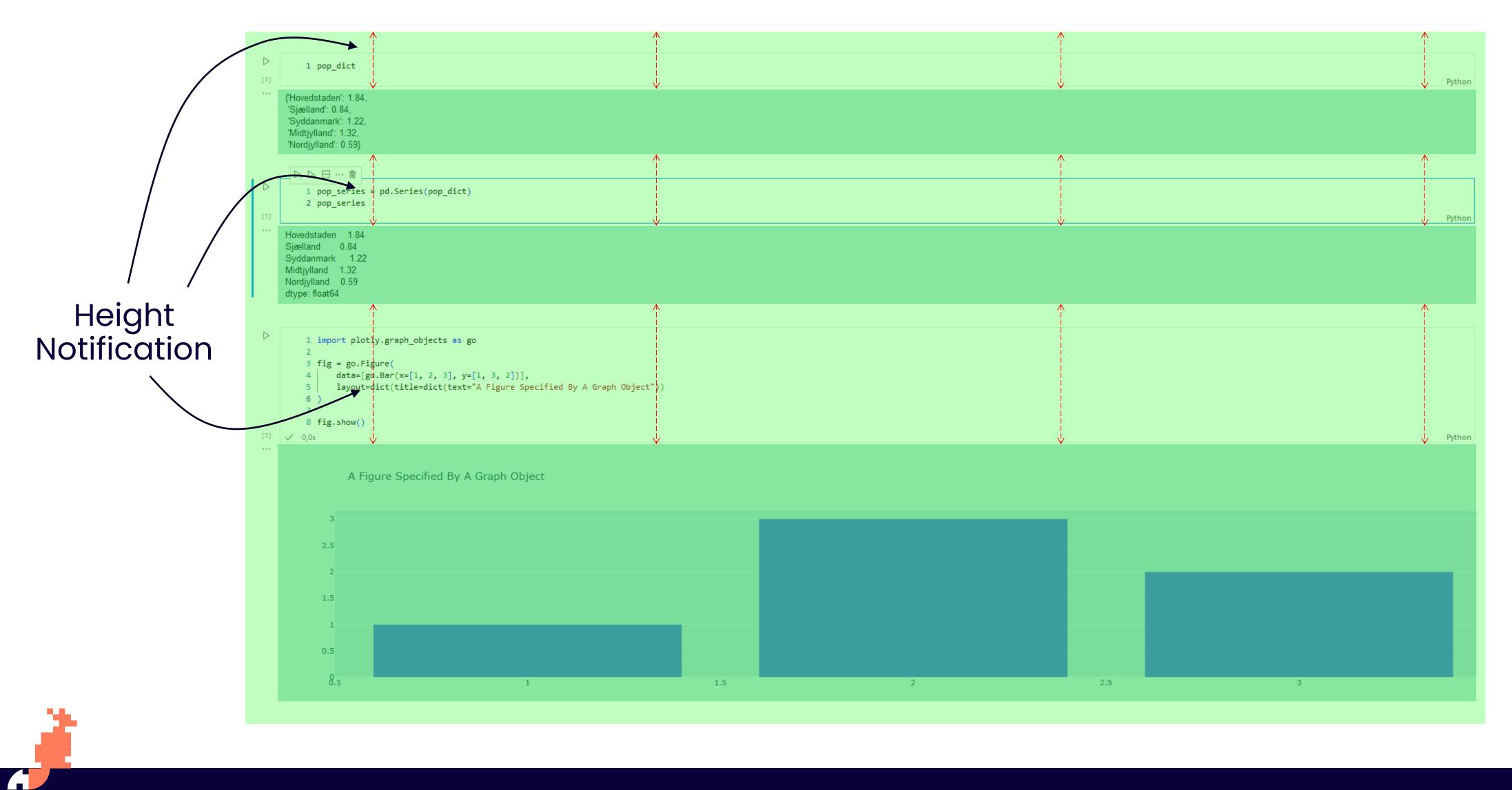
Notebook Layouting – Backlayer Webview





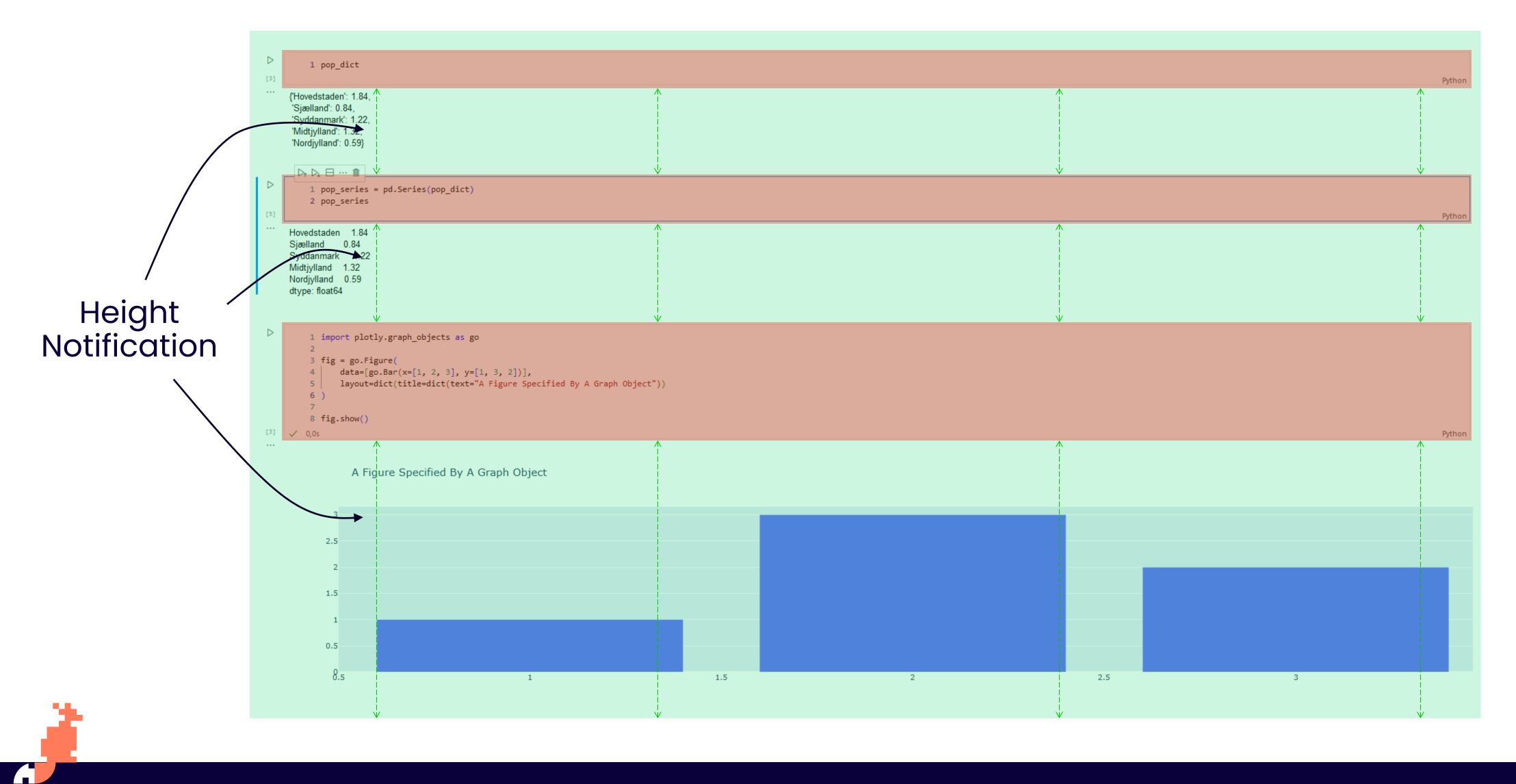
			Python
		 	Python
			Python
2	2.5	3	

Notebook Layouting – Backlayer Webview



ТуреFox

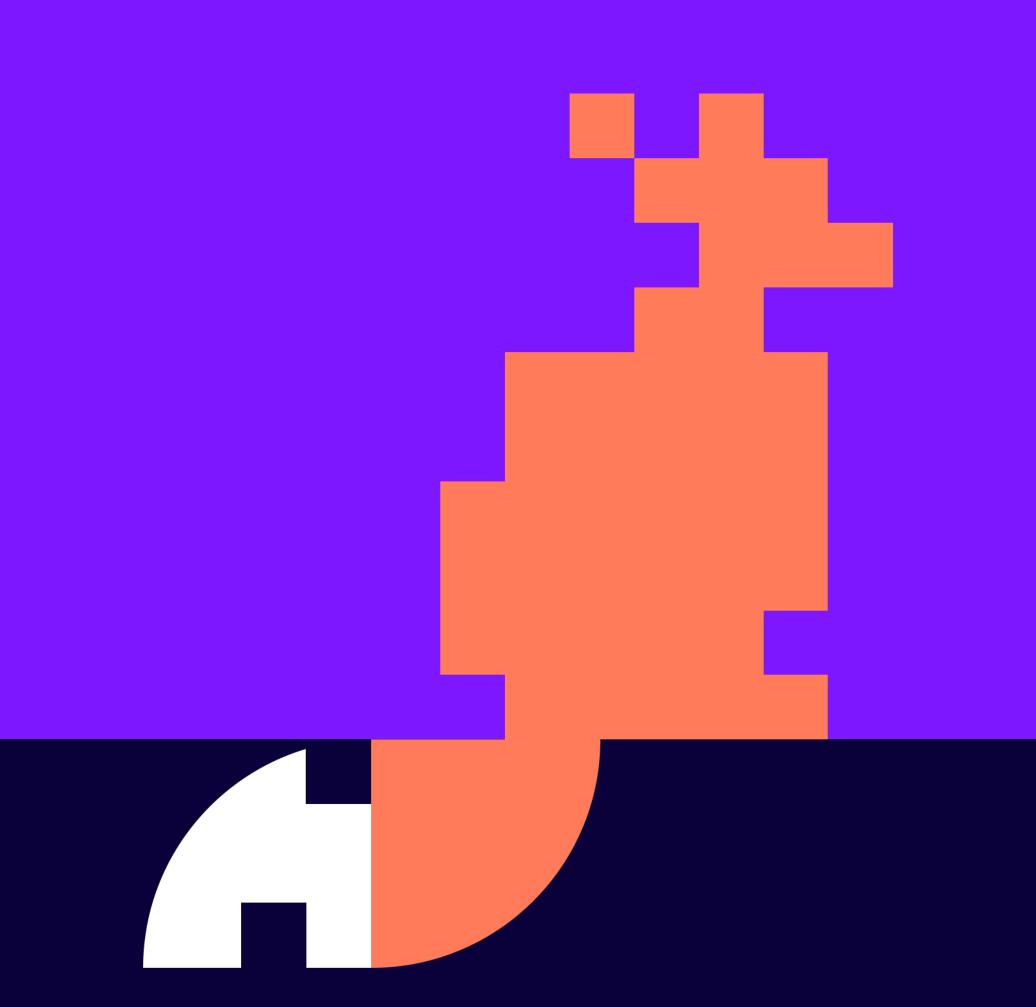
Notebook Layouting – Editor Overlay



ТуреГох

Demo





Questions?

YZVE

