



GPU Accelerated Maze route with BidirectionaL Expansion

Jingren Wang, 16th, Dec, 2025

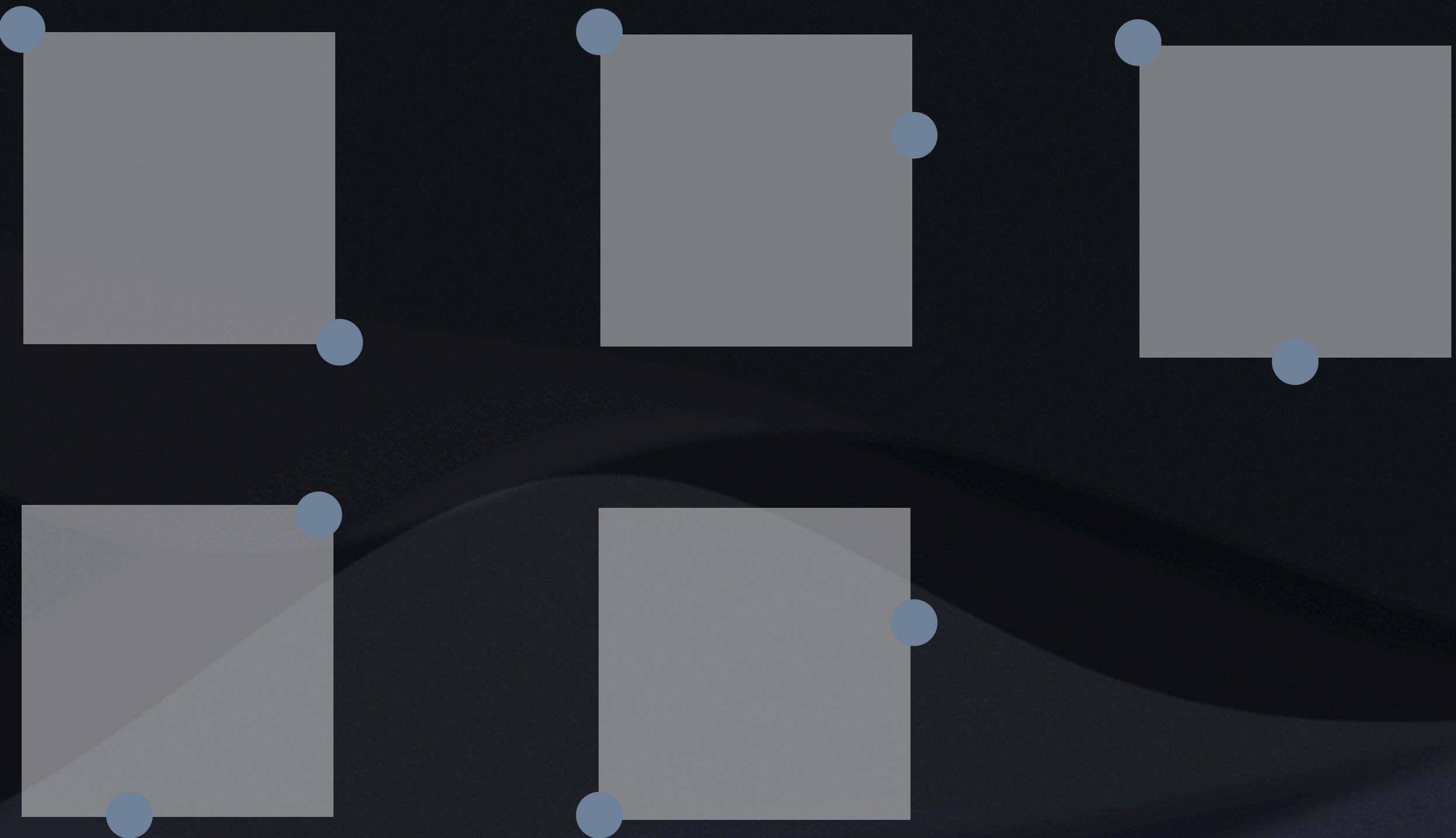
What

What has been proposed

- **A square based**

- Partitioned
- Bidirectional

$$L_n = \max(h_{diff}, w_{diff})$$

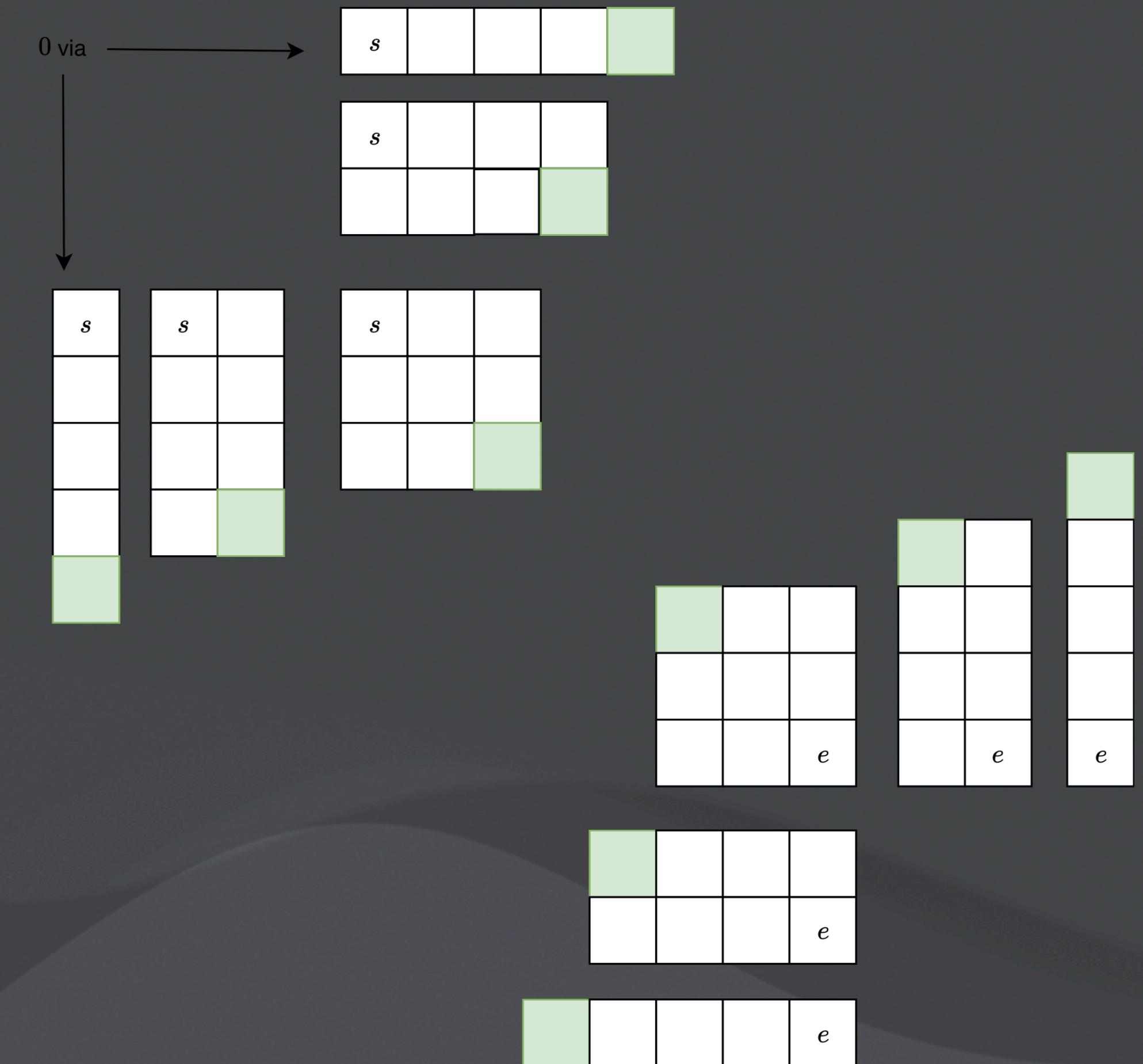
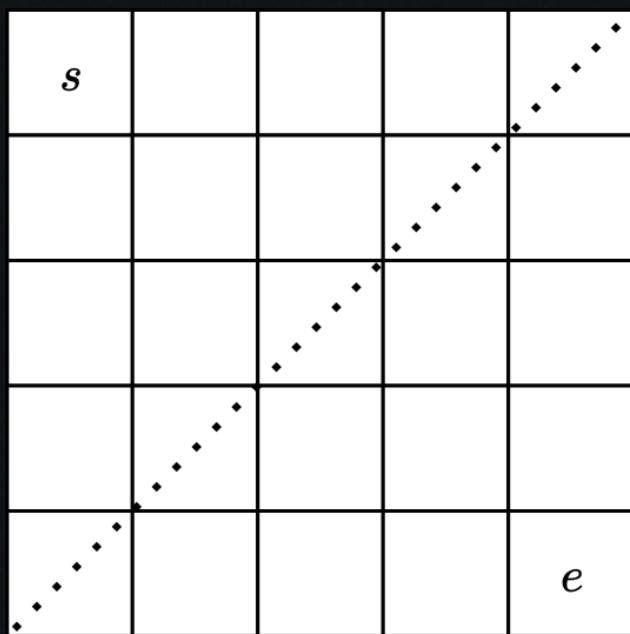


*Q: What if it exceeds the boundaries?

What

What has been proposed

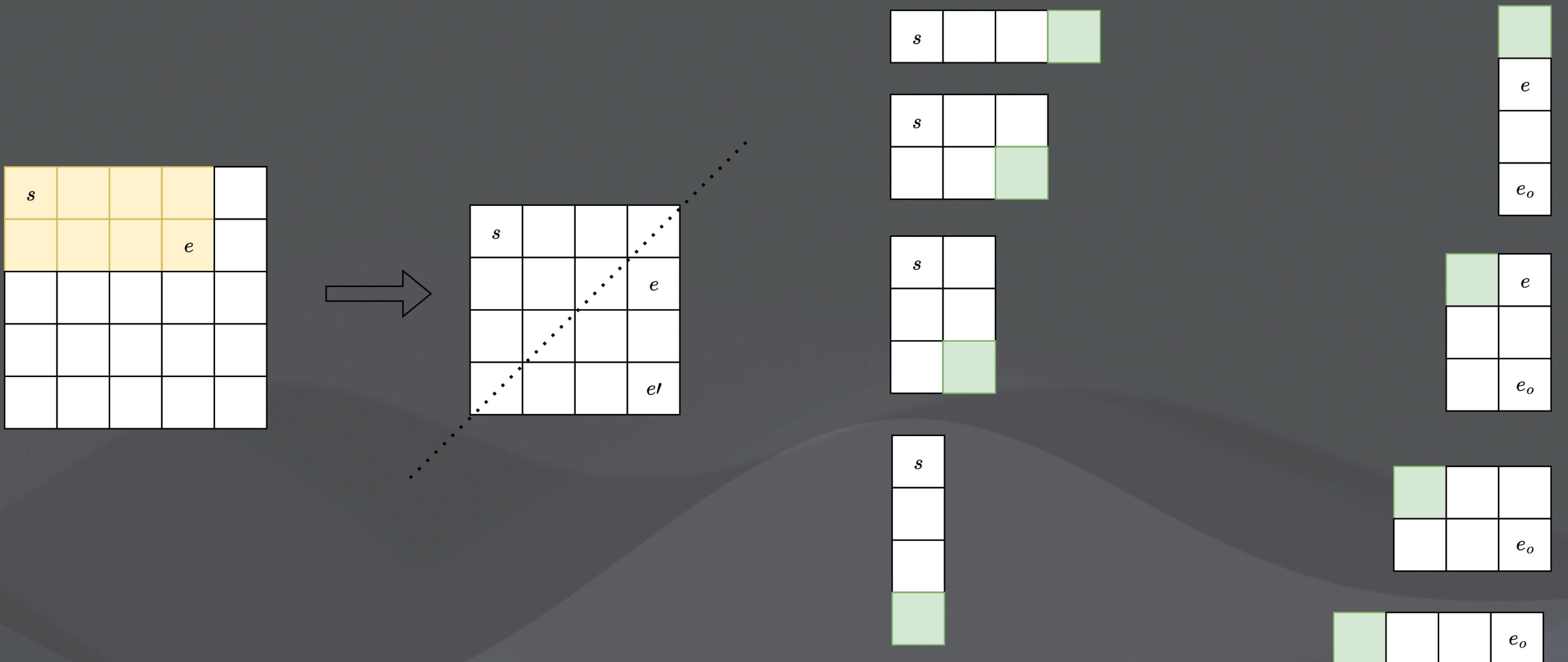
- A square based
- **Partitioned**
- Bidirectional



What

What has been proposed

- A square based
- **Partitioned**
- Bidirectional



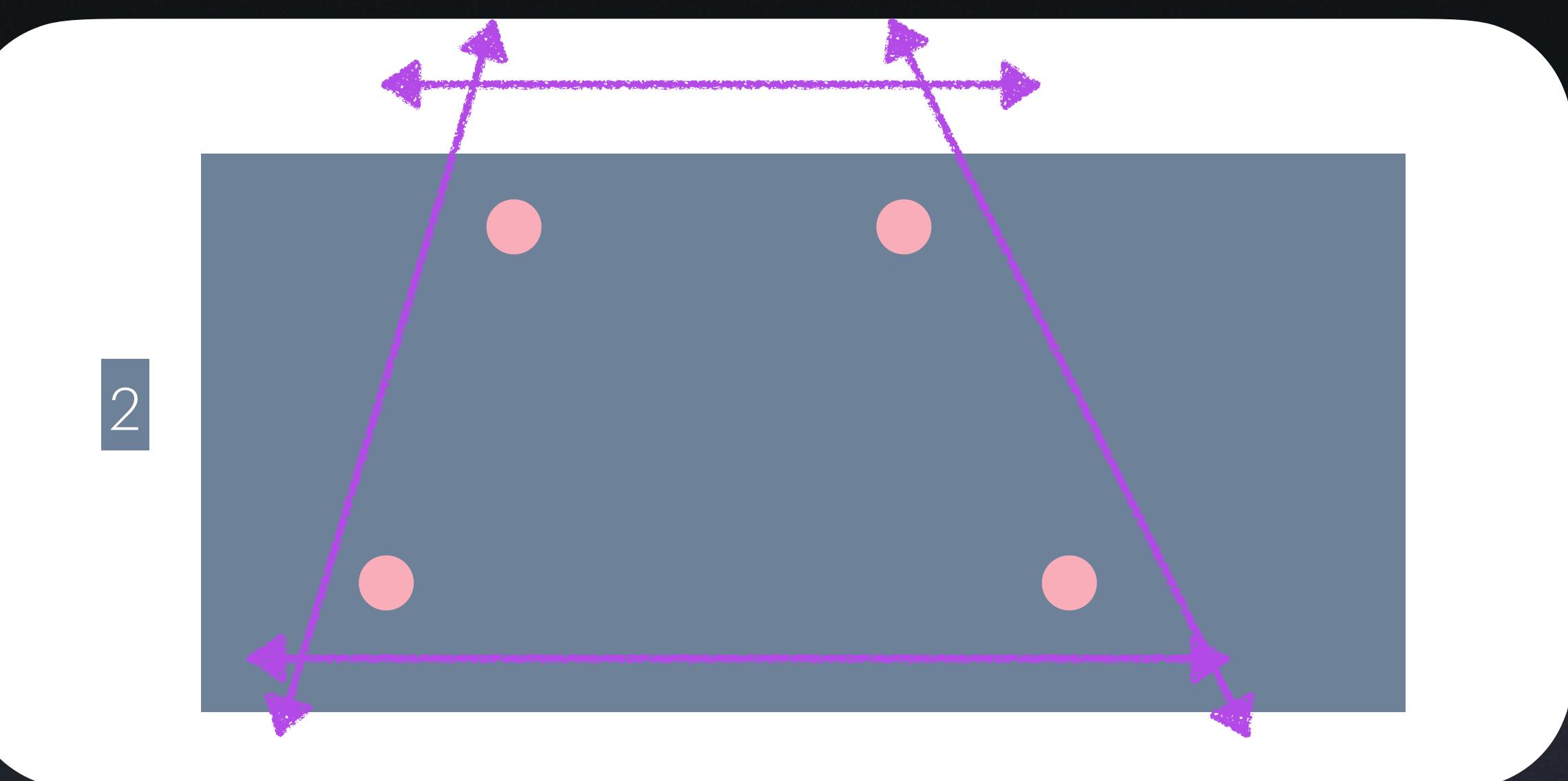
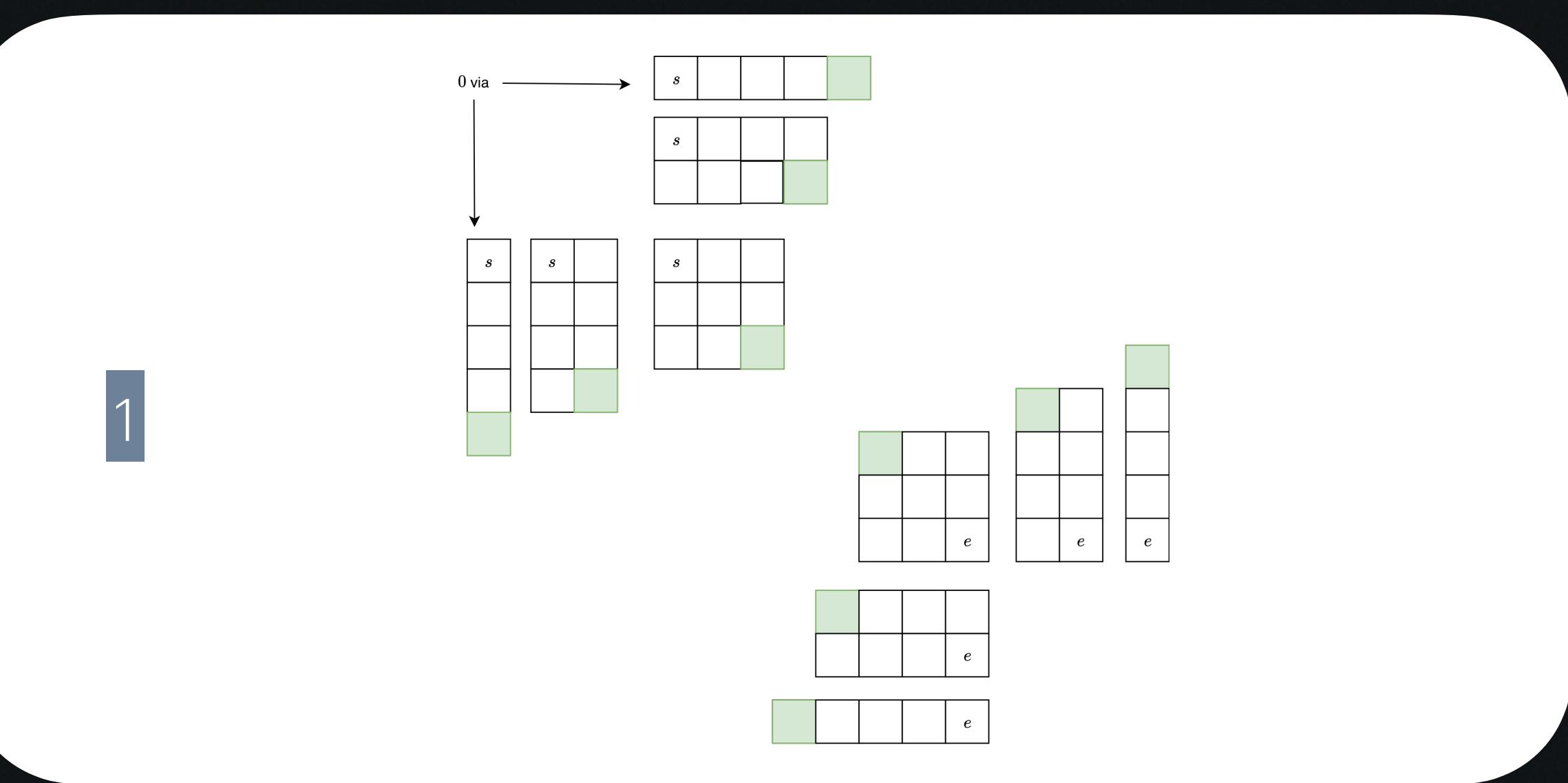
Jingren Wang, MICS

What

What has been proposed

- A square based
- Partitioned
- **Bidirectional**

*Logically a pair of nodes should be
normalised to simplify the process.

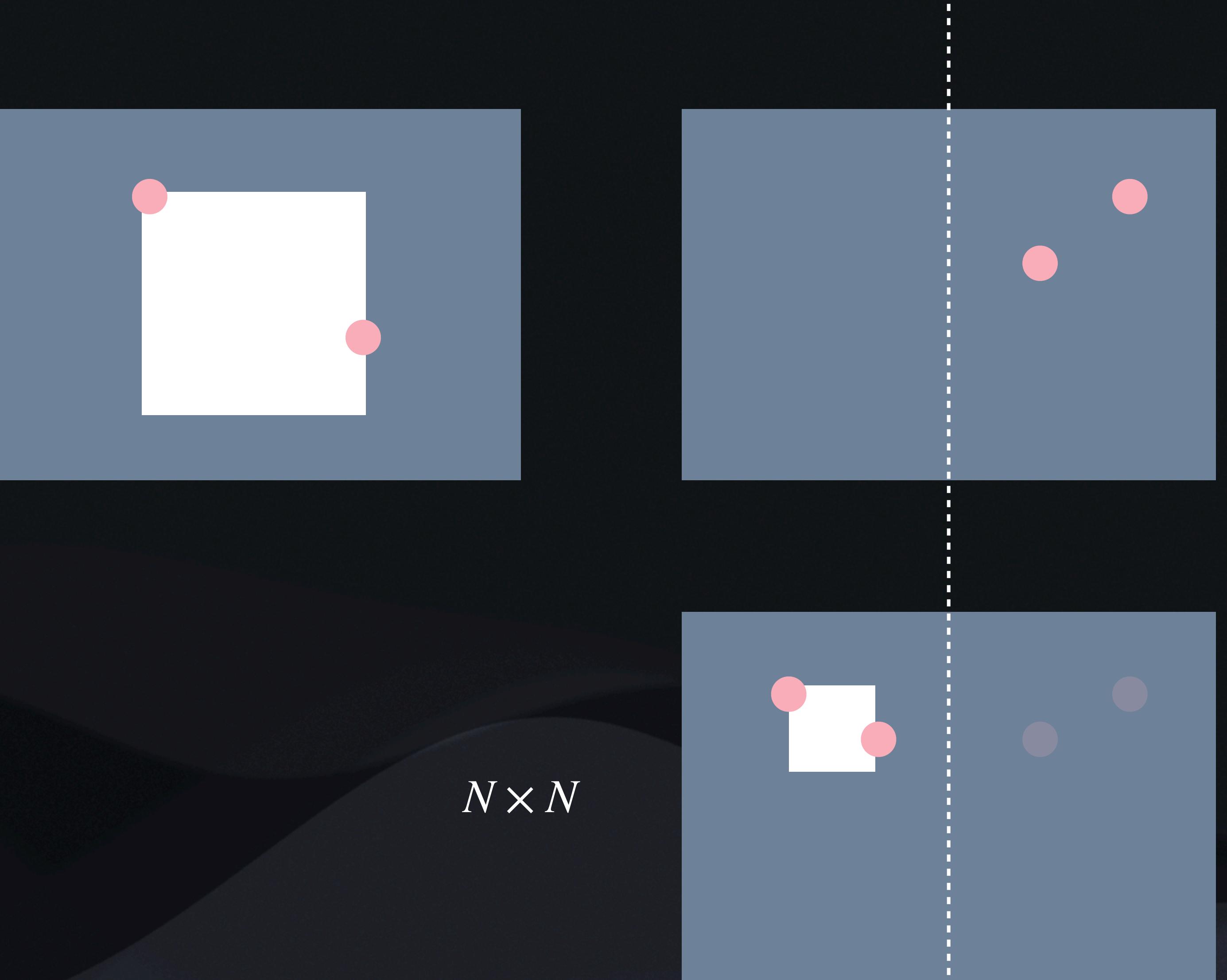


What

What has been proposed

- A square based
- Partitioned
- **Bidirectional**

*A pair of nodes should be **normalised** to simplify the process.



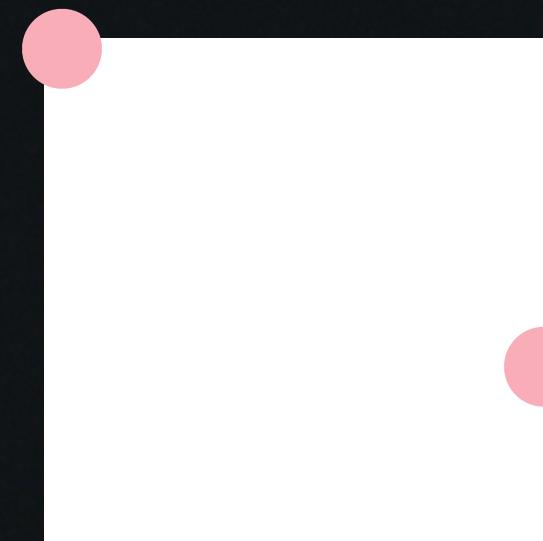
$N \times N$

Jingren Wang, MICS

What

What has been proposed

- A square based
- Partitioned
- **Bidirectional**



=====
TEST: ALL RELATIVE POSITIONS
=====

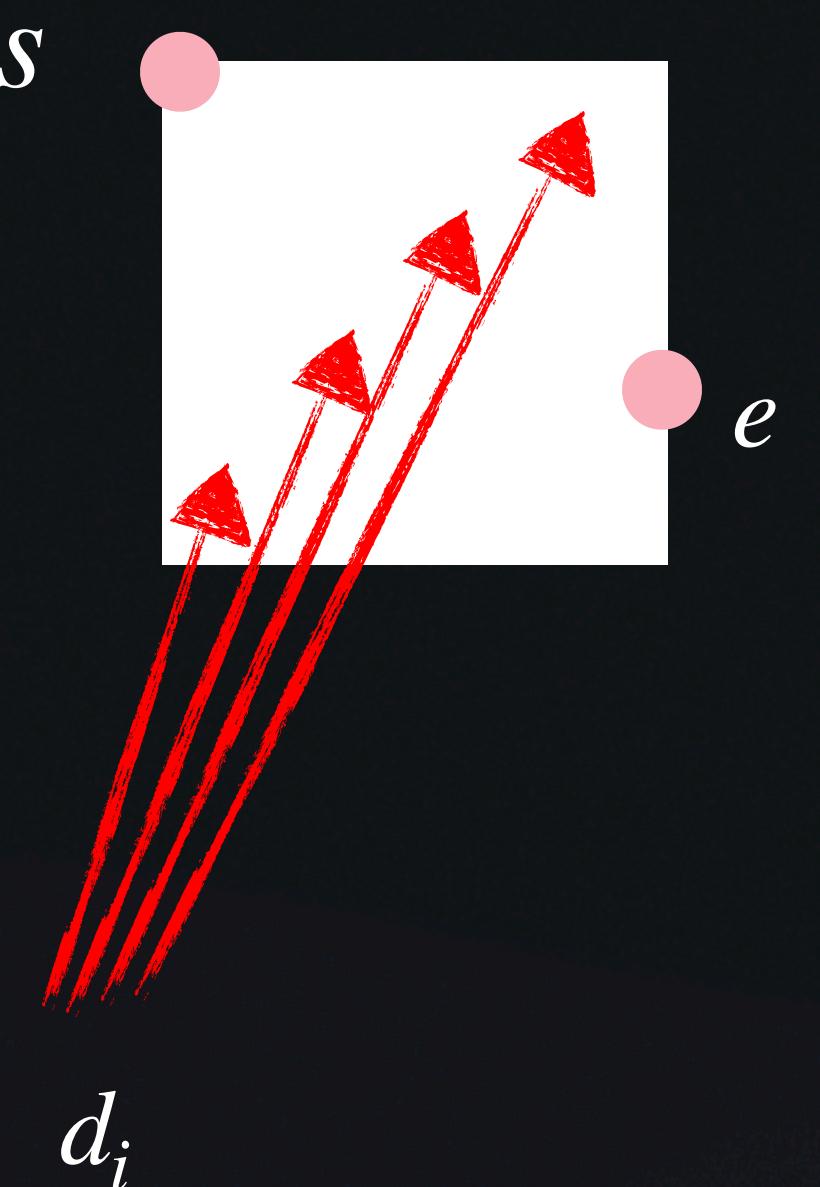
Testing normalizePoints function:

Case	Source->Sink	Case Type	Transformations
Case 1: TL->BR	(2,2)->(20,20)	1	None
Case 2: BR->TL	(20,20)->(2,2)	2	Swapped
Case 3: TR->BL	(20,2)->(2,20)	3	FlipX
Case 4: BL->TR	(2,20)->(20,2)	4	FlipY
Case 5: Horizontal	(10,10)->(20,10)	5	None
Case 6: Vertical	(10,10)->(10,20)	5	None
Case 7: Same point	(15,15)->(15,15)	6	None

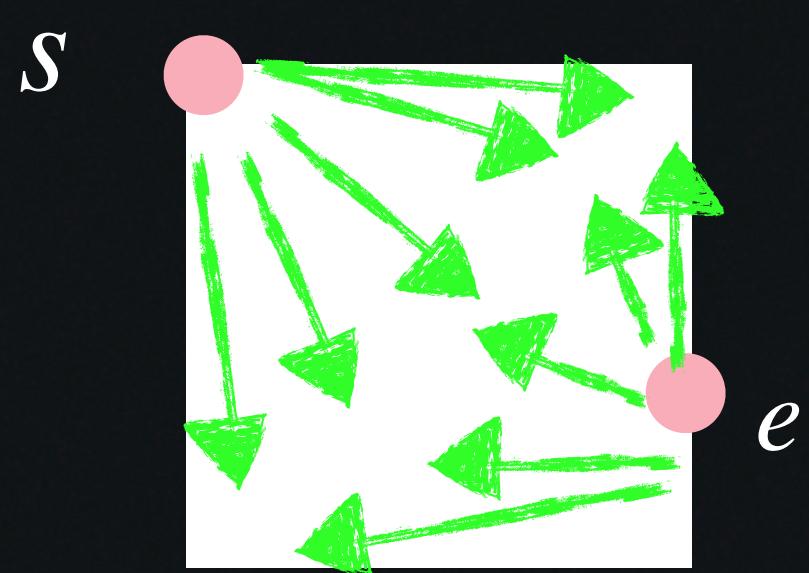
What

What has been proposed

- A square based
- Partitioned
- **Bidirectional**



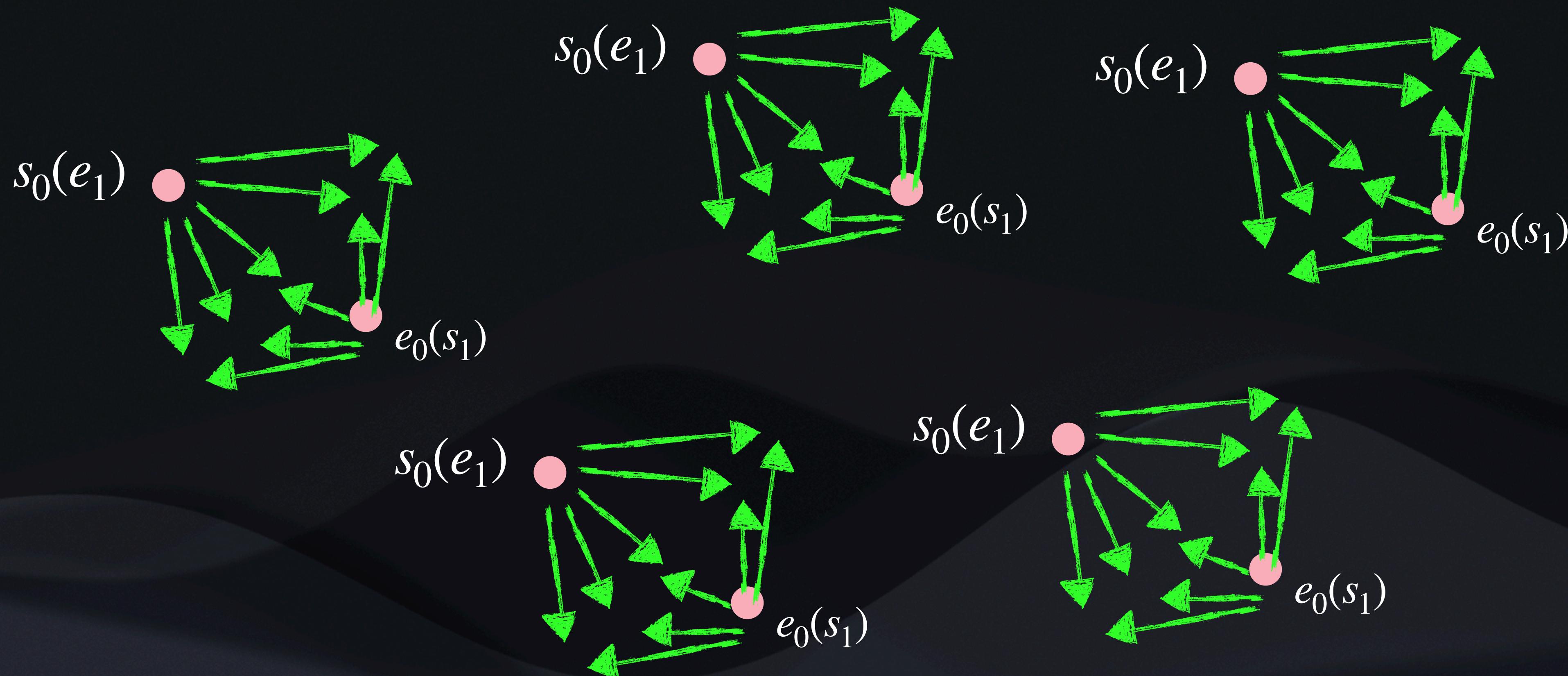
Transformation



Collection

Settings

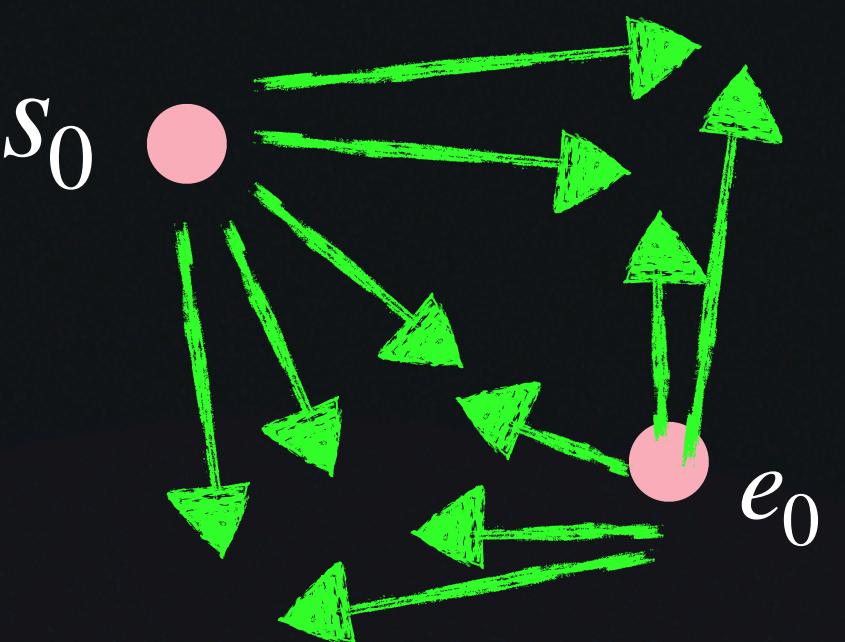
256 threads per block.



Jingren Wang, MICS

Settings

256 threads per block.



Init Result Analysis

Result analysis

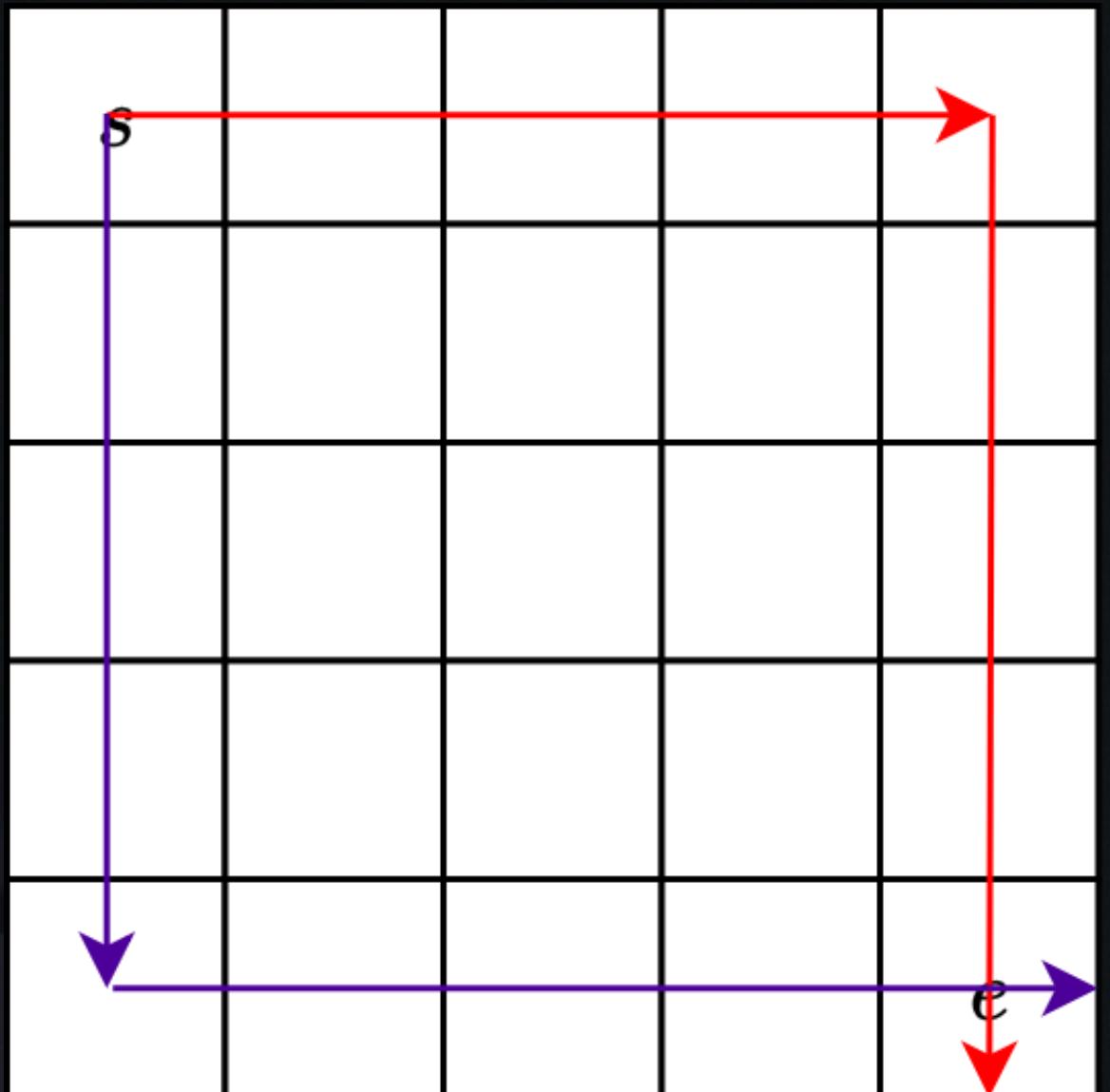
TEST: PERFORMANCE COMPARISON (PATH ONLY)						
Performance (Grid: 100x100)						
Pins	Pairs	CPU Direct (ms)	CPU Diagonal (ms)	GPU Diagonal (ms)	Cost Calc (ms)	
5	9	20.54	24.02	0.21	0.02	
10	19	46.30	45.28	0.24	0.04	
20	39	82.21	125.24	0.35	0.08	
100	199	406.06	504.50	1.03	0.30	
500	999	1914.99	2535.52	4.55	1.65	

Util

Trivial situation

*Q: *What if vias are too large for a small partition to bear?
Do we even need to consider different solutions?*

*Q: *What kind of square of cost especially favour this situation?*



Status

Achieved and Future Plan

- NVIDIA GeForce RTX 3090
- All cases can be processed pretty fast.
- Cost are not very good since lack of consideration.

<https://github.com/wjrforcyber/GAMBLE>

Initial result

Since path tracking is still using simple L shape, costs need to be upgraded.

Cases	CPU_time	CPU_cost	GPU_time	GPU_cost
case1.txt	5.80913s	608800	0.00998s	1345045
case2.txt	0.698954s	193416	0.003755s	677810
case3.txt	0.233073s	135455	0.000927s	249165
case4.txt	0.037691s	66573	0.000506s	227689
case5.txt	0.014779s	32296	0.000199s	50233
case6.txt	0.002633s	12972	0.000179s	23539
case7.txt	8.5175s	5022	0.010087s	15908
case8.txt	0.697453s	1969	0.002699s	5649
case9.txt	0.331217s	1550	0.001065s	7352
case10.txt	0.084318s	1019	0.000514s	6460
case11.txt	0.008438s	289	0.000223s	1024
case12.txt	38.3766s	13652	0.013925s	169478
case13.txt	58.2931s	17131	0.017707s	297765

Thank you!

Jingren Wang, MICS