The New Default Partitioner

Keeping well cells together

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Motivation

Good partitioning:

- is essential for efficient parallelization
- distributes workload evenly
- minimizes the communication between subdomains

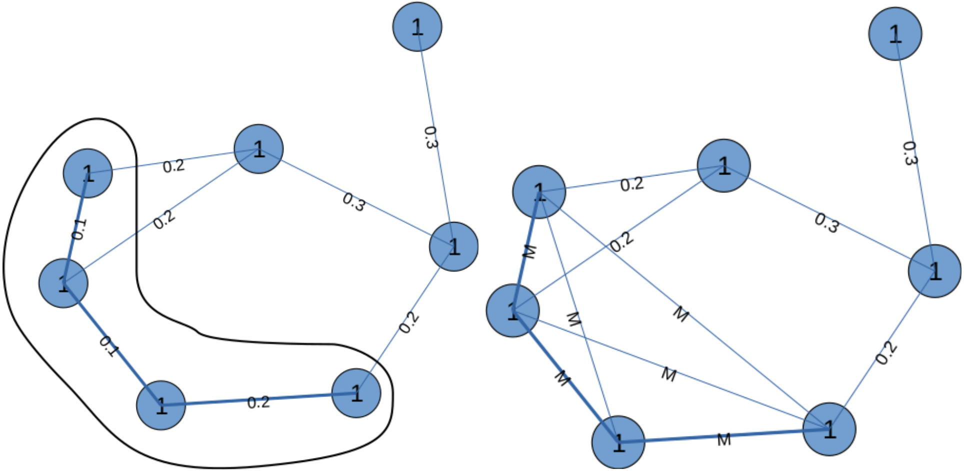
Standard well

- Connects a bunch of cells
  - Nonlocal, the well can be long
  - Strong connections, flow through a well is faster
- Adds four degrees of freedom regardless of the number of perforations

Previous partitioner(s)

1. Connect all cells of a well together
   - edges get big weights
2. Use algorithm Zoltan, Metis, or Scotch
3. Postprocess if `--allow-distributed-wells=false`
   - move cells of a well to one rank
4. Add overlap
5. Distribute cells (communicate)

Previous partitioner(s)



zoltanwell

1. Create graph representation of the grid
2. Contract cells of each well
   - Add up contracted vertices’ weights
   - Remap edges, possibly add up weights
3. Use algorithm Zoltan
   - The partitioner sees each well as one vertex
   - Vertex weight matters
4. Add missing cells to the list of exported cells
5. Add overlap
6. Distribute cells (communicate)

zoltanwell

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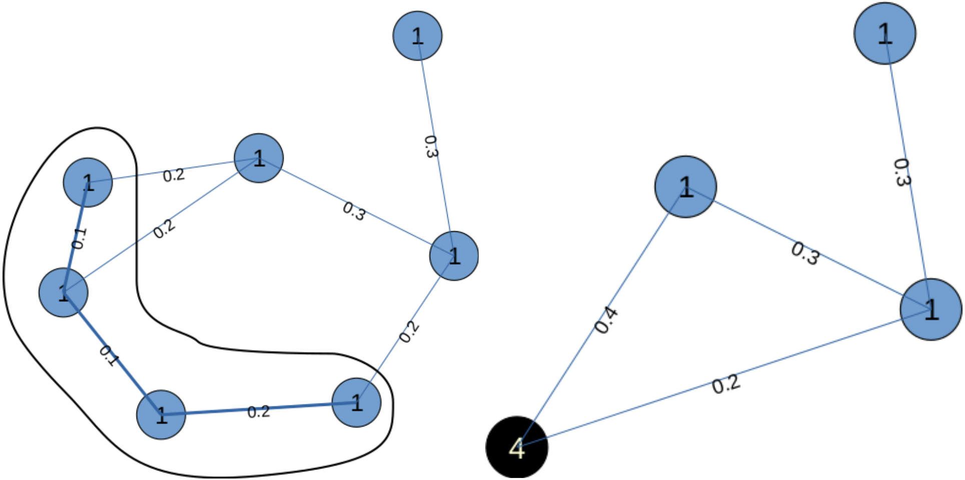
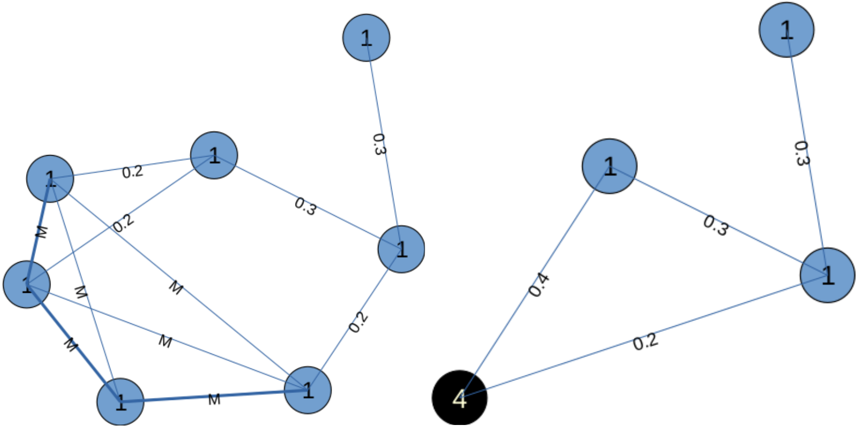


Differences between partitioners



- Big edge weights do not guarantee that the well won’t be split

How to use zoltanwell

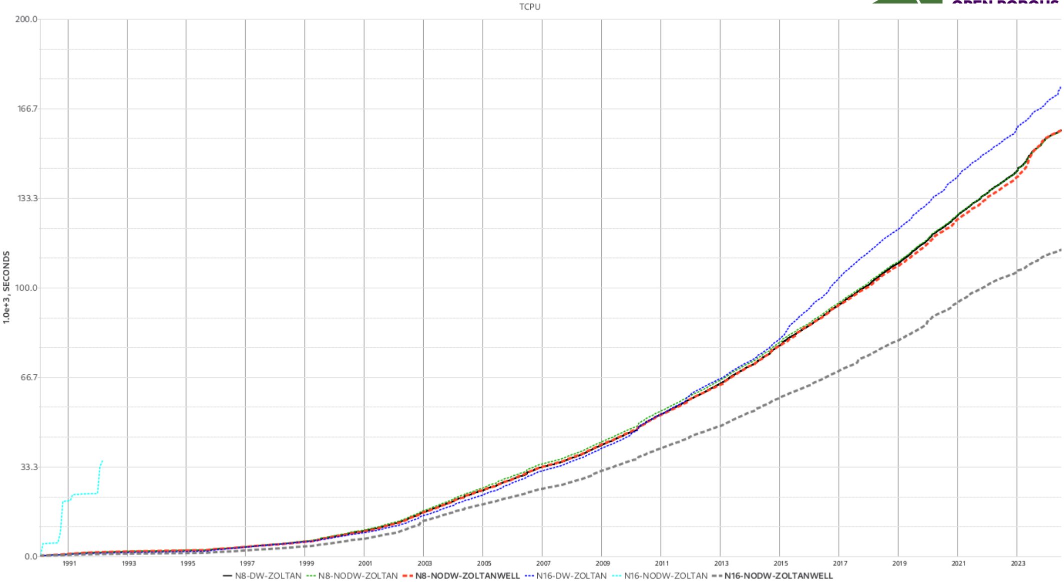
- `--partitioning-method=zoltanwell`
  - It is the default option!
- Parameter `--allow-distributed-wells=true`
  - Disables vertex contraction
- Parameter `--serial-partitioning=true`
  - Not so different to parallel partitioning, rank 0 has whole grid
  - Partitioner does not communicate
- Parameter `EnvelopeWellLayers=(int)`
  - Add neighboring cells to wells
  - Experimental, no useful usecase found (yet?)
  - Added in json file with `--zoltan-params=filename.json`

Comparison of partitioners

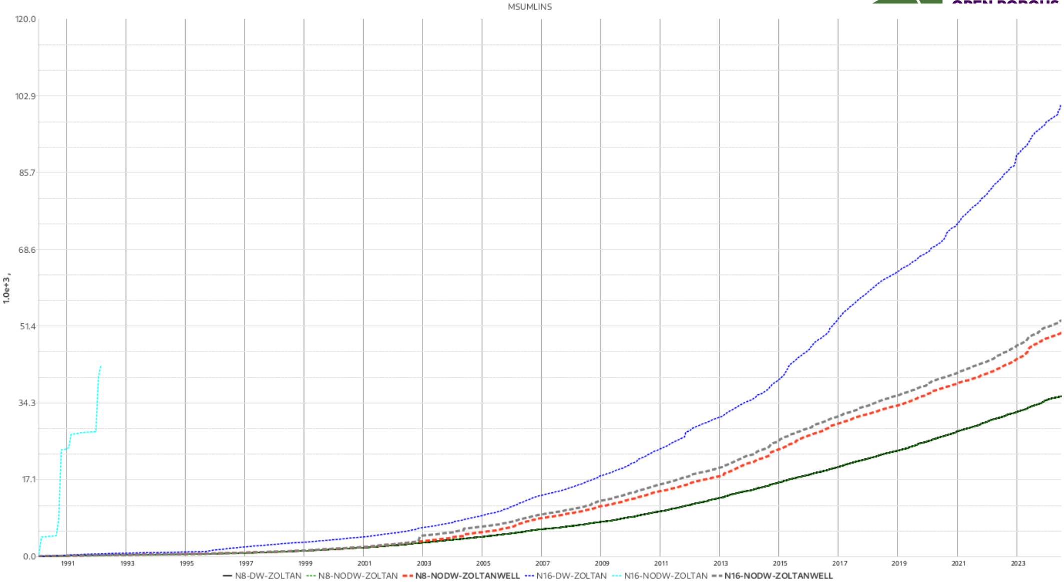
Table: Speed of partitioning. Time is in miliseconds.

Nr. ranks	SPE3 repeated 100×		Hard problem (≈ 1.5M cells)	
	zoltanwell	zoltan	zoltanwell	zoltan
`--serial-partitioning=false`				
2	85	76	11690	11725
4	128	118	17395	19643
8	188	186	32585	35719
`--serial-partitioning=true`				
2	120	113	11055	12287
4	240	226	20723	22797
8	405	394	35600	41526

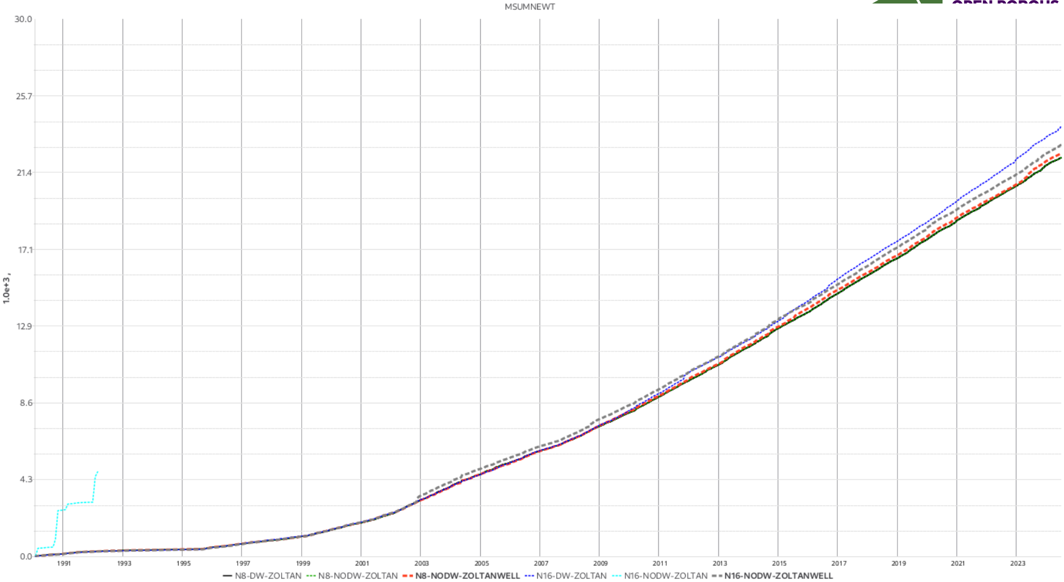
Comparison of partitioners



Comparison of partitioners



Comparison of partitioners


MSUMNEWT
1.0e+3 ,
— N8-DW-ZOLTAN
--- N8-NODW-ZOLTAN
--- N8-NODW-ZOLTANWELL
--- N16-DW-ZOLTAN
--- N16-NODW-ZOLTAN
--- N16-NODW-ZOLTANWELL