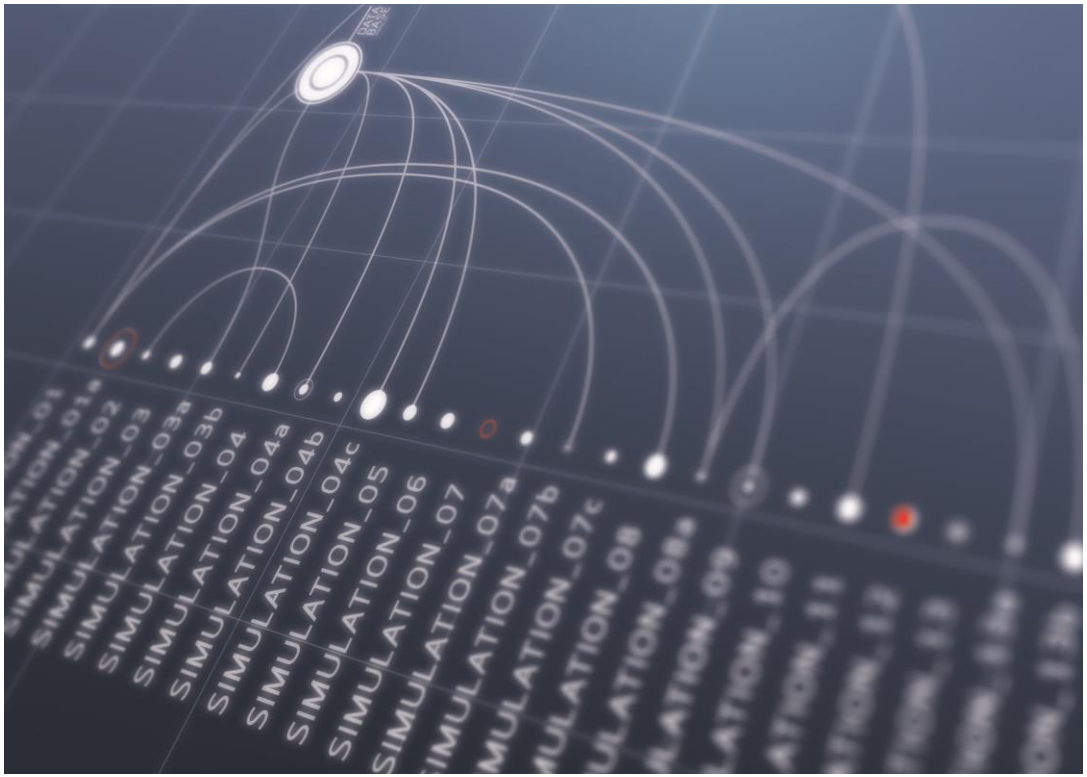
Reducing Storage Footprint and Bandwidth Requirements to a Minimum: Compressing Sets of Simulation Results



Stefan Mertler, Stefan P. Müller

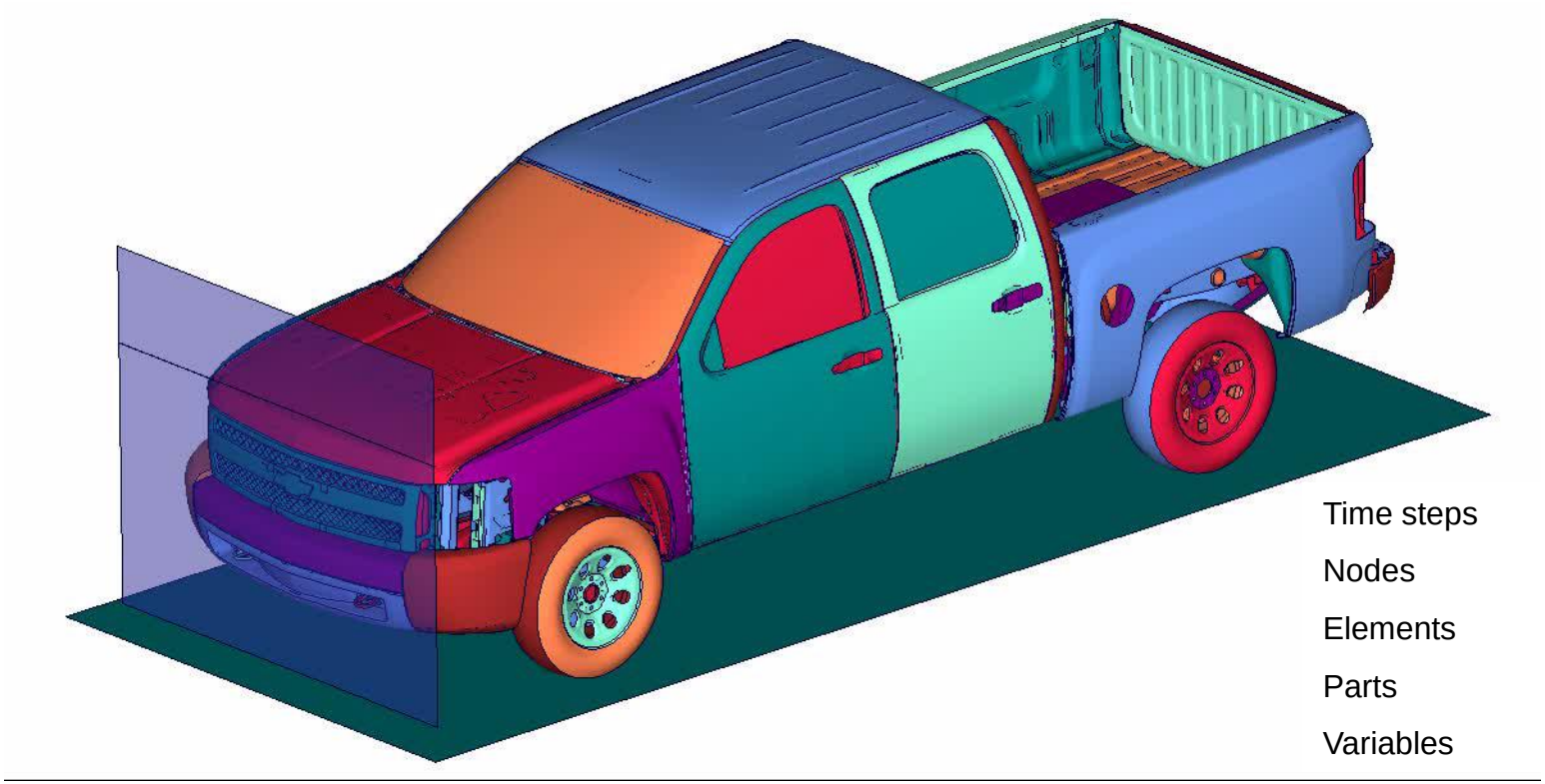
SIDACT GmbH

Compression of simulation results

Standard solution for industry applications: FEMZIP

- Lossy compression of a single simulation result
- Versions for several data formats
- Continuing improvement (L4)
- Integrated decompression in several postprocessors
- Compression rates of 15 to 30

Example: Chevrolet Silverado simulated using LS-DYNA



Time steps	38/152
Nodes	942.749
Elements	929.181
Parts	679
Variables	14

The displayed model has been developed by the National Crash Analysis Center (NCAC) of the George Washington University under a contract with the FHWA and NHTSA of the US DOT.
The crash simulation was done by SIDACT with help of Fraunhofer Institut SCAI, Sankt Augustin Germany, and are their respective property

SIDACT GmbH

Compression results

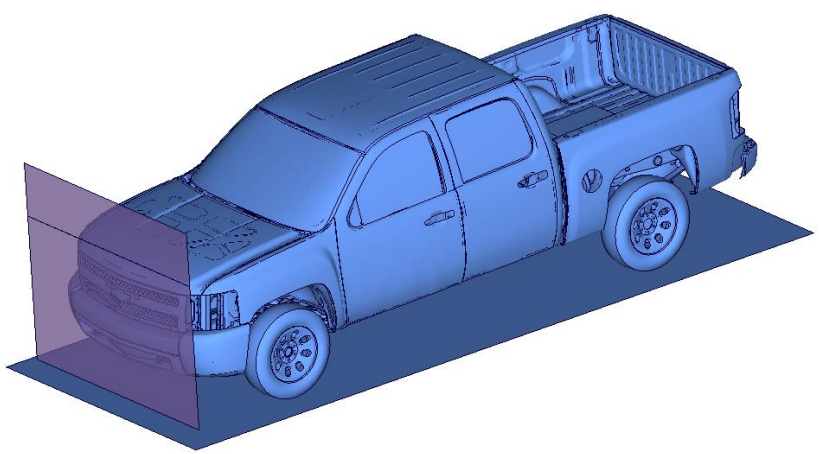
Single simulation

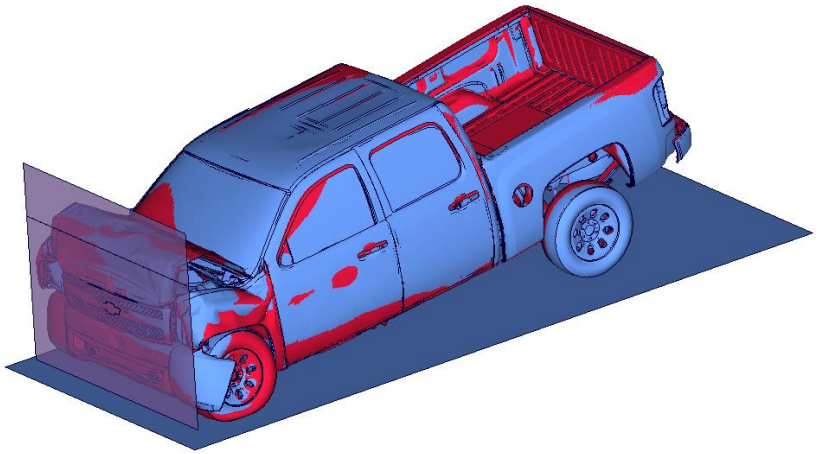
- Original size: 1.525,1 MB
- FEMZIP size: 55,9 MB
- Compression rate: 27,28 (L4)

Additional simulation

- Original size : 1.525,1 MB
- FEMZIP size : 56,25 MB
- Combined compression rate: 27,19

Comparison: Two simulations, first and last time step





- Are the simulations disparate?
- Can the commonalities be exploited?

The displayed model has been developed by the National Crash Analysis Center (NCAC) of the George Washington University under a contract with the FHWA and NHTSA of the US DOT.
The crash simulation was done by SIDACT with help of Fraunhofer Institut SCAI, Sankt Augustin Germany, and are their respective property

Recently developed:

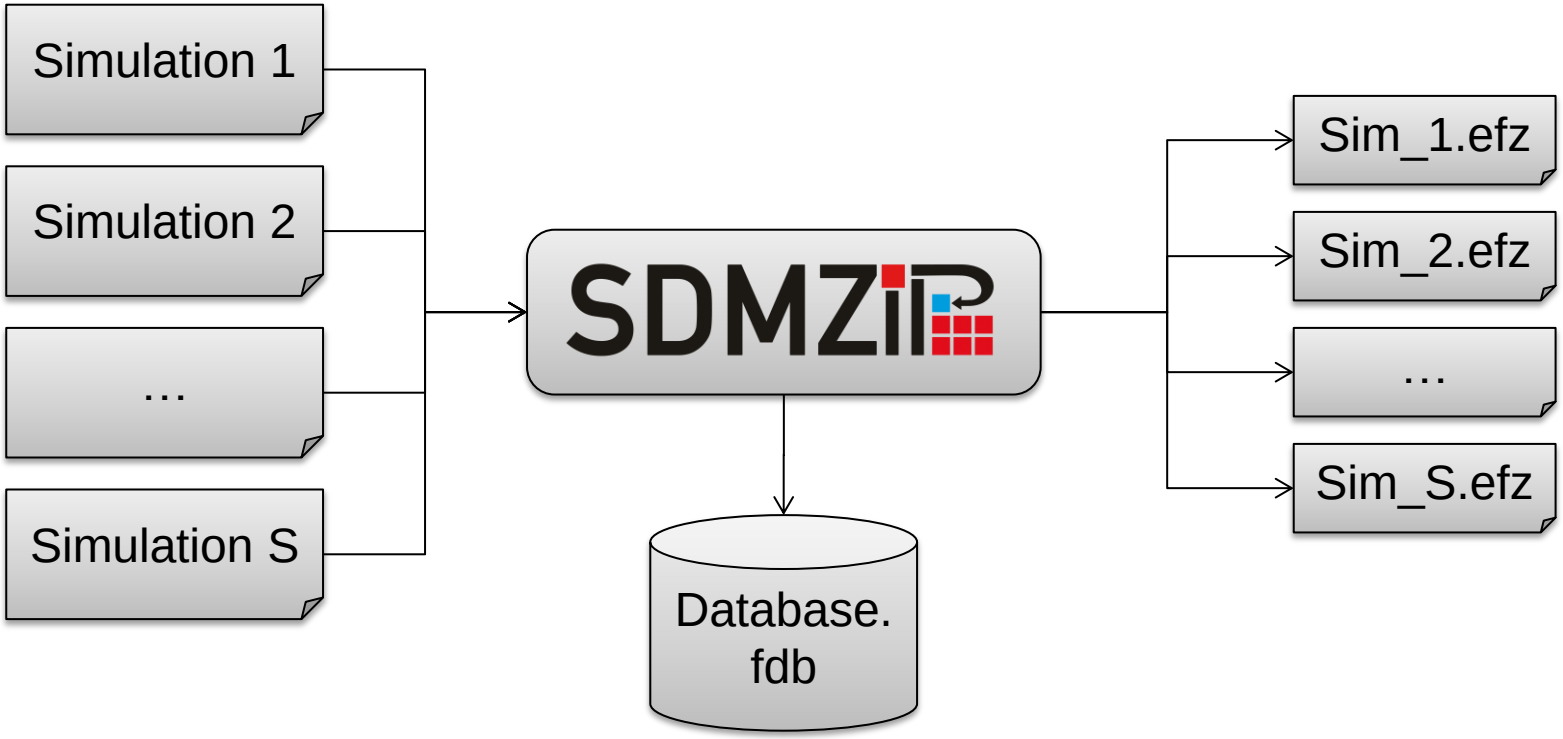
SDMZIP

New software for compression of sets of simulation results: SDMZIP

- Lossy compression
- Information is processed part-based
- Modular storage concept
- Commonalities of similar simulations is aggregated

Compressing sets of simulation results

SDMZIP



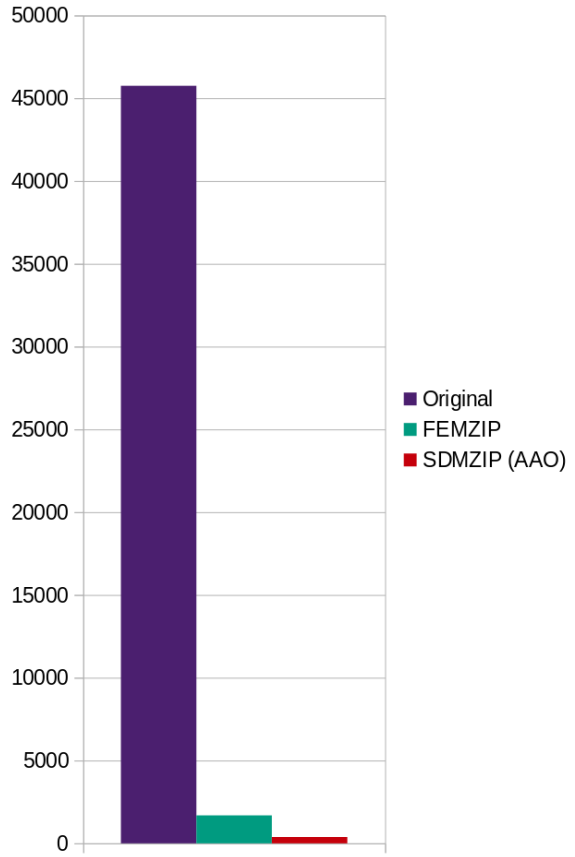
SIDACT GmbH

Compression results

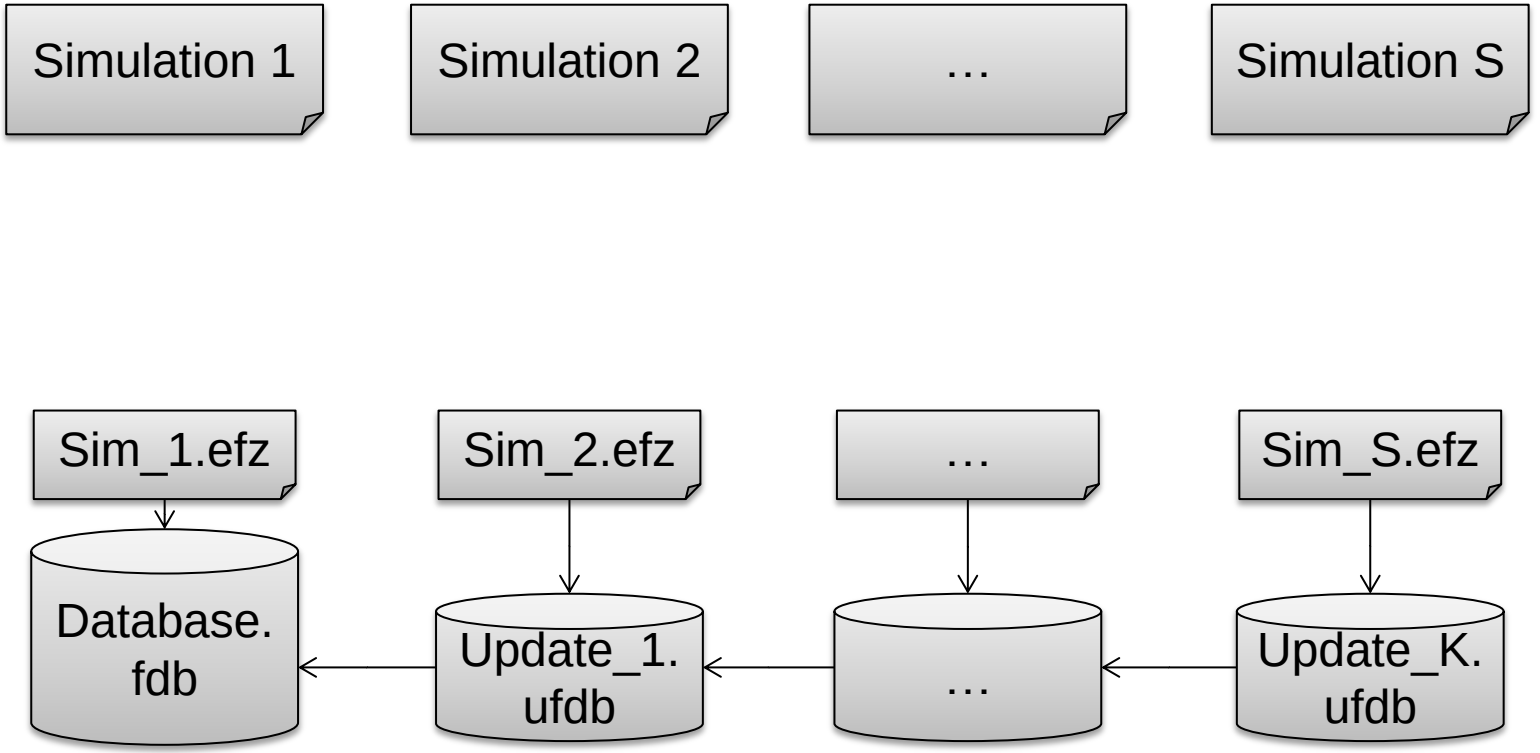
30 Simulations, with 38 time steps:

- Original size: 45.752,58 MB
- FEMZIP size : 1.684,54 MB
- SDMZIP size : 379,23 MB
  - Database : 110,17 MB
  - *.efz ca. : 8,98 MB

Problem: Rare scenario

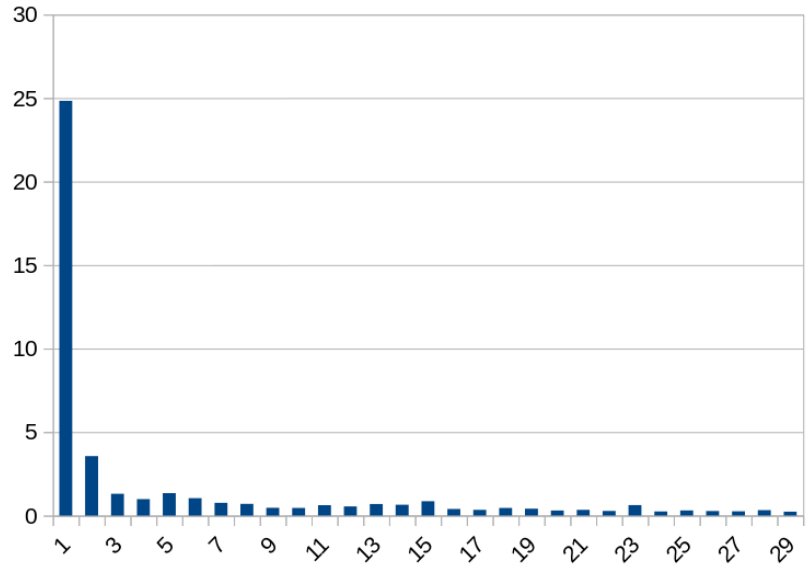


Incremental compression



Database development for 30 simulations

Size of databases in MB for incremental compression.



Size of *.efz ca. : 19,01 MB

Results vary depending on:

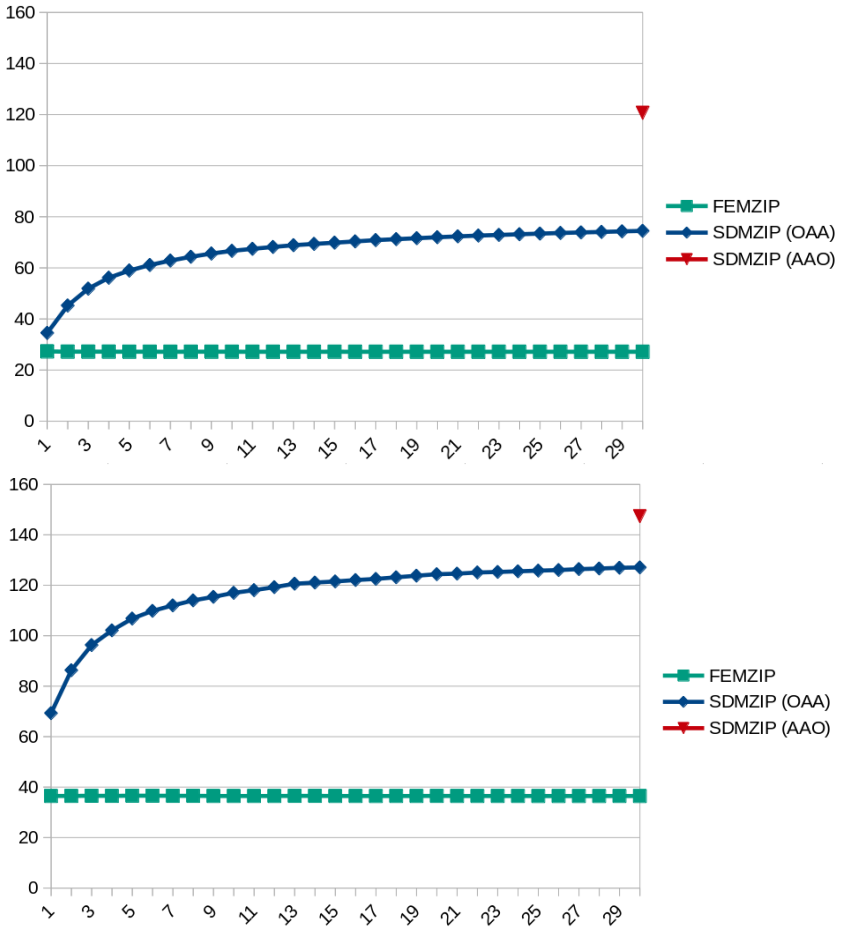
- Similarity of simulations
- Time resolution

Compression results: Comparison

Development of compression rates for 38 and 152 time steps.

Improvement on FEMZIP for 30 simulations if the simulations are compressed one after another (OAA) or all at once (AAO)

No. Time steps	OAA	AAO
38	2,74	4,44
152	3,48	4,03



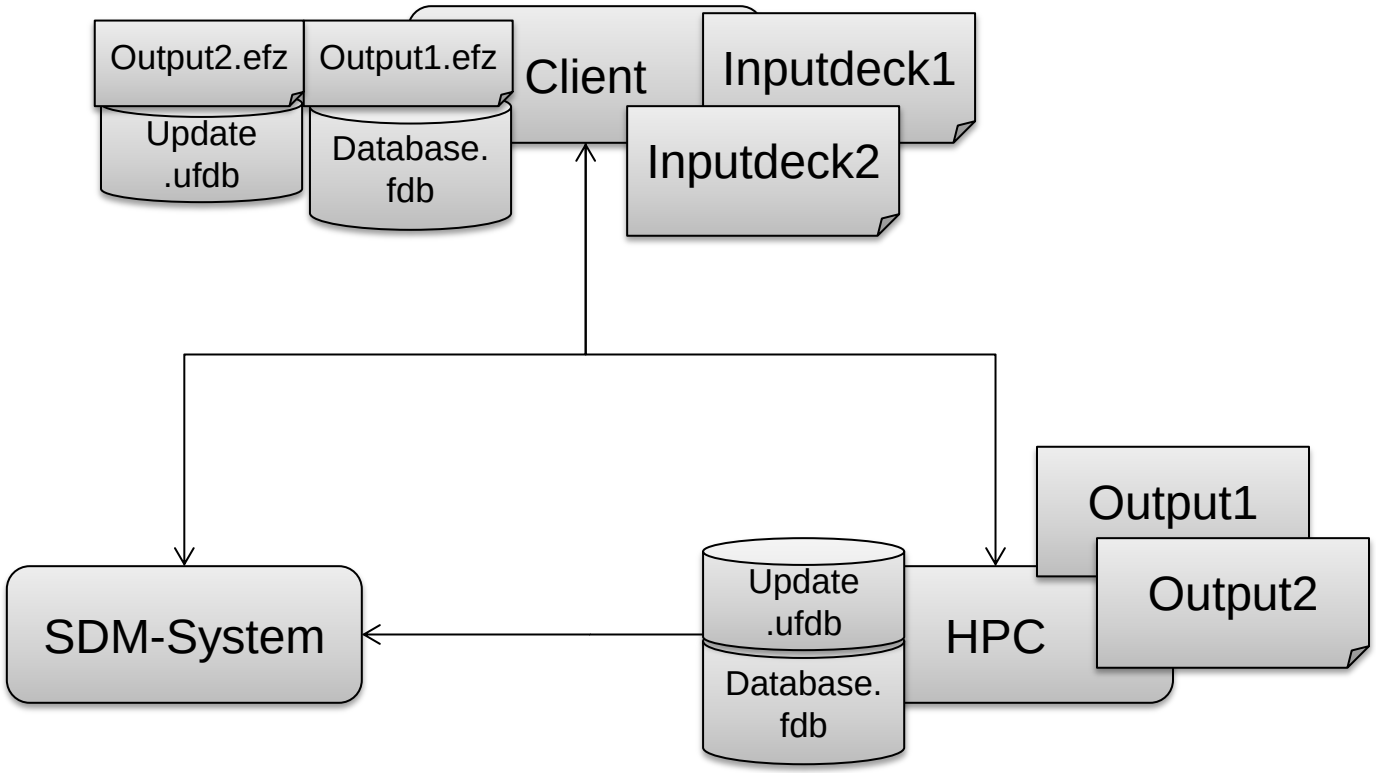
Deployment

The more complex procedure needs a special integration, mainly in regards to:

- Synchronization tasks
- Identification of similar set
- Deletion protocols

These are currently under investigation in a pilot project with SCALE

Deployment in SDM-Systems:

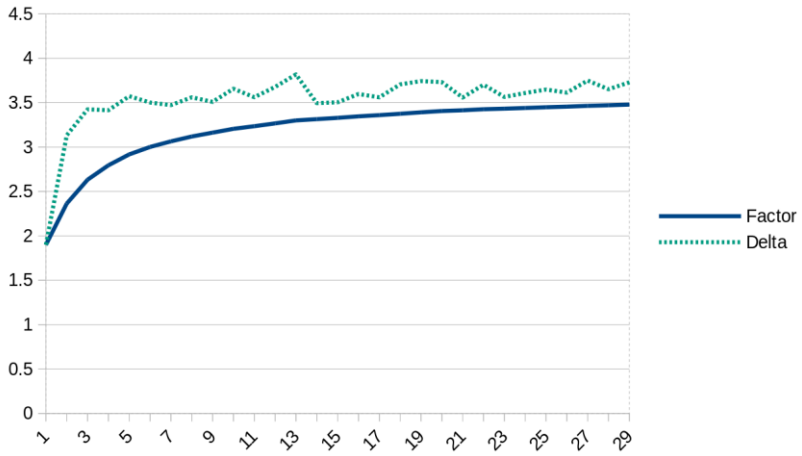


Bandwidth reduction

SDMZip

The extra complexity for synchronization results in an additional improvement for transmission.

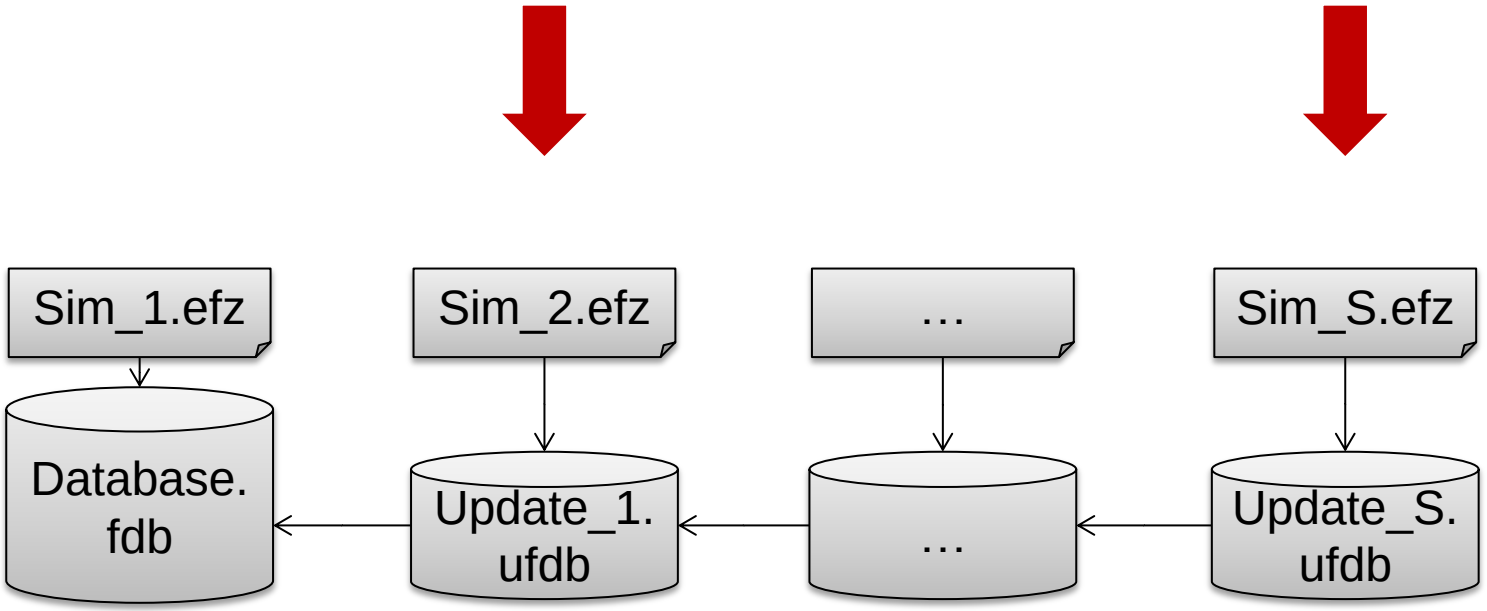
- Only the update has to be send



SIDACT GmbH

Deleting simulation results

The dependencies need to be considered for deletion protocols



Deleting simulation results: Worst Case

FEMZIP size: 55,9 MB

Database size: 43,9 MB

Mean .efz size: 19,01 MB