Tearing For Parallelization and Control of Sparsity in Process Flowsheeting

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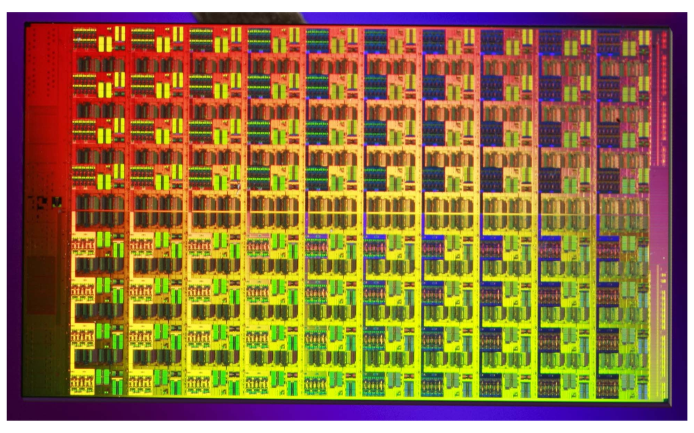
ESCAPE-18 (18th European Symposium On Computer Aided Process Engineering) June 1-4 2008 - Lyon, France

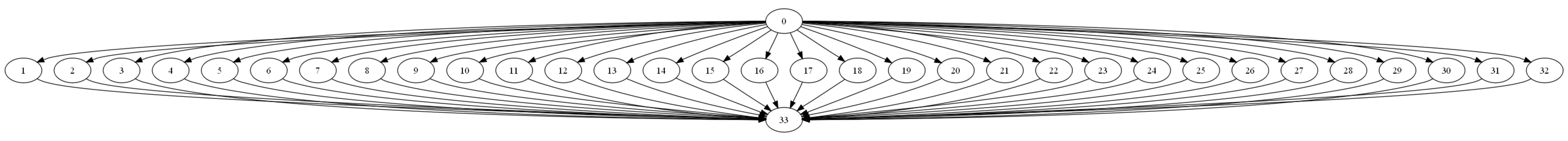
in the future, computer processing power will mainly grow by increasing the number of cores; software will need to go parallel



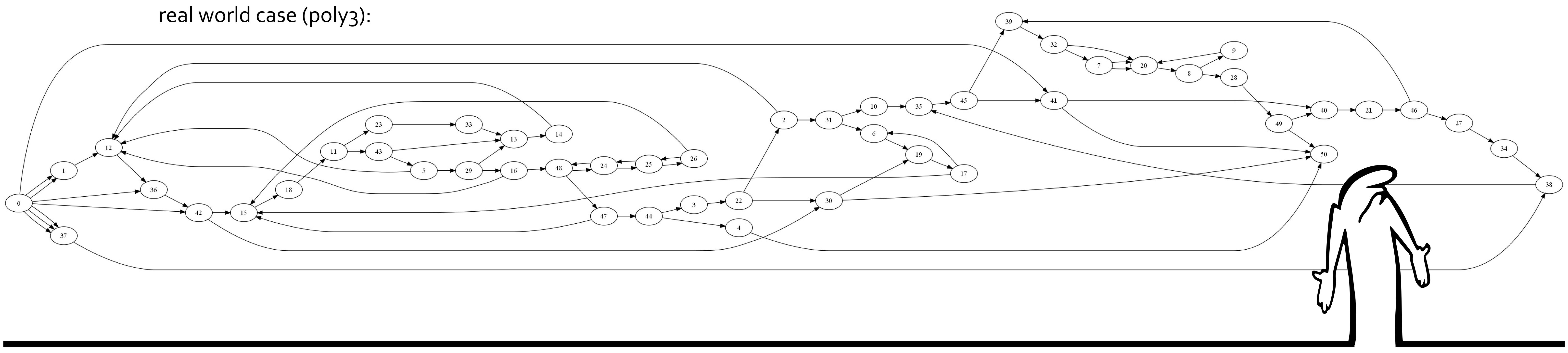
Intel terascale computing prototype, 80 cores, 02/2007

Process flowsheet are not always suitable for parallelization; worst case:

lucky case:

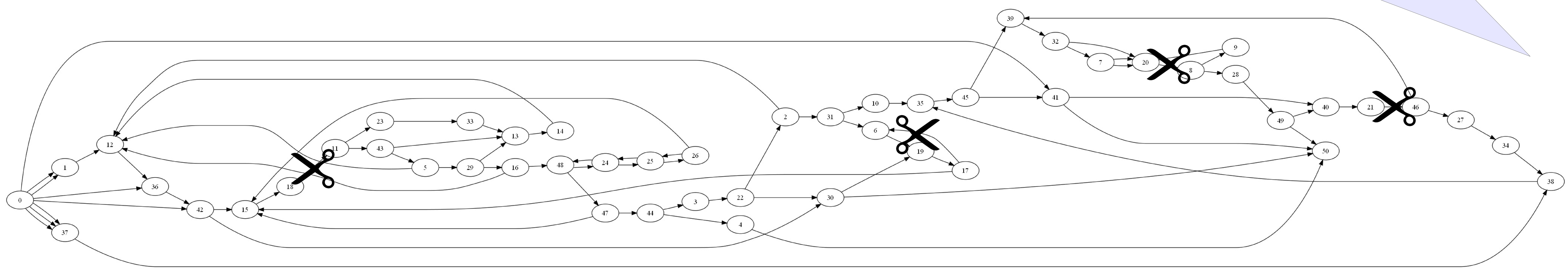


real world case (poly3):

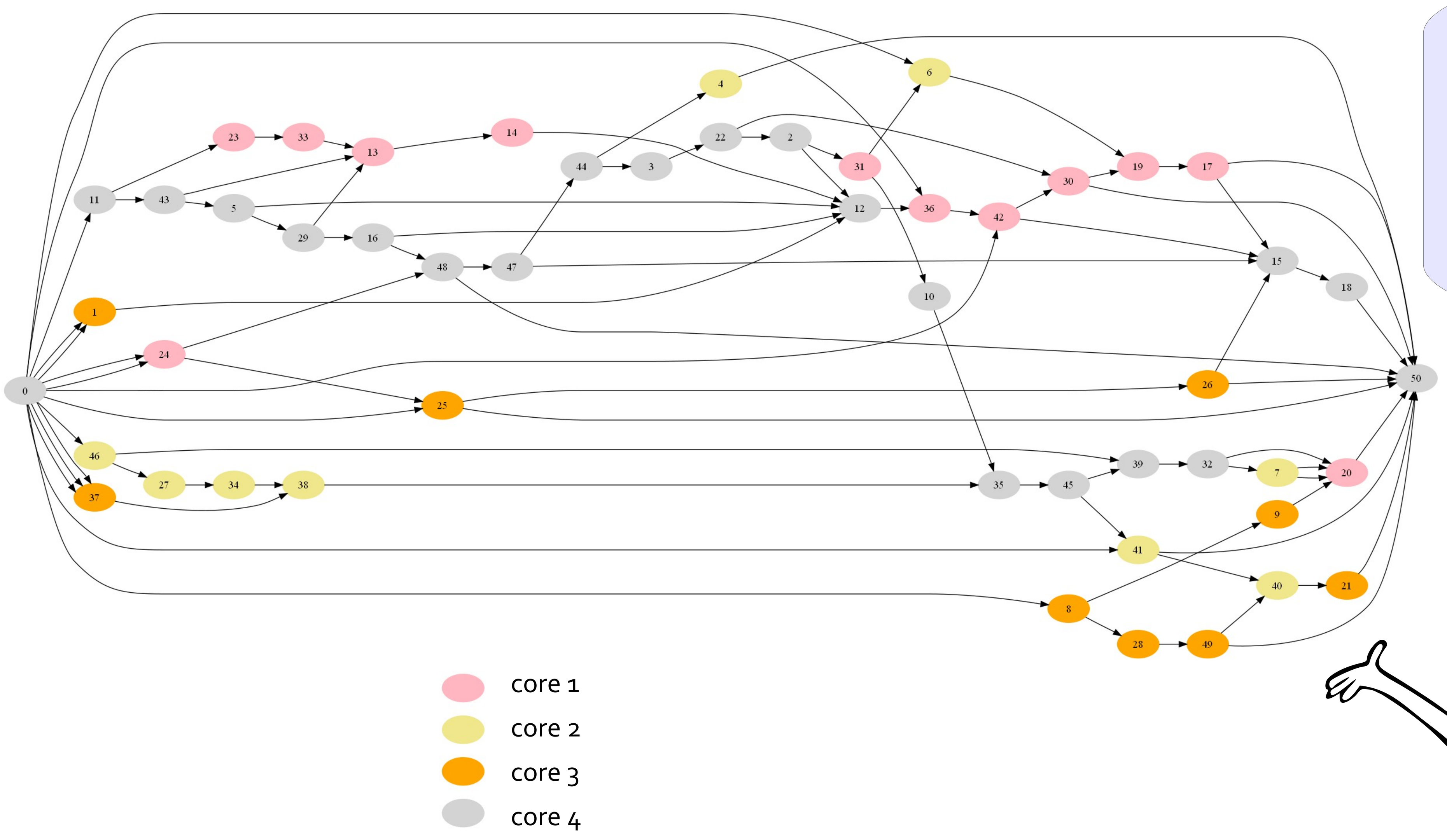


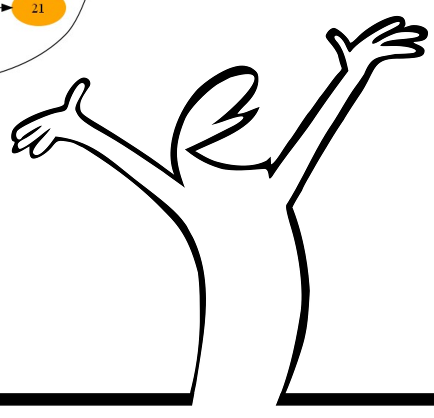
how can we exploit parallelism to accelerate process flowsheeting ?

we can tear additional streams to shorten the critical path



we can then use standard task scheduling algorithms such as CP/MISF to assign the unit operations to different cores





Test case	nodes	arcs	arc/ node	minimal tearing	speed-up	new torn arcs	new speed-up
cross_flow	16	40	2.5	0	228%	5	320%
mcfc	23	34	1.5	4	141%	5	262%
multistage_evap	25	49	2	4	111%	12	296%
gas_compr	100	116	1.2	0	241%	4	393%
chem1	148	156	1.1	12	376%	0	=
chem2	58	102	1.8	1	131%	7	329%
poly1	25	39	1.6	2	134%	4	293%
poly2	29	51	1.8	3	163%	4	306%
poly3	51	81	1.6	7	231%	4	327%

applying tearing to real-world flowsheets, the speed-ups on 4 cores increase on average from 50% to 80% of theoretical