Cache-efficient Graph Cuts on Structured Grids

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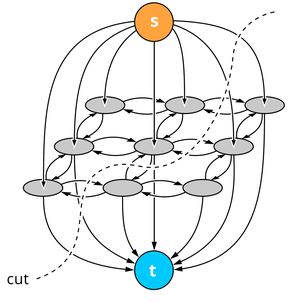
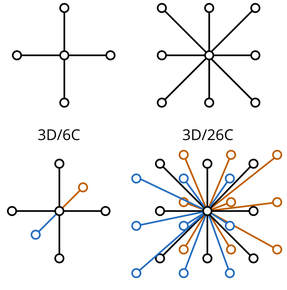
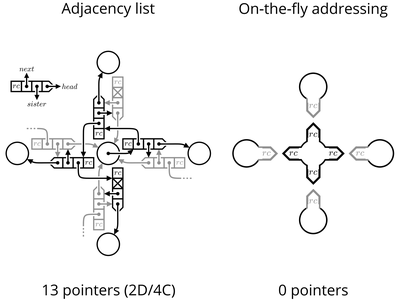
Graph Cuts



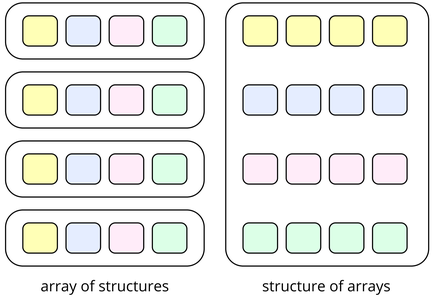
Grid-like Topologies



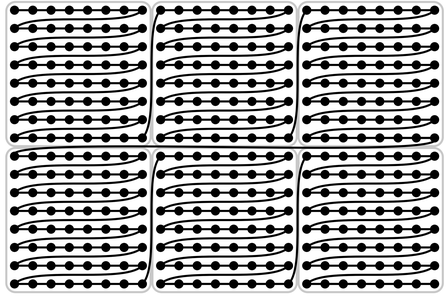
Compact Representation (CR)



Structure of Arrays (SoA)



Blocked Layout (BLK)



$$u = (x\&7) + ((y\&7) \ll 3) + ((x\&\sim 7) \ll 3) + W \cdot (y\&\sim 7)$$

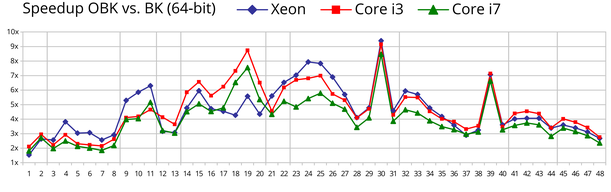
000000	000001	000010	000011	000100	000101	000110	000111
001000	001001	001010	001011	001100	001101	001110	001111
010000	010001	010010	010011	010100	010101	010110	010111
011000	011001	011010	011011	011100	011101	011110	011111
100000	100001	100010	100011	100100	100101	100110	100111
101000	101001	101010	101011	101100	101101	101110	101111
110000	110001	110010	110011	110100	110101	110110	110111
111000	111001	111010	111011	111100	111101	111110	111111

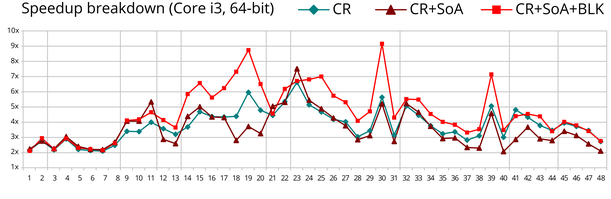
$$\begin{aligned} left(u) &= u \;\&\; 000111_b \;\; ? \;\; u-1 \;:\; u-57 \\ right(u) &= (\sim u) \;\&\; 000111_b \;\; ? \;\; u+1 \;:\; u+57 \\ top(u) &= u \;\&\; 111000_b \;\; ? \;\; u-8 \;:\; u-Y_{ofs} \\ bottom(u) &= (\sim u) \;\&\; 111000_b \;\; ? \;\; u+8 \;:\; u+Y_{ofs} \end{aligned}$$

$$Y_{ofs} = 8 \cdot (W - 8 + 1).$$

Speedup and Memory Reduction

BK: [Boykov & Kolmogorov 2004], LS: [Liu & Sun 2010], OBK: optimized BK (CR+SoA+BLK)





OBK vs. state-of-the-art (average speedup)

total	2D/4C D	2D/4C S	3D/6C	3D/26C
OBK vs. BK	**2.5x**	**4.4x**	**4.2x**	**3.0x**
OBK vs. VPP	**2.0x**	**18.4x**	**n/a**	**n/a**
OBK vs. IBFS	**3.5x**	**17.0x**	**6.7x**	**5.8x**

maxflow	1-13	14-20	21-40	41-48
OBK vs. BK	**3.0x**	**4.6x**	**4.6x**	**3.4x**
OBK vs. VPP	**2.4x**	**21.7x**	**n/a**	**n/a**
OBK vs. IBFS	**2.3x**	**18.8x**	**3.0x**	**2.1x**

VPP: [Arora et al. 2010], IBFS: [Goldberg et al. 2011]

GRIDCUT

Source code & Benchmark:
http://gridcut.com