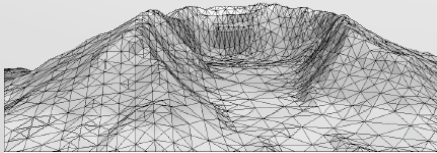


Streaming processing of spatial data

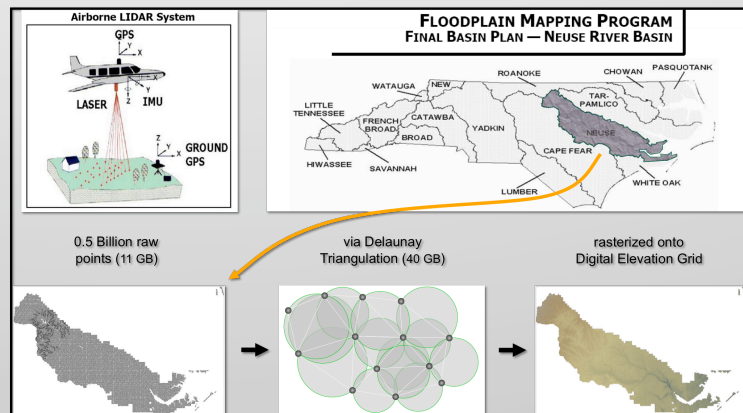
Waldo Tobler's 1st Law of Geography:

"Everything is related to everything else, but near things are more related than distant things."

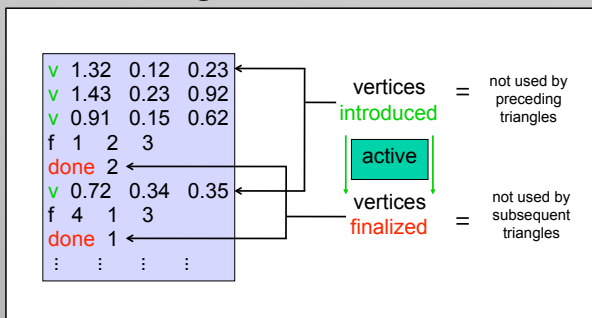
Motivation



After Hurricane Floyd, North Carolina used LIDAR to acquire elevation data for the entire state. Billions of sample points were to be processed into raster elevation maps by Delaunay triangulation. Existing external memory methods are slow and require temp. storage for GB of auxiliary data structures.

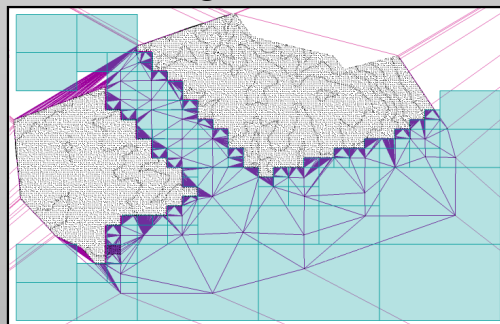


Streaming Mesh



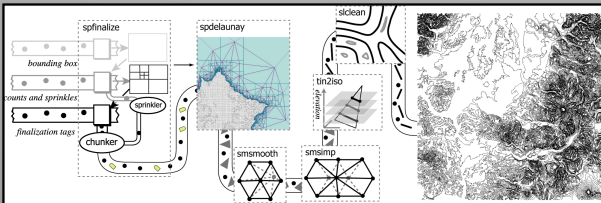
A streaming mesh specifies interleaved vertices and triangles, in addition vertices not used by subsequent triangles are finalized.

Streaming Points



Streaming points begin by transmitting a grid or quad-tree with the number of points contained in each cell, allowing for finalization.

Example Processing Pipeline



Using streaming we process 6 million points into a terrain model on an "average" laptop

Experimental Results

"grbm" (6,016,833 points, 69 MB)		number of produced objects (comp)	size MB	time (sec)	memory (MB)
added module	produced data	objects (comp)	MB	prep first last	other cmd total
spfinalize	finalized LIDAR	6,016,833	71	2+2 1 3	- 28 28
spfinalize	raw TIN	12,018,597	213	2+2 1 27	28 7 35
tin2iso	raw lines	1,236,155	7,127	2+2 1 35	35 6 41
slclean	clean lines	1,180,364	228	2+2 1 36	41 1 42
smsmooth	smooth TIN	12,018,597	213	2+2 2 43	42 6 48
smimp	smooth simpl lines	1,201,860	21	2+2 15 170	44 15 59
	smooth simpl clean lines	398,694	608		
		390,357	145		
			9		
"pgrm" (67,125,109 points, 568 MB)		number of produced objects (comp)	size MB	time (sec)	memory (MB)
added module	produced data	objects (comp)	MB	prep first last	other cmd total
spfinalize	finalized LIDAR	67,125,109	776	27+27 1 42	- 21 21
spfinalize	raw TIN	134,207,228	2328	27+27 1 426	21 10 31
tin2iso	raw lines	8,861,024	8,434	205 27+27 1 469	31 11 42
slclean	clean lines	8,697,263	3,382	201 27+27 1 475	42 1 43
smsmooth	smooth TIN	134,207,228	2328	27+27 2 547	43 12 55
smimp	smooth simpl lines	13,420,723	232	27+27 28 2118	50 16 66
	smooth simpl clean lines	2,853,504	7,894		
		2,708,640	1,796		
			63		

spfinalize -i points.raw | spfinalize -i sp -oamb | amsmooth -iamb -oamb | amimp -iamb -oamb | tin2iso -iamb -oalb | slclean -iamb -o lines.alb