



# DistTC: High Performance Distributed Triangle Counting

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The University of Texas at Austin

IEEE HPEC Graph Challenge 2019

# Goal: Implement an Efficient Triangle Counting

## Challenges

Not enough memory to fit it on single machine (clueweb12 has 37 B edges)

Most of the implementations are on shared memory/single GPU

Distributed processing requires efficient partitioning and synchronization

TC is not a vertex program

## Solution: DistTC

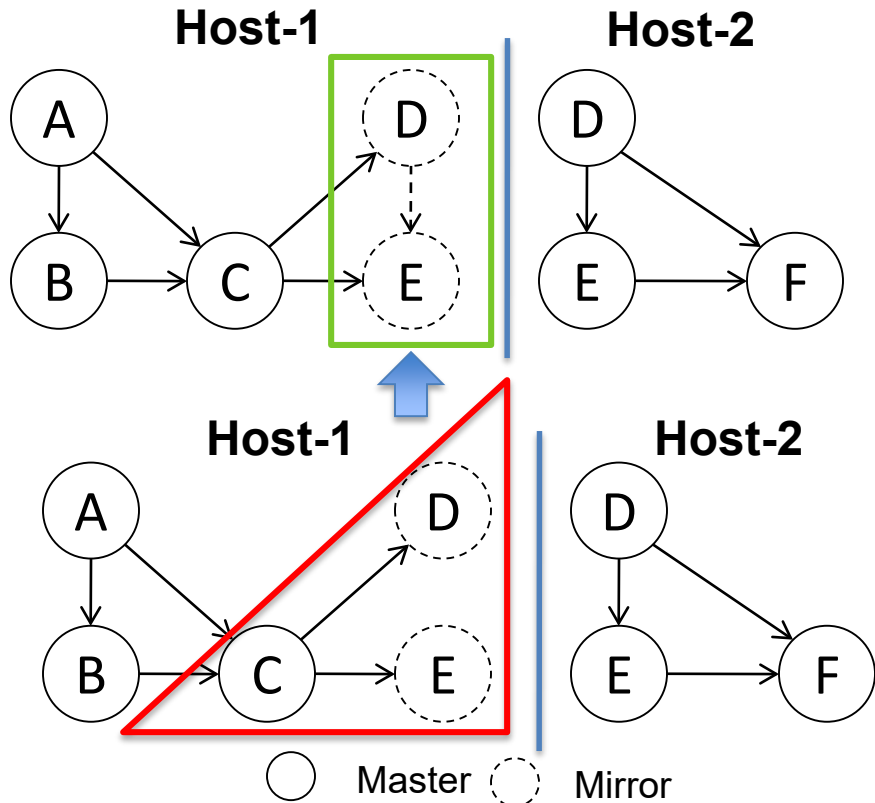
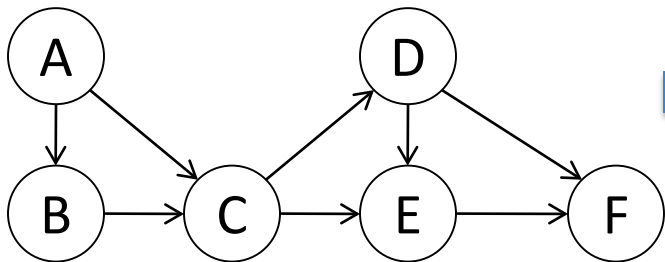
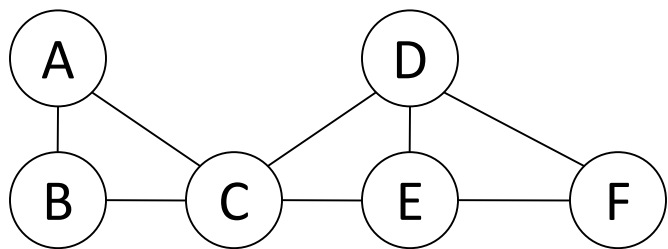
A novel graph partitioning policy

Eliminates almost all communication for distributed TC

Platform-agnostic

Up to **1.6×** faster than previous graph challenge champions

# Partitioning Scheme For Distributed Triangle Counting



# Experimental Setup

Software

CuSP [Hoang et al. IPDPS 2019]

Hardware

Bridges Super Computer  
 32 (nodes) \* 2 (NVIDIA P100 GPUs)

Inputs

Input	V	E	Input	V	E
scale19	0.33 M	7.7 M	twitter40	41.6 M	1.2 B
scale20	0.64 M	15.6 M	friendster	66 M	1.8 B
scale21	1.24 M	31.7 M	gsh-2015	988 M	25 B
scale22	2.39 M	64.1 M	clueweb12	978 M	37 B

# Results

Graph 500 Input	IrGL (sec)	DistTC (sec)
scale18	0.06	0.06
scale19	0.18	0.15
scale20	0.56	0.35
scale21	1.58	0.80
scale22	4.41	1.91

Comparison on Single GPU

- DistTC is up to **2.31x** faster than IrGL.

Input	GPUs	TriCore (sec)	DistTC (sec)
twitter40	8	6.5	6.7
friendster	8	2.1	4.0
gsh-2015	32	253.4	159.9
clueweb12	64	-	172.4

Comparison on Distributed GPUs

- DistTC is up to **1.58x** faster than TriCore

# Summary

- Proposed a new graph partitioning policy
- Eliminates most of the synchronization
- Implemented distributed multi-GPU triangle counting
- Achieves up to 1.6x speed up over 2018 champion

Questions?

# Results: Distributed Multi-GPUs

Input	GPUs	Pre-Processing (sec)	Exec. Time (sec)	Total Time (sec)
rmat26	16	30.16 (29.15)	5.95	36.11
	32	26.92 (25.99)	3.63	30.55
	64	23.74 (22.89)	2.62	26.36
twitter40	16	24.90 (24.20)	3.92	28.82
	32	20.81 (20.20)	2.83	23.64
	64	18.73 (18.19)	2.35	21.08
friendster	16	52.13 (51.32)	2.49	54.62
	32	41.80 (41.19)	1.64	43.44
	64	36.13 (35.64)	1.50	37.63
uk2007	16	12.16 (11.63)	8.64	20.80
	32	12.06 (11.66)	6.52	18.58
	64	11.41 (11.05)	5.47	16.88
gsh-2015	32	143.43 (142.30)	16.44	159.87
	64	143.72 (142.97)	15.25	158.97
clueweb12	64	162.92 (162.61)	9.49	172.41