System and method for automatic parallel code generation for graph algorithms for multiple target architectures

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PROBLEM STATEMENT

- Generally, parallelization of graph algorithms is **unavoidable** with the growth of **unstructured** & **semi-structured** data, & graph algorithms have difficult to parallelize due to the inherent **irregularity** of **computation, memory access and communication.**
- Further, existing prior framework for exploiting the **parallelism** on different hardware is **difficult** for in different application domain.
- However, the existing framework unable to address the issues. Therefore, there is need for a system & method for **Graph Domain Specific Solution (DSL)** to address issues.

TECHNOLOGY CATEGORY/ MARKET

Technology: Graph Domain Specific Language **(DSL)** Compiler;
Industry: DSL Compiler;
Applications: Hardware & Software for Graph DSL Compiler, System software;

TECHNOLOGY

- The present invention describes a **system & method for automatic parallel code generation for graph algorithms for multiple target architectures**.
- A graph domain specific language (DSL) named **StarPlat** framework enables a user to provide an algorithm specification of graph problems (high level graph specific constructs) & generates **parallel code for multiple backends** from same algorithm specification.
- Said **System** comprises a user device, **a graph algorithm unit, an intermediate representation unit, a code generator unit, a performance analysis unit** and a compiler, shown in figure 1.

IMAGES

Graph	Acronym	Num. Vertices (million)	Num. Edges (million)	Diameter	Avg. Degree	Max. Degree
twitter-2010	TW	21.2	265.0		12	302779
soc-sinaweibo	SW	58.6	261.0		4	4000
orkut	OK	3.0	234.3	9	76.2813	33,313
wikipedia-ru	WK	3.3	93.3	10	55.4067	283,929
livejournal	LJ	4.8	69.0	16	28.257	22,887
soc-pokec	PK	1.6	30.6	11	37.5092	20,518
usaroad	US	24.0	28.9		2	9
germany-osm	GR	11.5	12.4		2	13
rmat876	RM	16.7	87.6		5	128332
uniform-random	UR	10.0	80.0		8	27

Table1: Illustrates as Input Graph for analysis;

KEY FEATURES / VALUE PROPOSITION

- ***Technical Perspective:*** Current method generates the codes for **multiple backends simultaneously** with **efficient parallel processing approach** for graph algorithms **for multiple target architecture (OpenMP, MPI & CUDA)**.
- ***Industrial Perspective***: Both **static and dynamic graph algorithm** can be taken as input & generates code (library or framework based).
- **Applicable** to **High performance computing** & **parallel computing, compilers.**

INTELLECTUAL PROPERTY

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TRL (TECHNOLOGY READINESS LEVEL)

TRL- 3, Proof of Concept ready & validated

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IMAGES

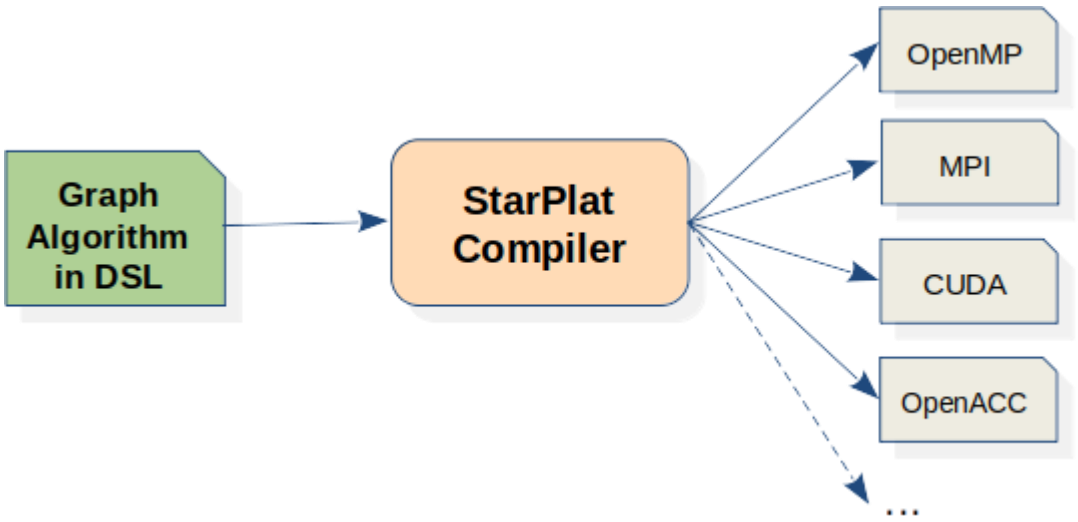

Fig. 1: Illustrates a detailed block diagram of a compiler for automatic parallel code generation of graph algorithm for multiple target architectures.

Experimental Result

Sr. No.	Algorithm	Lines of code				Lines of code	Reduction Ratio
		OpenMP	MPI	CUDA	Total	StarPlat	
1	BC	99	284	222	605	33	18.3
2	PR	42	157	139	338	31	10.9
3	SSSP	54	124	140	318	20	15.9
4	TC	31	60	106	197	18	10.9

Table 2 : Illustrates different algorithms analyzed by using proposed system and as an output obtained reduction of lines of code within the same time frame as that of conventional system.

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