# Computing@PNNL SEMINAR

# *Leveraging Domain-Specific Languages Using Verified Lifting*

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## February 26 | 11 AM | BSF Pasteur 2019

Advances in domain-specific languages, or DSLs, have enabled developers build performant applications across many different disciplines (e.g., CUDA for GPUs, Spark for data analytics, etc.). To leverage these DSLs, programmers must learn new abstractions and rewrite their existing applications to leverage the optimizations offered by such languages. For developers, this is a tedious, error-prone job. For DSL designers, it hinders the uptake of their language. In his talk, Professor Cheung will discuss how to build compilers that translate programs written in general-purpose languages to DSLs (almost) for free, using a technique called *verified lifting*. Unlike traditional syntax-driven compilers that rely on detecting patterns in the input code and translating them to the target language, verified lifting compiles by first automatically discovering ("lifts") a clean, high-level functional specification from the input code. The discovered specification then can be easily translated to the target DSL. In his work, Professor Cheung has applied verified lifting in various domains, lifting Java to SQL (orders of magnitude speedup), Fortran to CUDA (20*x* speedup), and Java to Spark (32*x* speedup)—all without writing a single rule to detect code patterns.

Professor Cheung also will describe *MetaLift*, a translator generator based on verified lifting. MetaLift comes with a simple functional language for DSL designers to describe the semantics of their DSL constructs. By providing such specifications and a few other inputs, MetaLift will generate a translator that scans the input source code for program fragments and automatically translates them to the target DSL. The talk will conclude with a discussion about how MetaLift was used to construct the compilers built via verified lifting.

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