SPADE: the System S declarative stream processing engine.

by Gedik, Bugra, et al from IBM, University of Illinois and Georgia Tech

What is SPADE?

- A declarative stream processing engine and language developed at IBM.
- Compiles and optimises stream-based SPADE code.
- Programs are deployed by IBM's System S.
- One of the early birds in "program like a stream" stream processing (2008).
  - Spark (2010), Storm (2011)

What is System S?

- A large-scale distributed data stream processing middleware
- Takes jobs, e.g. Data-Flow Graphs, a set of processing elements (PEs) and then distributes these on the cluster
- Comes as a C++ library and a high level inquiry engine. “Estimate customer satisfaction”
- Used for fault-tolerance, deployment, scheduling etc for SPADE

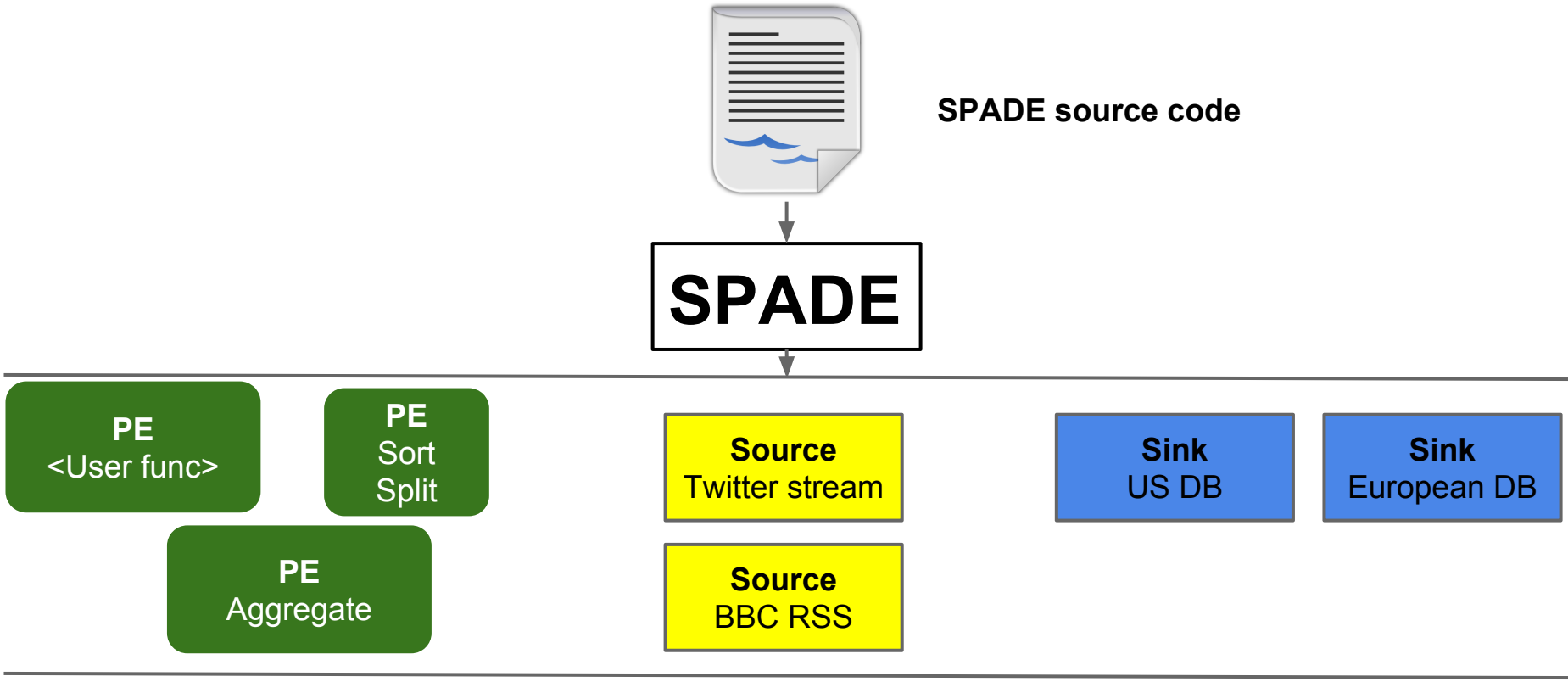
SPADE's programming model

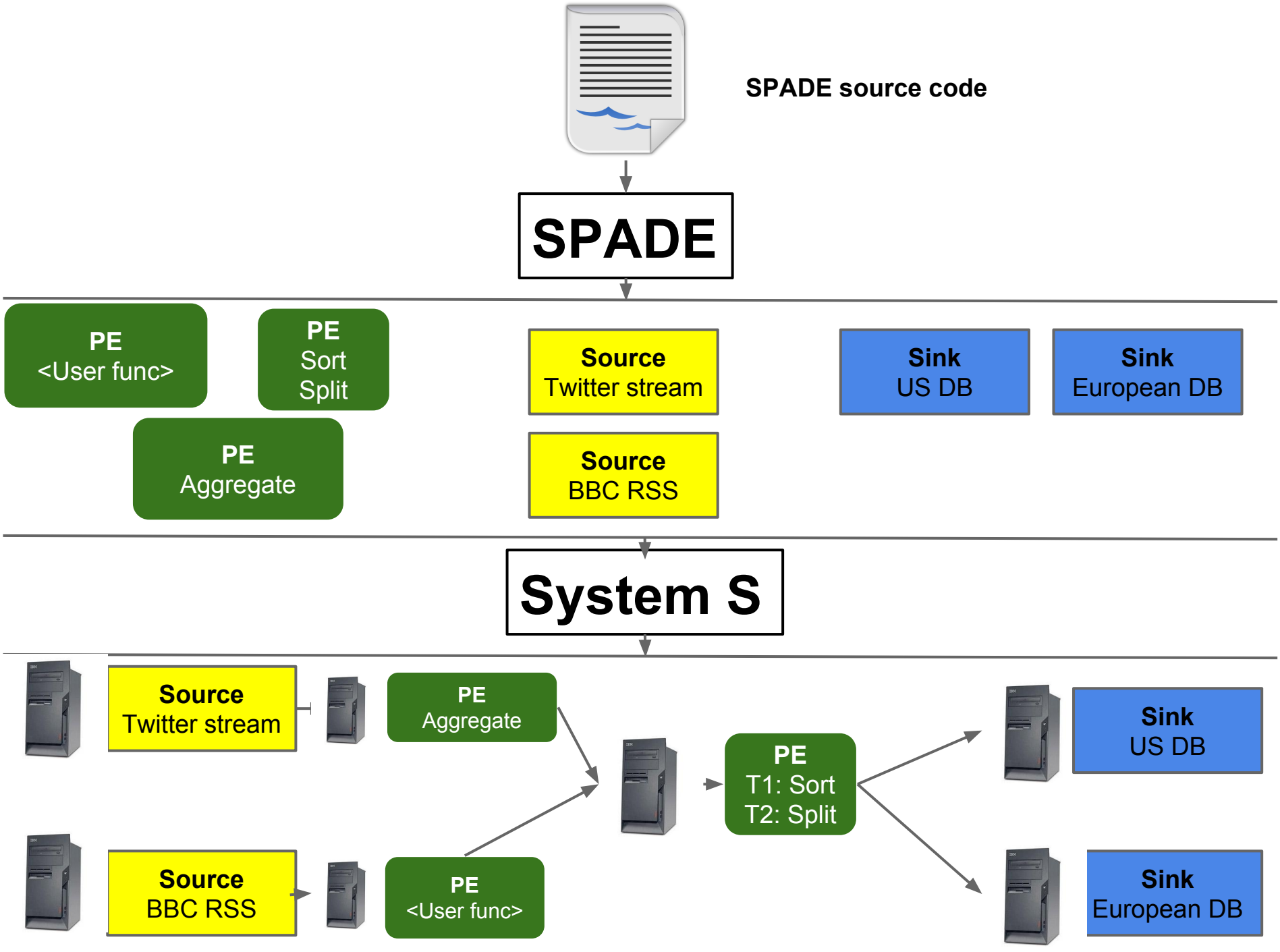
- Program in terms of streaming operators
  - SPADE supplies common relation algebra ones
  - Developers can add their own

- Operators compiled into Processing Elements (PEs)

- External inputs compiled as sources, outputs as sinks

SPADE source code


SPADE source code
SPADE
PE
<User func>
PE
Sort
Split
PE
Aggregate
Source
Twitter stream
Source
BBC RSS
Sink
US DB
Sink
European DB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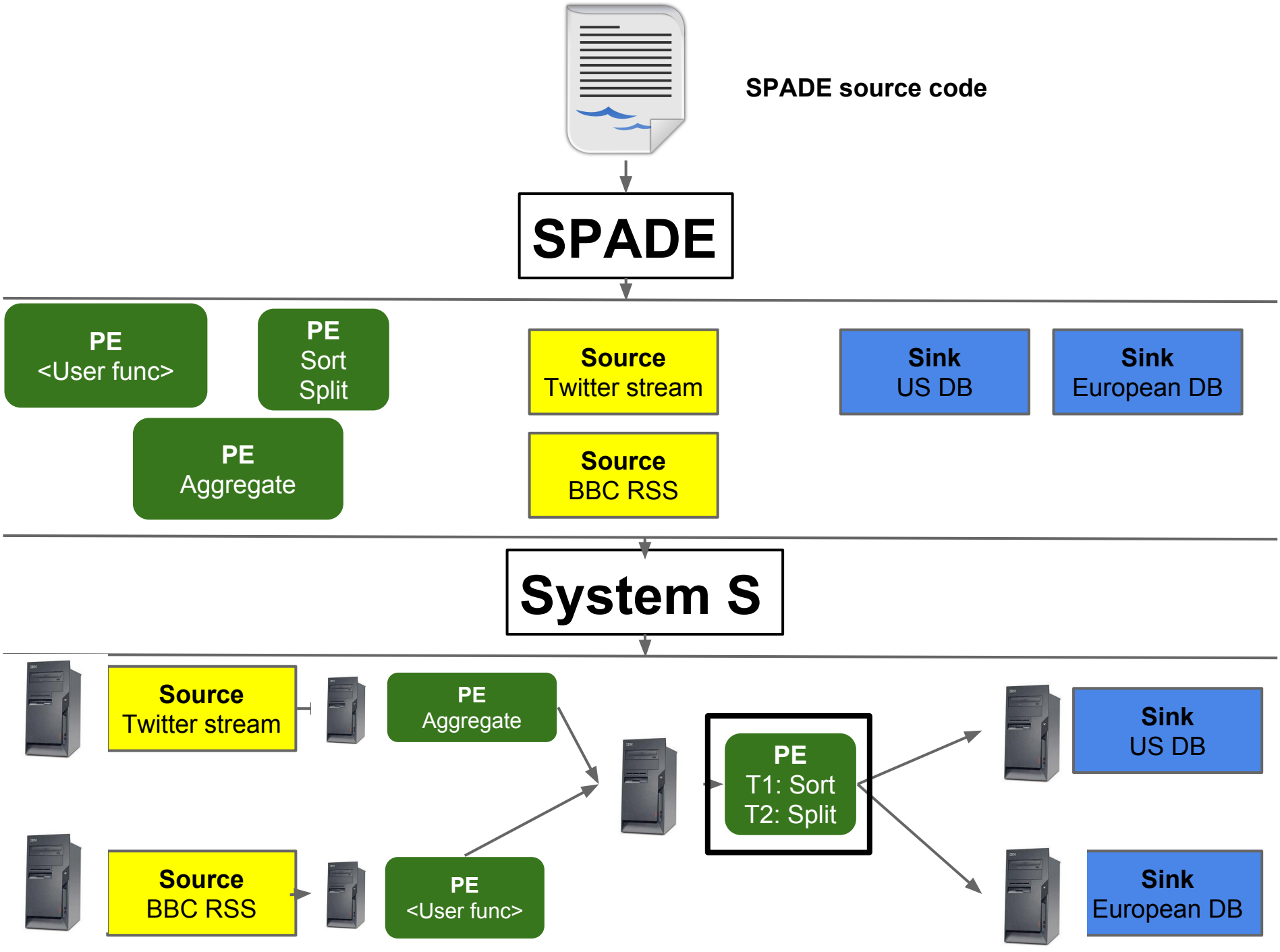
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All PEs can be put into a single system too!

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Multiple operators in one PE

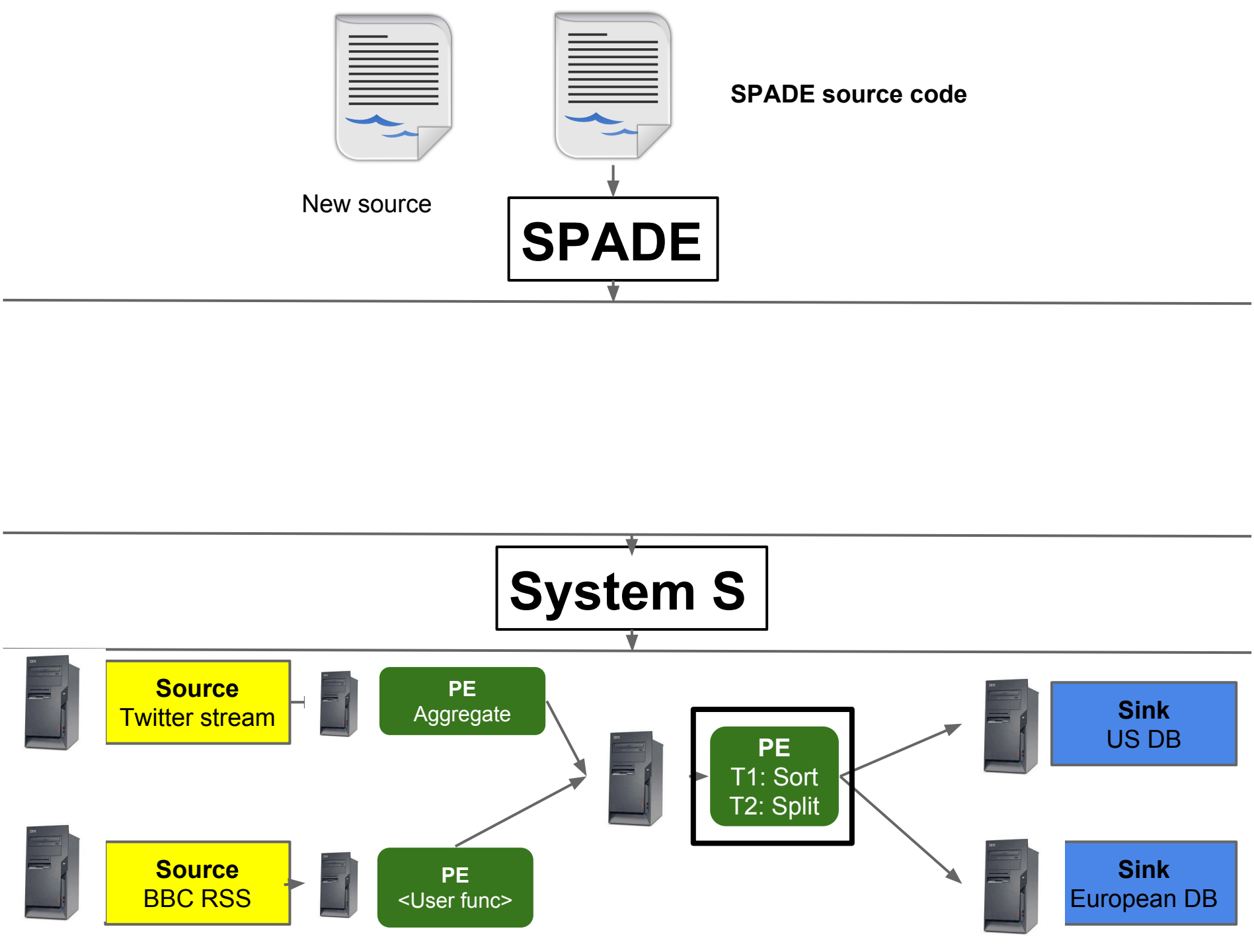
- Minimise communication overhead.
- Ensures two or more operators are scheduled on the same machine.
- Automatic thread safety even for user-defined operators

SPADE compilation

- Compilation specific to underlying system and network topology for better performance
- Support for different types of windows
  - Sliding windows, punctuations, tumbling
- Compile in a special mode for statistics collection to analyse the properties of the program.
- Recompilation then possible to optimise further due to know heuristics

Incremental Deployment and Programs

- SPADE supports live updates to running programs.
- Like other streaming frameworks it is suitable for incremental algorithms.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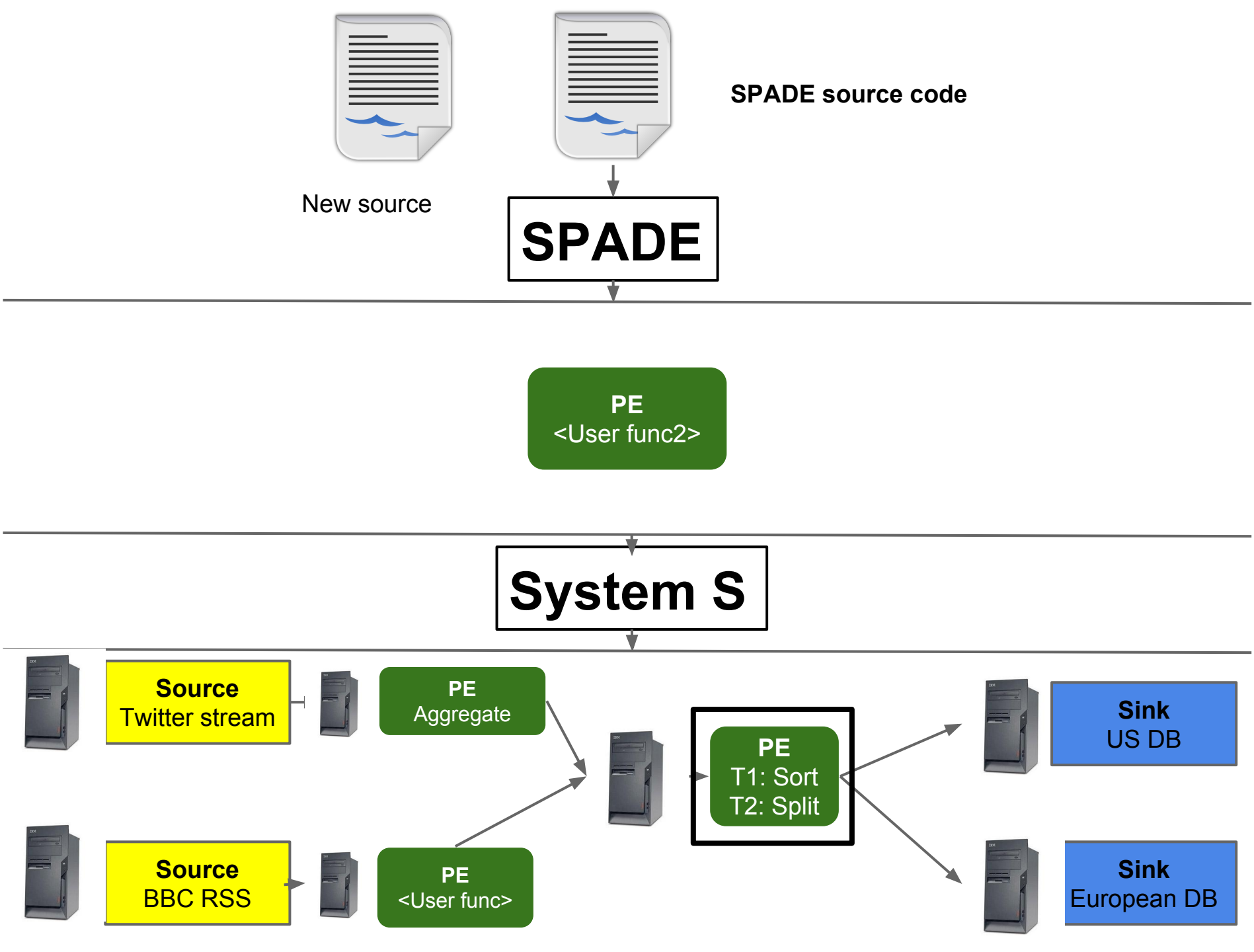
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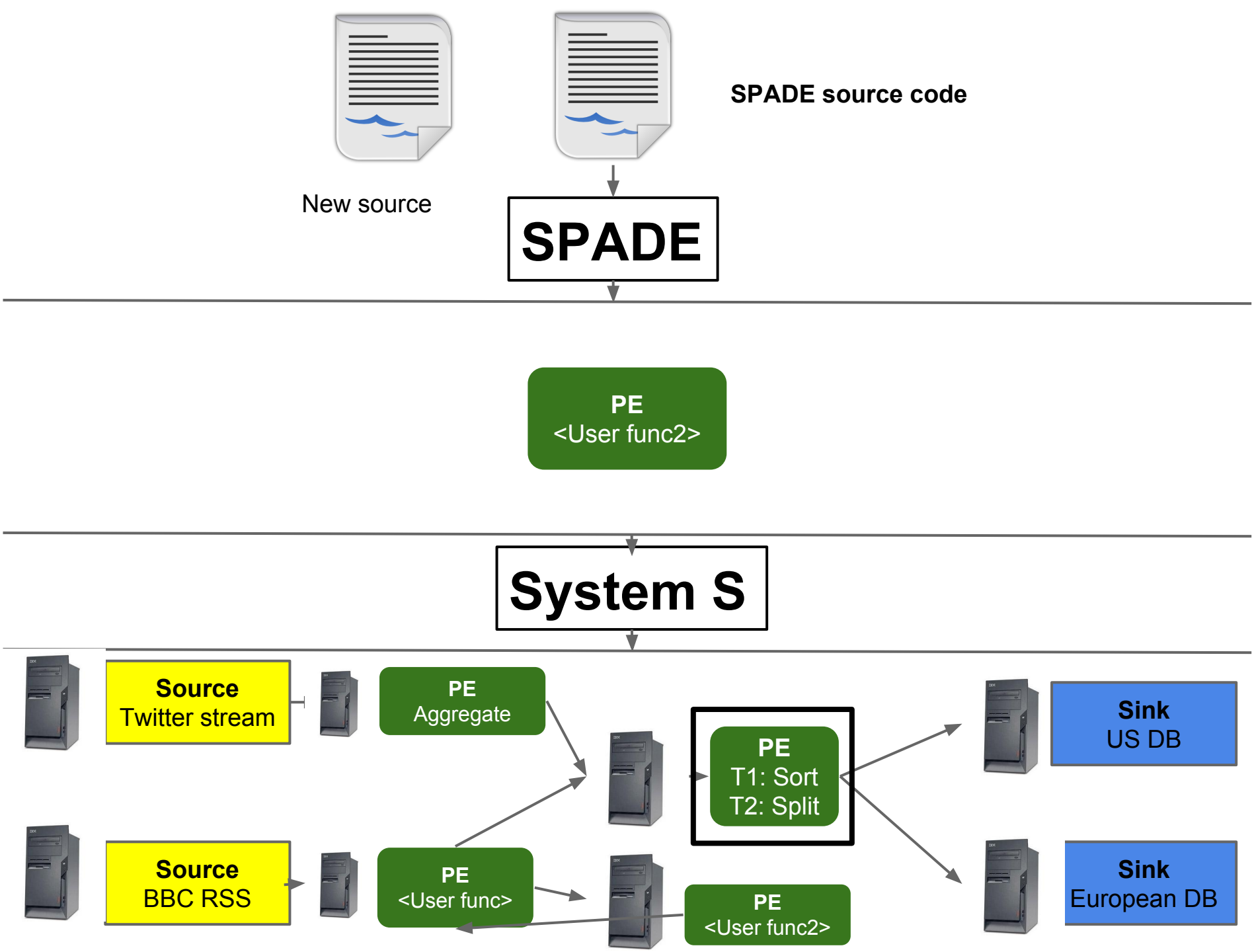
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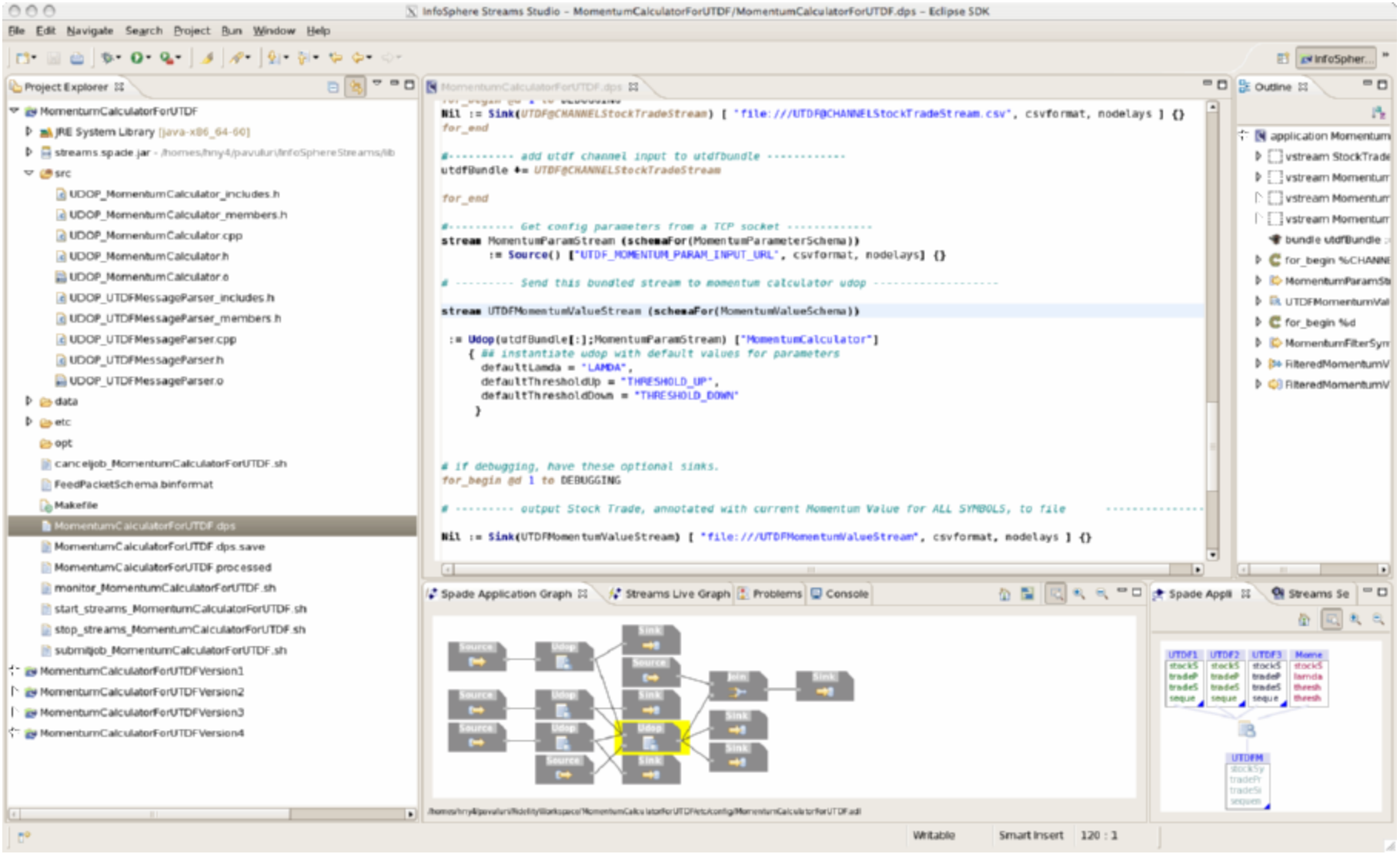
Development IDE



Results

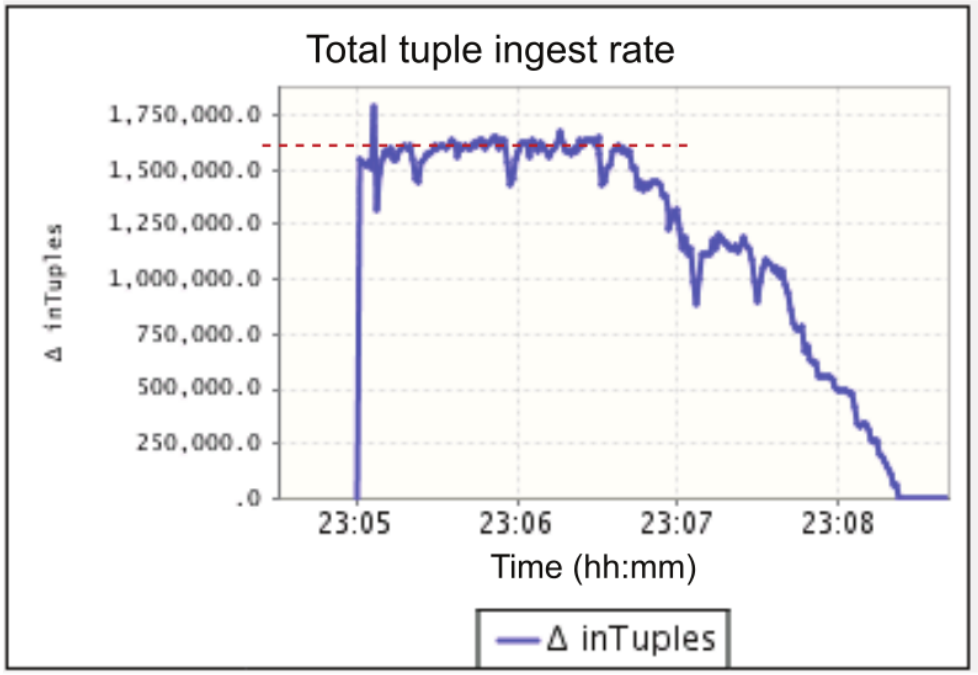


Figure 6: Tuple ingestion rate for the parallel and distributed bargain index computation application, using 22 parallel queries distributed over 16 nodes.

Strengths 1/2

- Declarative topology (through operators)
- Extensible operators
- Good performance ratio to programming difficulty

Strengths 2/2

- Intermediate results made available
- Incremental algorithms / deployment
- Natural development environment
- Highly influential for newer systems

Criticisms 1/2

- Uses raw numbers in results without context or comparison.
- Only one arbitrary experiment carried out.
- Fixed number of nodes for test

Criticisms 2/2

- How well does thread-locking with user defined operators work in practise?

- Long compilation times and system specific compilations.

Questions?