Motivation and Contributions

State of the art for big-velocity applications:
- Stream processing: No/weak transactional guarantees
- OLTP systems: No support for data-driven processing

Features for transaction processing over big-velocity data:
- Main-memory OLTP foundation
- Fault-tolerance: command logging & upstream backup
- Data-driven processing
- Uniform state management

Added constructs: Streams, Windows, Triggers, Workflows

Application: Canadian Dreamboat

The Canadian pop star popularity contest!
- Viewers submit votes via text (one vote per viewer)
- Leaderboard maintained for:
  - Top three contestants
  - Bottom three contestants
  - “Trending” (in last 100 votes)
- Every 1,000 votes, the lowest contestant is removed
- Viewers who voted for a removed contestant may resubmit their vote for a remaining candidate
- Voting continues until a single winner is decided

Workflow separated into three stored procedures:
- Each SP comprises an ACID transaction
- State stored in tables, accessed by multiple SPs

Application: Bicycle Sharing

A website and mobile app based on bike sharing programs
- Full integration of streaming data and OLTP workloads
- Customers check out, ride, & check in bikes
- Checkout and check in are OLTP transactions
- Bike locations arrive as streaming data
- Discounts are used to encourage bike returns to stations lacking bikes (calculated dynamically using location data)

S-Store Discounts Workflow

Streaming Transactions

- Streaming Transaction = stored procedure + batch of input tuples
- Workflows are a DAG of SPs
- Due to data and processing dependencies:
  - Transaction Executions (TEs) can’t be arbitrarily ordered
  - Window state can only be accessed by TEs of a given SP
  - Presence of shared tables and OLTP transactions require additional isolation rules

Voting System Comparison

H-Store: Transactions, no workflow definitions
- SP execution can be arbitrarily ordered
- Additional votes submitted before the deletion occurs can lead to incorrect candidate deletion

S-Store: Transactions with streaming workflows
- Workflows are serially processed when state is shared across stored procedures
- Workflows prevent incorrect ordering of transactions

BikeShare System Demonstration