Responding to Extended Events in near Real-Time

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Agenda

- Monitoring overview
- Extended Events Core Concepts
- Streaming Extended Events
- Possible Applications
- Extended T-SQL Collector
- XESmartTarget

Monitoring

Goals:

- Troubleshooting
  What happened tonight at 03:40?
- Tune performance
  Which queries consume most resources?
- Capacity Planning
  How fast are my databases growing?
- Baselining
  Is the system behaving normally?
- Alerting
  Hey, look: something's wrong here!

How should I monitor?

× Buy a commercial suite

- SQLSentry, RedGate, SolarWinds, Dell…
- Big value, Big money 😐

× Use open source/free tools

- Often unreliable/incomplete ☹

× Code your own

- Are you sure? 😐

× Use SQL Server built-in tools

- SQL Trace
- Event Notifications
- Alerts
- Extended Events
- Data Collector

Monitoring before SQL Server 2012

- **Polling:**
- Performance counters
  - OS counters: CPU, Memory, Disk…
  - SQL specific
- DMO – Dynamic Managment Objects
  - DMV - Views
  - DMF - Functions
- **Capturing:**
- SQL Trace

Extended Events

- **Replacement for SQL Trace**
  - Introduced in SQL Server 2008
  - Real replacement from version >= 2012

- **Lightweight event capture infrastructure**
  - Deep inside SQLOS
  - Low performance overhead
  - Allows capturing events not available otherwise

Extended Events - Concepts

- **Event**
  - Fired by SQLOS when a point in code is reached
  - Contains information → **Fields**

- **Action**
  - Additional operations performed when event fires
  - Adds more data to the event

Extended Events - Concepts

- **Session**
  - Defines what we want to capture and how we do it
  - Events + Fields + Actions = Session

- **Target**
  - Event consumer
  - Several types of targets
  - Multiple targets for the same session
  - A session does not necessarily need a target

Extended Events - Concepts

- **Targets**

  BOL describes 6 types of targets:

Name	Description
Ring buffer	Use to hold the event data in memory on a first-in first-out (FIFO) basis
Event file	Use to write event session output from complete memory buffers to disk.
Event pairing	Use to determine when a specified paired event does not occur in a matched set.
Event Tracing for Windows (ETW)	Use to correlate SQL Server events with Windows operating system or application event data.
Event counter	Counts all specified events that occur during an Extended Events session.
Histogram	Use to count the number of times that a specified event occurs

http://technet.microsoft.com/en-us/library/bb630339.aspx

Extended Events – Anything Missing?

× **No built-in alerting target**

Connect item for SB target (Won't fix)

http://bit.ly/1A8HqG0

× **Possible solutions**

- Post-process the target → not fast enough
- Poll the target for changes → ugly
- Use something else
  - Alerts
  - Event notifications

A Hidden Target Type?

- **Watch Live Data**

  How does it work behind the scenes?

```
SELECT *
FROM sys.dm_xe_session_targets
```

Results | Messages

	event_session_address	target_name	target_package_guid	execution_count	execution_duration_ms	target_data
1	0x00000004786510C1	ring_buffer	60AA9FBF-673B-4553-B7ED-71DCA7F5E972	968	0	<RingBufferTarget truncated="1" processing
2	0x00000004786510C1	event_file	60AA9FBF-673B-4553-B7ED-71DCA7F5E972	968	10098	<EventFileTarget truncated="0"><Buffers log
3	0x00000004786510C1	event_stream	60AA9FBF-673B-4553-B7ED-71DCA7F5E972	1	0	<LiveStreamTarget truncated="0"><clients><
4	0x000000046F23D841	router	03FDA7D0-91BA-45F8-9875-8B6DD0B8E9F2	200	0	NULL
5	0x0000000478438851	event_file	60AA9FBF-673B-4553-B7ED-71DCA7F5E972	0	0	<EventFileTarget truncated="0"><Buffers log

DEMO

Extended Events Streaming API

Displaying Captured Events

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Streaming Extended Events

- **What we have seen**
  - Events showed up in a queue to be processed
  - No XML shredding
  - Fields and actions are available as properties of the event

Streaming Extended Events

- **Possible Applications:**
  - Watch events as they occur
  - Perform actions in response to an event
  - Alert when specific events are raised
    (Does not make sense for all events)
  - Save events to a target database

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Streaming API in C#

Replaying a Workload

Streaming Extended Events

- Nice, but...
  - Not fully available in the T-SQL realm
  - DBAs need to learn C# ???
  - Streaming API is available in PowerShell
    - SQLAgent job with PoSh step
    - Background process running PoSh script

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Streaming API in Powershell

Capturing Successful Logon Events

Streaming Extended Events

- **Saving events to a database table**
  - Capture some data, save to a database
  - Sounds familiar, doesn't it?
  - Data Collector
  - Needs a specialized Collector Type for XE stream

Introducing Extended T-SQL Collector

- Provides a GUI for the Data Collector
- Incorporates 2 new collector types:
  - Extended TSQL Collector Type
    - Adds support for LOB columns
  - Extended XE Reader Collector Type
    - Reads data from Extended Events sessions
    - Incorporates alerting
- Free and Open Source
  https://github.com/spaghettidba/ExtendedTSQLCollector

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Working with Extended T-SQL Collector

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Introducing XE Smart Target

Provides a way to process Extended Events with no coding required

- **Capabilities:**
  - Write event data to database tables
  - Pre-aggregate and filter events*
  - Aggregate events with existing data in target table*
  - Alert via email*
  - Extensible design (code your own responses)

* = (soon)

Free and Open Source
https://github.com/spaghettidba/XESmartTarget

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Working with XESmartTarget

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All that glitters is gold?

× Performance Impact

- Depends on what the session captures
- Depends on what you do with events
- If reader gets behind it is disconnected automatically

× Gotchas

- Events are placed in a queue
- Sometimes the queue does not get flushed
- Dispatcher latency has no effect on the queue

Bottom line

- Streaming API is a lesser known target type
- Provides convenient way to process events as they occur
- Some coding required
- Extended T-SQL Collector to the rescue!
- XE Smart Target to the rescue!

Resources

- Extended T-SQL Collector
  https://github.com/spaghettidba/ExtendedTSQLCollector
- Monitoring Blocking and Deadlocking with Extended T-SQL Collector
  http://spaghettidba.com/2014/12/12/monitoring-blocking-and-deadlocking-with-extended-t-sql-collector/
- XE Smart Target
  https://github.com/spaghettidba/XESmartTarget
- Tracking Table Usage with Extended Events
  http://spaghettidba.com/2015/04/20/tracking-table-usage-and-identifying-unused-objects/
- Reacting to Extended Events in almost real-time
  http://www.sqlskills.com/blogs/bobb/reacting-to-xevents-in-almost-real-time/

Q&A

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Questions?

dataMinds

Thank You!

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