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Responding to Extended Events in Near Real-Time

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Agenda

- Monitoring Overview
- Extended Events Concepts
- Streaming Extended Events
- Possible Applications
- Extended T-SQL Collector
- XE Smart Target

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

SentryOne, RedGate, SolarWinds, Quest…

Big value, Big Money 😐

USE OPEN SOURCE / FREE TOOLS

Often unreliable / incomplete ☹

CODE YOUR OWN

Are you sure?? 😐

USE SQL SERVER BUILT-IN TOOLS

SQLTrace

Event Notification

Alerts

Extended Events

Data Collector

Monitoring before SQL Server 2012

POLLING

Performance counters

- OS counters: CPU, Memory, Disk…
- SQL specific

DMO – Dynamic Management Objects

- DMV – Views
- DMF - Functions

CAPTURING

SQLTrace

Extended Events

Replacement for SQL Trace

- First introduced in 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: https://goo.gl/Pbm6Fn

Name	Description
Ring buffer	Use to hold the event data in memory from 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

Extended Events – Missing something?

No built-in alerting target

Connect item for SB target (Won't fix)

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 covers?

```
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	0x0000004786510C1	ring_buffer	60AA9FBF-673B-4553-B7ED-71DCA7F5E972	968	0	<RingBufferTarget truncated="1" processing
2	0x0000004786510C1	event_file	60AA9FBF-673B-4553-B7ED-71DCA7F5E972	968	10098	<EventFileTarget truncated="0"><Buffers log
3	0x0000004786510C1	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	0x000000478438851	event_file	60AA9FBF-673B-4553-B7ED-71DCA7F5E972	0	0	<EventFileTarget truncated="0"><Buffers log

DEMO

Streaming API:
Displaying Captured Events

Streaming API

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 API

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
- The same API can also be used to open .xel files

DEMO

Streaming API: Replaying a Workload

Streaming API

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

DEMO

Powershell API:
Capturing Logon Events

Streaming Extended Events

Saving events to a database table

- Capture some performance data, save to a databases
- 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

DEMO

Extended TSQL Collector

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

DEMO

XE Smart Target

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

Questions?

Ask me:

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