



SQL Server 2012 Extended Events

Bob Beauchemin
SQLskills.com

SQL
skills

About Bob Beauchemin

- ◆ Independent Consultant/Trainer/Writer/Speaker
- ◆ Developer Resources Partner, SQLskills
 - ◆ Website: <http://www.SQLskills.com>
 - ◆ Blog: <http://www.SQLskills.com/blogs/bobb>
 - ◆ Email: bobb@sqlskills.com
 - ◆ Twitter: @bobbeauch
- ◆ SQL Server MVP
- ◆ Author of books and numerous resources related to SQL Server and data access
 - ◆ A Developer's Guide to SQL Server 2005
 - ◆ A First Look at SQL Server 2005 for Developers
 - ◆ SQL Server MVP Deep Dives – Volume 1
 - ◆ Essential ADO.NET



Outline

- ✦ Extended Events Concepts
- ✦ SQL Server 2012
 - ✦ Additional Events
 - ✦ All Trace Events – Parity with Profiler
 - ✦ Extended Events User Interface in SSMS
 - ✦ User-Defined Events
 - ✦ Better Integration With Client Trace
 - ✦ PowerShell Integration

What is Extended Events?

- ✦ A general event-handling system
- ✦ Part of SQL Server 2008
 - ✦ Used for problem diagnosis and info gathering
 - ✦ Used to implement auditing
- ✦ Engine lives in sqlserver.exe
 - ✦ Consumers can be in-proc or out of proc
 - ✦ ETW consumer is provided
 - ✦ Enables correlation between SQL Server and Windows trace information

SQL Server Diagnostics

- ◆ SQL Server pre-2008 supports
 - ◆ Performance monitor counters
 - ◆ Counters are cumulative
 - ◆ Little/no built in filtering
 - ◆ SQL Profiler
 - ◆ Granular events
 - ◆ Column filters
 - ◆ Automated via server-side trace queues
 - ◆ Event Tracing for Windows (ETW)
 - ◆ Exposed profiler events

Extended Events in SQL Server 2012

- ◆ In SQL Server 2012
 - ◆ Extended events subsume SQL Profiler
 - ◆ See Mike Wachal blog: "Migrating from SQL Trace to Extended Events"
 - ◆ Extended Events User Interface
 - ◆ Supported in SSMS
 - ◆ Extended Events included in SMO
 - ◆ Extended Events object model
 - ◆ Extended Events in PowerShell provider

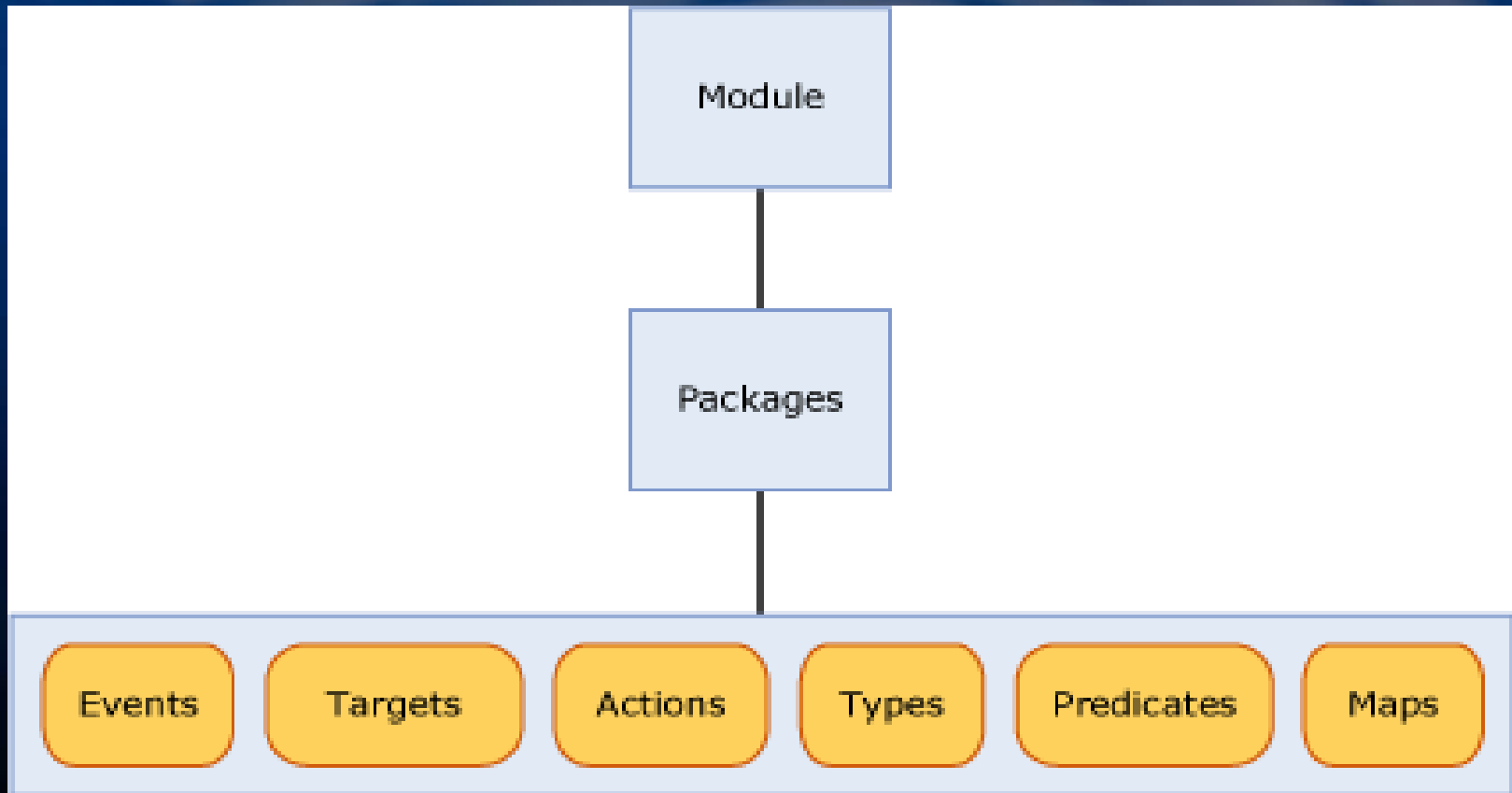
How are extended events different?

- ◆ Extended events
 - ◆ Less overhead than server-side trace queues
 - ◆ Single event cost is ~2us on a 2GHz processor
 - ◆ Event and consumer agnostic
 - ◆ Any event can be processed by any consumer
 - ◆ New events can be added, immediately useable
 - ◆ Allows actions to be taken when an event fires
 - ◆ Additional information can be included
 - ◆ Rich predicate system for filtering

Starting extended events

- ◆ Extended event sessions defined via DDL
 - ◆ CREATE EVENT SESSION
 - ◆ ALTER EVENT SESSION
 - ◆ DROP EVENT SESSION
- ◆ Event sessions specify
 - ◆ Events
 - ◆ Actions
 - ◆ Targets (consumers)

What's Available?



Modules and Packages

- ◆ A module is a container for packages
 - ◆ DLL or EXE
 - ◆ Loaded on demand
- ◆ A package is a container for event objects
 - ◆ Identified by GUID
 - ◆ Need not contain all object types
 - ◆ Package is not a boundary
 - ◆ Any package's objects usable with any packages
 - ◆ Except some auditing objects

Available packages

- ✦ `sys.dm_xe_packages` list them
 - ✦ `sqllos`
 - ✦ `sqlserver`
 - ✦ `package0`
 - ✦ `secaudit` - use by new audit facility
 - ✦ `sqlclr`
 - ✦ `sqlserver - second guid`
 - ✦ `ucs`
 - ✦ `filestream`
- ✦ `sys.dm_xe_objects` list the objects contained in packages

Events

- ✦ Events are trace points in the code
- ✦ Events live in packages
- ✦ Events can be added to running EVENT SESSIONS
- ✦ Events have a versionable schema
 - ✦ Some events have customizable columns

Events in SQL Server 2012

- ✦ SQL Server 2012 adds events for
 - ✦ All trace events (that were not in 2008)
 - ✦ Including user-configurable events
 - ✦ Except for auditing events (XEEvents has auditing)
 - ✦ Always On (new)
 - ✦ New packages (sqlclr, ucs, filestream)
 - ✦ Additional event tweaks/refactoring
- ✦ Note: Some 2008 R2 events are not in SQL Server 2012 extended events

Targets

- ◆ Target is an event consumer
 - ◆ Can be synchronous or asynchronous
 - ◆ Can process event-at-a-time or buffered
 - ◆ Event Session can specify what to do if target can't keep up
 - ◆ Event Session can specify buffering specifics

Available Targets

- ✦ ETW classic sync target
- ✦ Synchronous/Asynchronous bucketizer
 - ✦ **Renamed to histogram**
- ✦ Pair matching
- ✦ Asynchronous file target
- ✦ Synchronous event counter
- ✦ Ring buffer
- ✦ Audit targets - file, security/application logs
- ✦ **Synchronous/Asynchronous router**
- ✦ **Event stream**

Actions

- ✦ Actions can add data to the event
- ✦ Actions can add additional context
 - ✦ Stack trace
 - ✦ T-SQL stack
 - ✦ **Actions corresponding to trace columns**
- ✦ Actions are invoked synchronously

Predicates

- ◆ Predicates filter events at publish time
- ◆ Boolean expressions
 - ◆ Local event data-based
 - ◆ Global state-based
- ◆ Predicates can store and use state
 - ◆ Fire every n-th time

EVENT SESSION Revisited

✦ CREATE EVENT SESSION

- ✦ Specify events, targets, actions, predicates
- ✦ Event session options
 - ✦ Max memory, memory partitioning, max event size
 - ✦ Dispatch latency and event retention
 - ✦ Startup state
 - ✦ Causality tracking

✦ ALTER EVENT SESSION

- ✦ Can start and stop session
- ✦ Can add or drop events, targets, objects

Extended Event Use Cases

- ✦ Correlate OS and SQL Server activity
 - ✦ ETW Kernel provider
 - ✦ Note: Supports Windows 2003 style ETW, not Windows 2008/Vista style
- ✦ Use with client API for end-to-end tracing
 - ✦ Correlation ID between client and server
 - ✦ Register SNAC11 mof
- ✦ Monitor Locks
 - ✦ Bucketizer and event pairing useful here
- ✦ Wait analysis
- ✦ Audits built with extended events

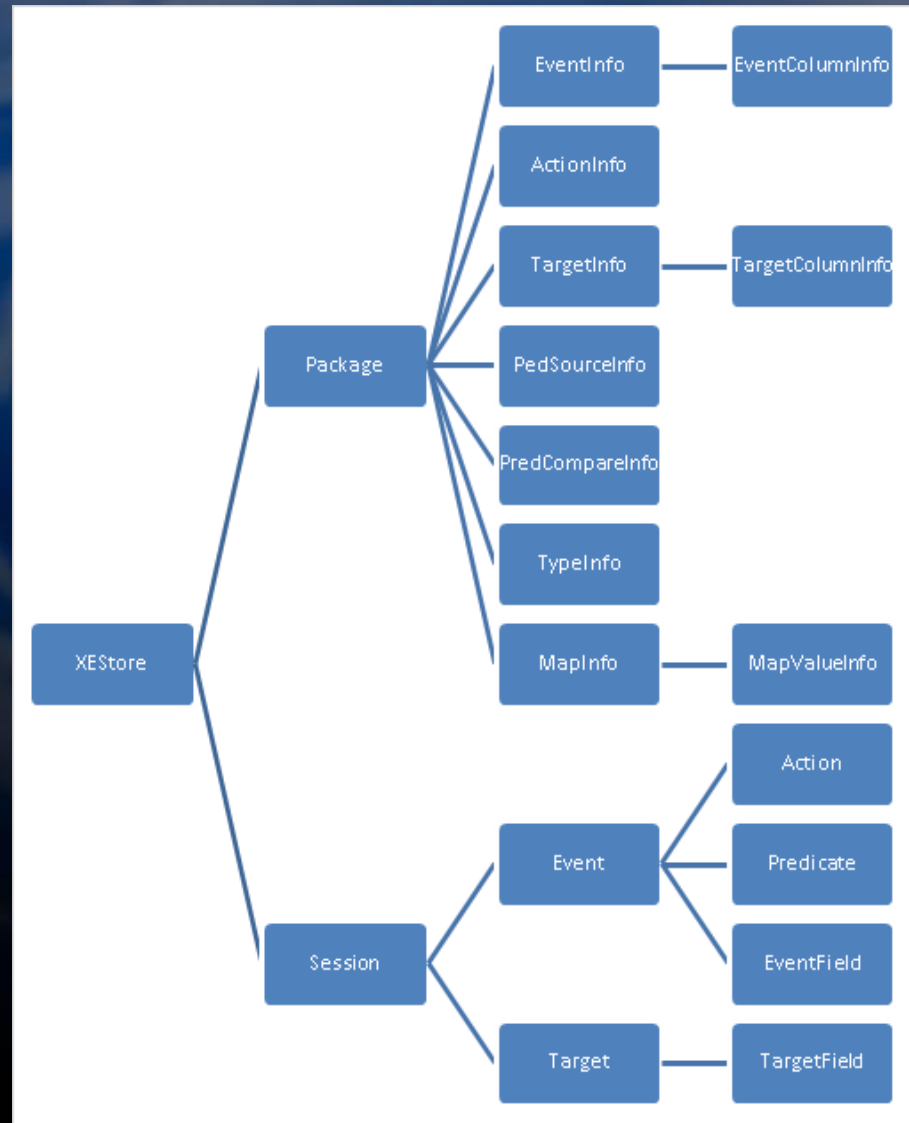
System Health Event Session

- ◆ Predefined event session
 - ◆ Collects Information About Common Problems
 - ◆ Errors with severity > 20
 - ◆ Memory errors (e.g. 701, 17803)
 - ◆ Non-yielding problems
 - ◆ Deadlocks
 - ◆ Waits on latches > 15 seconds
 - ◆ Waits on locks > 30 seconds
 - ◆ Long preemptive or external waits
 - ◆ Collects to Ring Buffer Target
- ◆ **Always On System Health**

SQL Server 2012 - XEvents in SSMS

- ✦ In Management Folder
 - ✦ List Sessions
 - ✦ Create Session/Create Session Wizard
 - ✦ Stop/Start Sessions
 - ✦ Export Sessions (as XML format templates)
 - ✦ Start PowerShell
- ✦ Watch Live Data
 - ✦ Similar to SQL Profiler

SQL 2012 - XEvents Object Model



SQL 2012 - PowerShell Support

- ◆ XEvent object model exposed by SMO
 - ◆ Microsoft.SqlServer.XEvent.dll
- ◆ XEvent "directory" in SQL Server provider
 - ◆ Package Subdirectory
 - ◆ Per-package metadata
 - ◆ Sessions Subdirectory
 - ◆ Per-session information

SQL 2012 XeReader Programming

- ✦ XeReader API can read
 - ✦ XEL files from SQL Server 2008, R2, 2012
 - ✦ Real-time feed
- ✦ Uses event stream target
 - ✦ Modifies `max_dispatch_latency` to 3 secs
- ✦ To use the API
 - ✦ Add ref to `Microsoft.SqlServer.XEvent.Linq.dll`
 - ✦ Instantiate `QueryableXEventData`
 - ✦ File name(s) or Connection string/XEvent session
 - ✦ Specify `EventSource` and `EventCache` options
 - ✦ Work with enumerable collection
 - ✦ `PublishedEvent`

Summary

- ✦ Engine built into SQL Server
- ✦ Extensible architecture
 - ✦ Objects can be added to the architecture
 - ✦ Immediately useable by event sessions
- ✦ Less intrusive form of monitoring
- ✦ Specialized consumers for
 - ✦ OS and client level correlation
 - ✦ Reference counting and bucketizing

References

- ✦ MSDN Webcast: SQL Server 2008 Advanced Troubleshooting with Extended Events
 - ✦ <http://msevents.microsoft.com/cui/WebCastEventDetails.aspx?culture=en-US&EventID=1032356291&CountryCode=US>
- ✦ Blogs:
 - ✦ Extended Event Team Blog: http://blogs.msdn.com/b/extended_events
 - ✦ PSS Team Blog: <http://blogs.msdn.com/sqlpss>
 - ✦ SQLOS Team Blog: <http://blogs.technet.com/sqlos>
- ✦ Jonathan Kehayias Blog: "An XEvent A Day" in Dec 2010
 - ✦ http://sqlblog.com/blogs/jonathan_kehayias/default.aspx
- ✦ Bob Beauchemin's Blog: Series in August 2007
 - ✦ <http://www.sqlskills.com/blogs/bobb/default,month,2007-08.aspx>
- ✦ Extended Event Manager
 - ✦ <http://www.codeplex.com/ExtendedEventManager>