

The logo graphic consists of two overlapping, stylized lines that form a shape reminiscent of a roofline or a stylized 'S'. The upper line is a dark brown color, and the lower line is a light grey color. Both lines are thin and have a slight gradient.

# STONERIDGE CONNECT

2016 Client Conference



Performance Optimization

What you should know



# About the Speaker

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Joshua Lee

Senior Consultant

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Stoneridge: 1 year

Microsoft: 9 years

Total Industry Experience: 10 years

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More about Josh:

<https://stoneridgesoftware.com/author/JoshL/>

# Session Overview



Monitoring



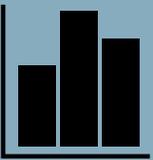
Tools



Tuning Methodology



SQL Recommended Configuration



Environment and Code Management Processes

# Monitoring – What to monitor?

## Dynamics AX

Kernel Versions

Active Sessions

Batch  
Configuration/  
Jobs

Database Alerts

Client Crashes

Security

## SQL

Locking

Deadlocking

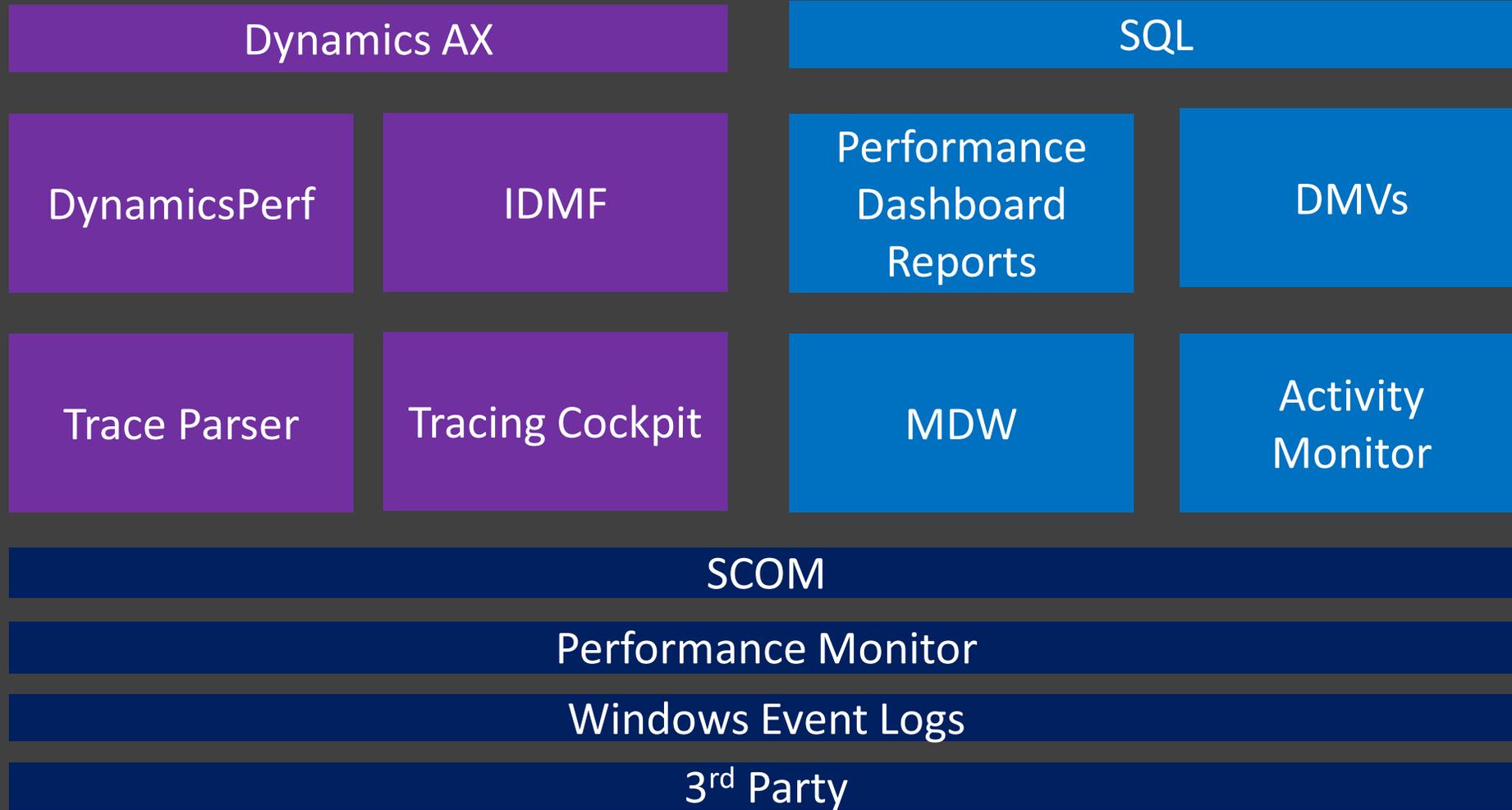
Queries

Wait Statistics

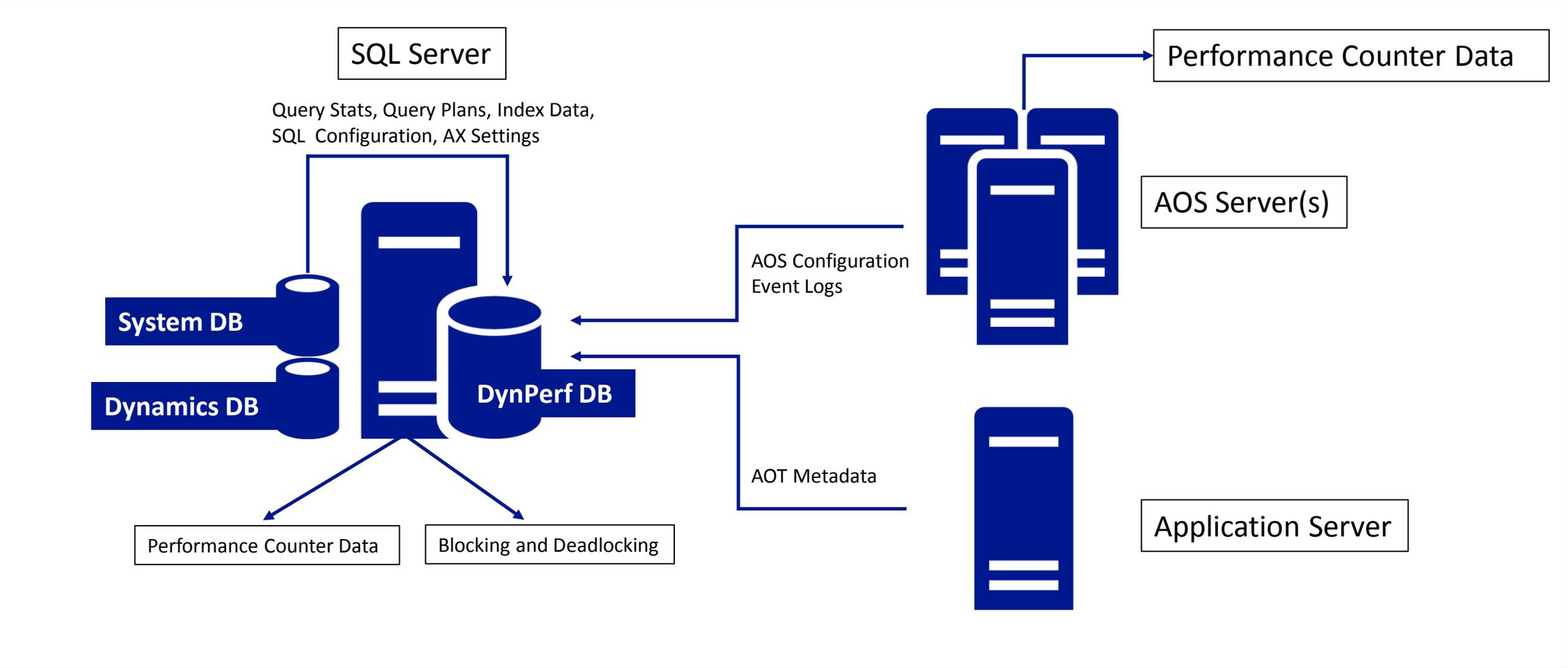
Table Sizes

Table Activity

# Monitoring Tools



# DynamicsPerf (DynPerf)



# Tracing, Trace Parser and Profiler

## Tracing

Tracing Cockpit in Development Workspace

Trace from multiple processes in one file

Performance Monitor Data Collector Set

XPPMarker, TraceInfo, RPC, XPP, SQL, DatabaseDetailed, TTS, BindParameter and XPPParm

## Trace parser

Overview page with top X++ and SQL

Call tree view

Filter/Search X++ and SQL

Jump to call stack

## SQL Profiler

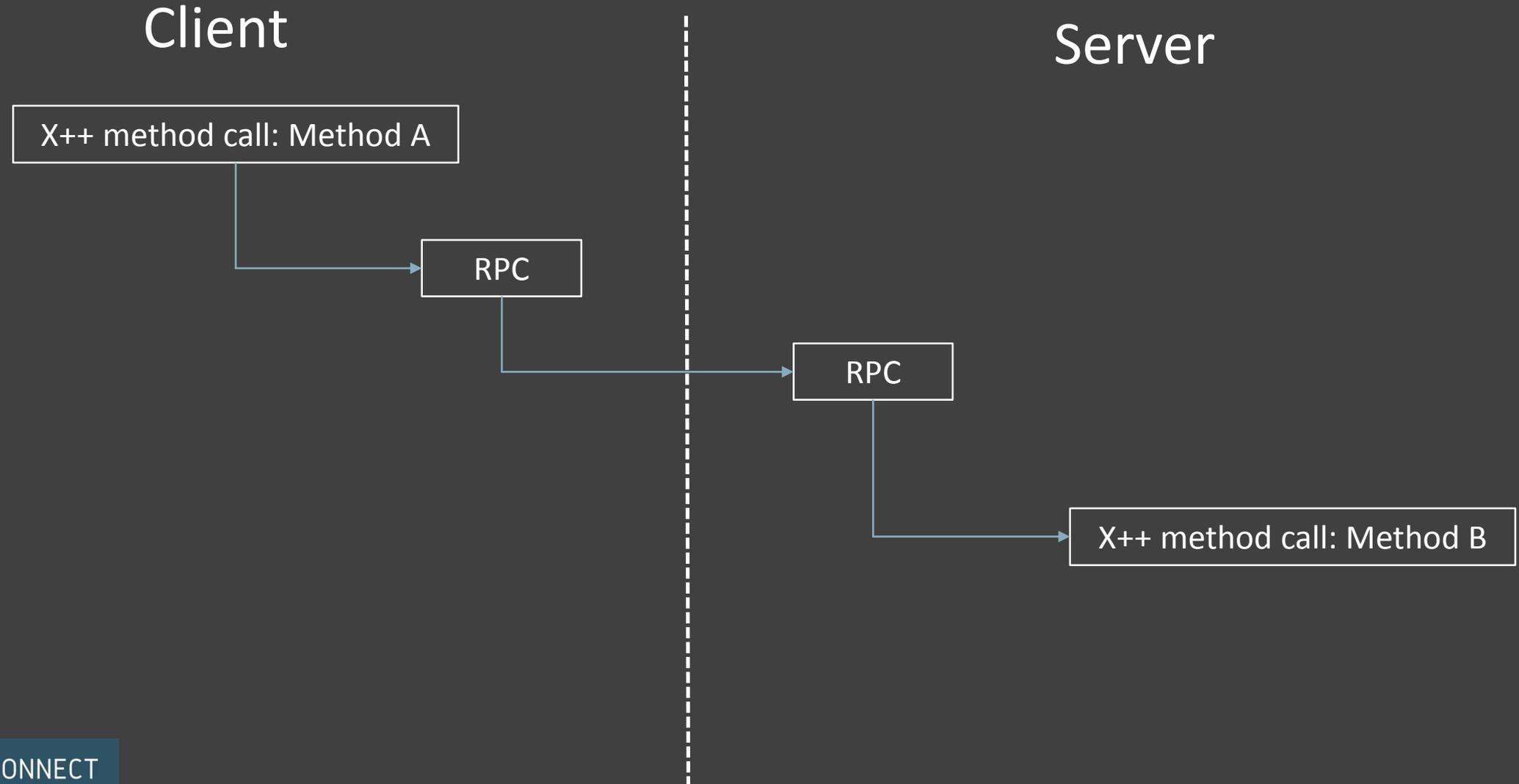
See true statements

Useful for tuning

Compliments Trace Parser

All Errors and Warnings, Lock:Deadlock, Lock:Timeout >0, RPC:Completed, SP:Completed, SQL:BatchCompleted, CursorPrepare, CursorExecute, Showplan XML Statistics Profile, Filter on dbid

# Tracing



# Tracing Cockpit

**Tracing cockpit (2 - usmf)**

File Start trace Stop trace Cancel trace Open trace Reset options

Date	File name	Directory
3/21/2016 4:01:17 ...	CustomerService.etl	C:\TEMP\
3/18/2016 4:40:45 ...	DirectDelivery.etl	C:\TEMP\

**Trace options**

- Collect server trace:
- Circular logging:
- Maximum file size (MB): 2000

**Event selection**

X++ events	SQL events	Info. events
Xpp: <input checked="" type="checkbox"/>	SQL: <input checked="" type="checkbox"/>	Trace info: <input checked="" type="checkbox"/>
Xpp markers: <input checked="" type="checkbox"/>	TTS: <input checked="" type="checkbox"/>	RPC: <input checked="" type="checkbox"/>
Xpp parameters: <input checked="" type="checkbox"/>	Detailed database: <input checked="" type="checkbox"/>	Client access: <input checked="" type="checkbox"/>
	Bind parameters: <input checked="" type="checkbox"/>	

► Xpp markers

Date that the trace was collected. Close

# Trace Parser

Microsoft Dynamics AX Trace Parser - DirectDelivery (5)

File Edit View Help

Session: Ax32Serv.exe (3512): Session 5 - Admin

Overview Call Tree X++/RPC SQL

Show summary across all sessions:

### Top 5 X++ Methods by Inclusive Duration

Class	Count	Inclusive (ms)	Exclusive (ms)	RPC	Database Calls
PurchCreateFromSalesOrderDropShipment::run	1	12460.23	21.88	33	1172
PurchAutoCreate_Sales::create	2	10253.92	0.45	9	1047
PurchAutoCreate::create	2	10253.47	1.68	9	1047
PurchAutoCreate_Sales::createLines	2	7272.15	2.41	1	798
PurchAutoCreate_Sales::createPurchLine	2	6846.54	0.84	1	793

### Top 5 X++ Methods by Exclusive Duration

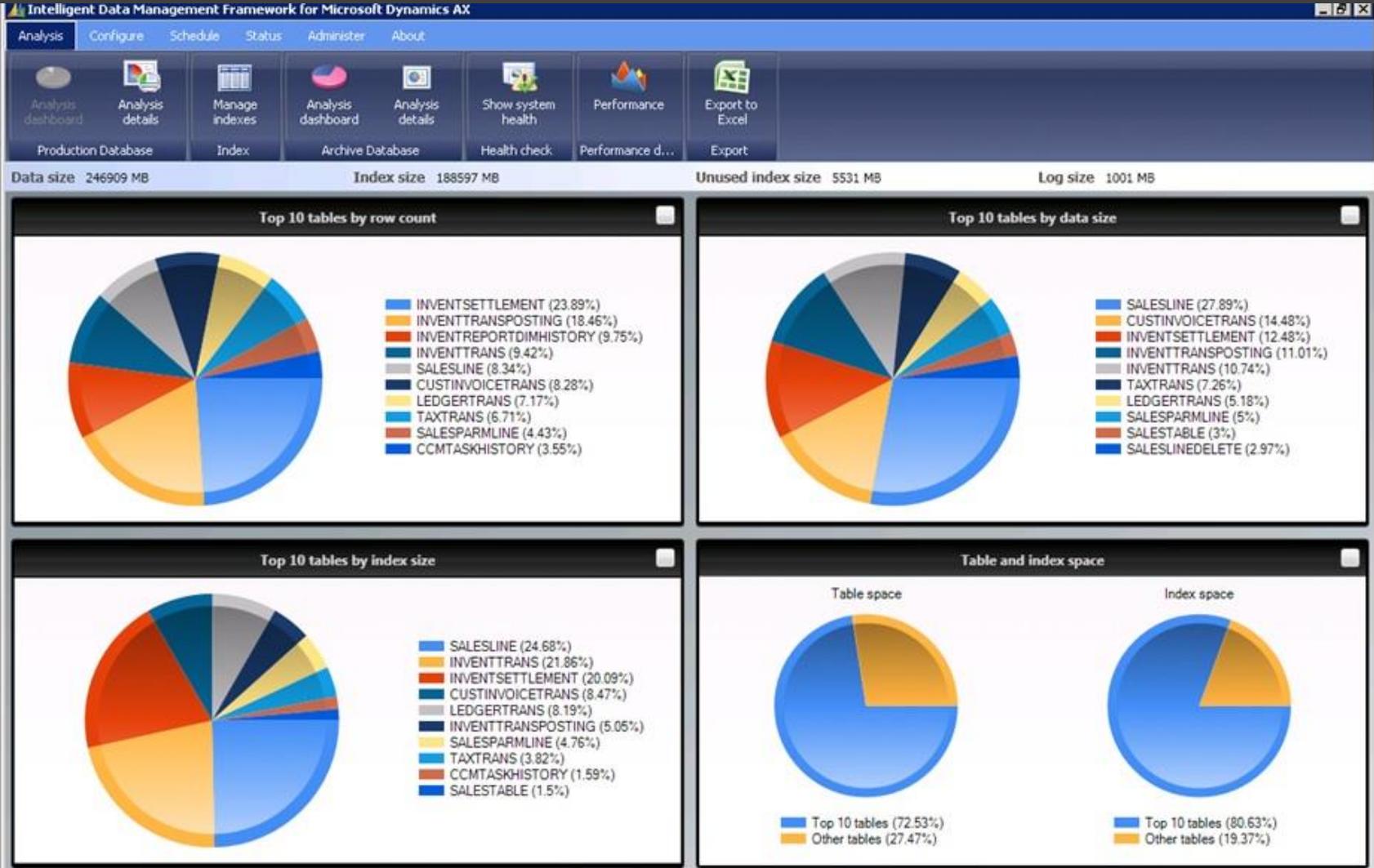
Class	Count	Inclusive (ms)	Exclusive (ms)	RPC	Database Calls
ServerUtilLoad	2	216.29	208.50	2	10
DictField::getPrimaryTableForSurrogateField	124	178.36	178.36	0	0
Map::insert	15861	165.94	165.94	0	0
QueryRun::next	265	1194.86	143.80	0	17
PurchLineType_Purch::initFromPurchTable	6	275.47	107.91	0	3

### Top 5 SQL Queries by Inclusive Duration

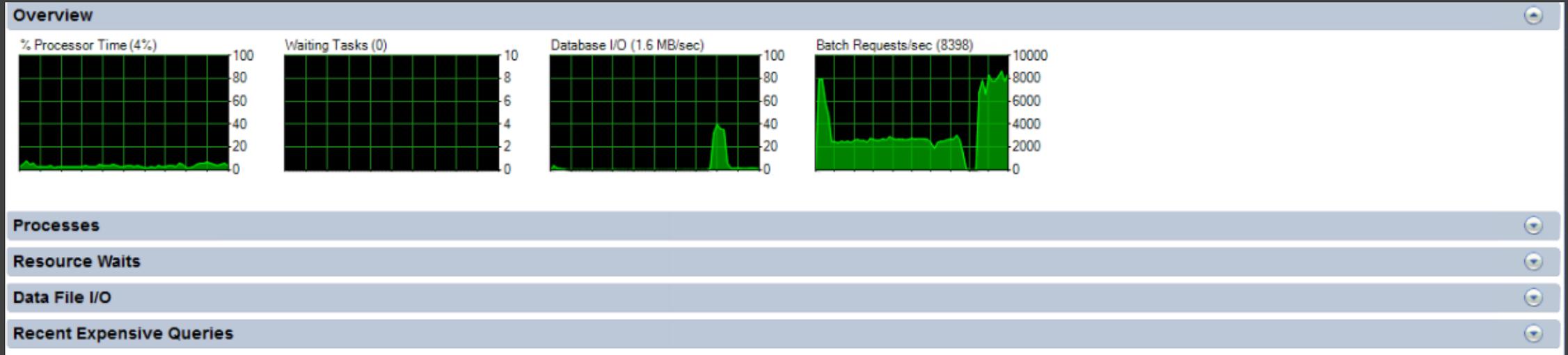
Statement	Count	Inclusive (ms)
SELECT TOP 1 T1.PURCHLINEINVENTTRANSID,T1.INVENTTRANSORIGIN,T1.PURCHLINEID,T1.RECVERSION,T1.PARTITION,T1.RECID FROM INVENTTRANS...	8	1130.29
SELECT SUM(T1.TAXAMOUNT) FROM TAXTRANS T1 WHERE (((PARTITION=? AND (DATAAREAID=?)) AND (INVENTTRANSID=?))	4	800.32
SELECT TOP 1 T1.RECID FROM TAXUNCOMMITTED T1 WHERE (((PARTITION=? AND (DATAAREAID=?)) AND ((HEADINGRECID=? AND (HEADINGTABLEID=?)))	4	705.02
SELECT T1.UTILLEVEL,T1.RECORDTYPE,T1.PARENTID,T1.NAME,T1.BASEVERSION,T1.VERSION,T1.SAVECOUNT,T1.MODIFIEDDATETIME,T1.DEL_MODIFIEDTIME,T1....	2	560.02
SELECT T1.NAME,T1.RECVERSION,T1.PARTITION,T1.RECID FROM ECORESCOLOR T1 WHERE ((T1.PARTITION=? AND (T1.NAME=?)) AND EXISTS (SELECT 'X' FRO...	2	317.91

Registered database: \Traces

# Intelligent Data Management Framework



# Activity Monitor



# Performance Dashboard Reports

### System CPU Utilization

End Time

There are currently no user requests waiting for a resource.

#### Current Activity

	User Requests	User Sessions
Count	1	73
Elapsed Time (ms)	3	5796911
CPU Time (ms)	3 (100.00%)	5418638 (93.47%)
Wait Time (ms)	0 (0.00%)	378273 (6.53%)
Cache Hit Ratio	100.000%	99.984%

#### Historical Information

[Waits](#)
[IO Statistics](#)

Expensive Queries

[By CPU](#)
[By Duration](#)  
[By Logical Reads](#)
[By Physical Reads](#)  
[By Logical Writes](#)
[By CLR Time](#)

#### Miscellaneous Information

<a href="#">Active Traces</a>	1
<a href="#">Active Xevent Sessions</a>	2
<a href="#">Databases</a>	25
<a href="#">Missing Indexes</a>	89

# Management Data Warehouse



# DMVs

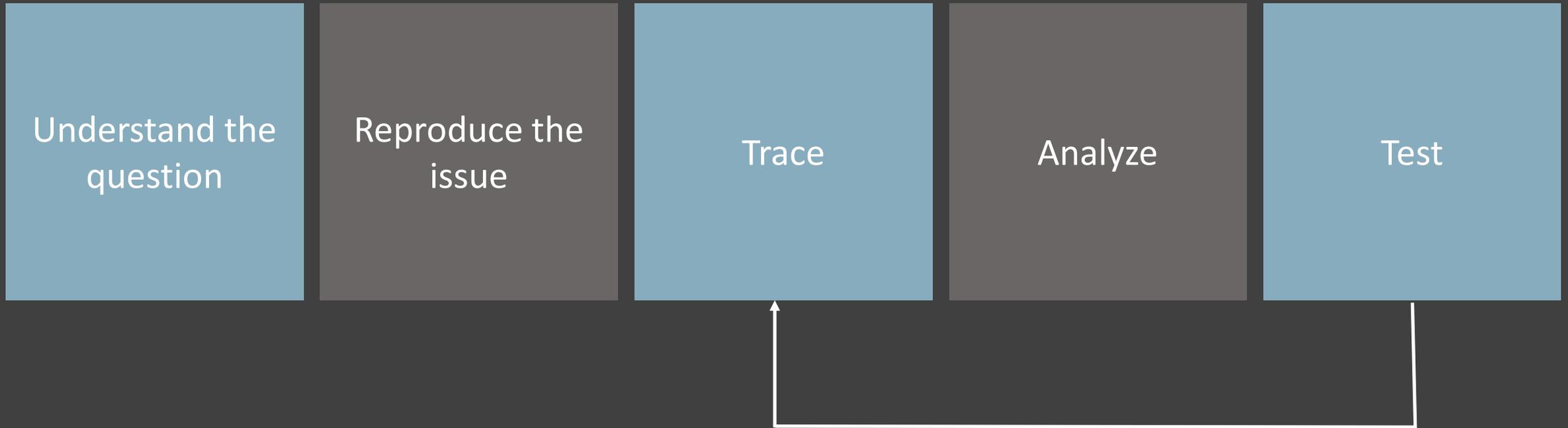
## Plan Cache

```
SELECT *  
FROM sys.dm_exec_query_stats qs  
CROSS APPLY sys.dm_exec_sql_text(qs.sql_handle) qt  
CROSS APPLY sys.dm_exec_query_plan(qs.plan_handle) qp  
ORDER BY ....
```

## Currently Executing

```
SELECT *  
FROM sys.dm_exec_requests R  
LEFT OUTER JOIN sys.dm_exec_sessions S ON S.SESSION_ID = R.SESSION_ID  
LEFT OUTER JOIN sys.dm_exec_connections C ON C.CONNECTION_ID = R.CONNECTION_ID  
CROSS APPLY sys.dm_exec_sql_text(R.SQL_HANDLE) ST  
CROSS APPLY sys.dm_exec_query_plan(R.PLAN_HANDLE) QP  
WHERE R.session_id > 50 -- Ignore system spids  
AND R.session_id NOT IN (@@SPID) -- Ignore current spid
```

# Performance tuning methodology



# Tracing Tips

Test if the problem can be reproduced in a different environment

Trace on a server with an AOS (client and server sessions)

Trace on a warm run (prime the caches)

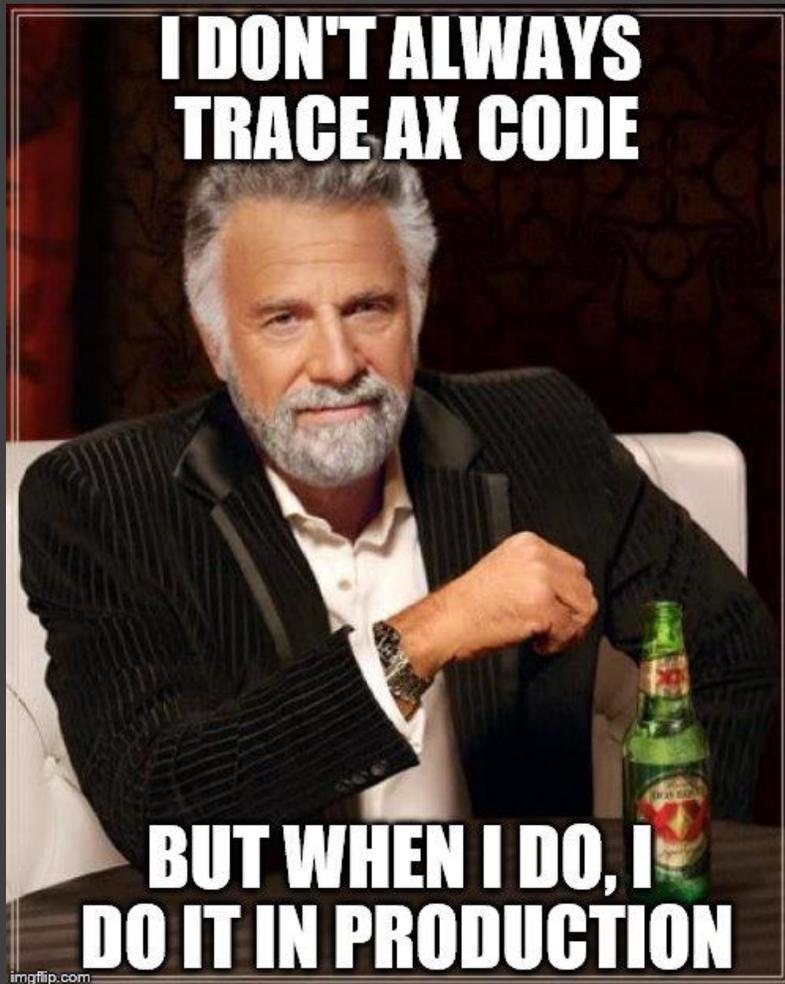
What to look for

Code Issue

SQL Issue

Other

# Production Tracing



Use a dedicated AOS

Bypass load balancer (-loadbalance=0)

During minimal activity times (if possible)

Don't always need to trace the entire process

# Trace Flags

- 1118 - Changes the default mixed page allocations in TempDB to full extent allocations
- 1117 - Evenly grow *ALL* database files
  - All files in a filegroup autogrow together
- 4199 - Enable all optimizer changes implemented in SP's, CU's and Hotfixes
- 1224 - Disables lock escalation and will only escalate locks under extreme memory pressure\*
- 2371 - Changes default auto-update statistics thresholds from default values to sliding row size

## A few others

- 3226 - Disables successful logging of backups to the error log
- 2505 - Prevents DBCC TRACEON messages from appearing in error log (Management Report)

\*Only enable on high memory systems

# User Right Assignments

## Lock Pages in Memory

- Windows policy determines which accounts can keep (lock) data in physical memory
- Preventing the system (OS) from paging the data to virtual memory on disk (page file)
- SQL uses AWE API calls to allocate/reference memory,
- NUMA performance
- Like Area 51

## Perform Volume Maintenance Tasks

- Data and log files are first initialized by filling the files with zeros
- Operations affected
  - Create a database.
  - Add files, log or data, to an existing database.
  - Increase the size of an existing file (including autogrow operations)
  - Restore a database or filegroup
- When enabled overwrites data instead of zeroing
- Does not apply to log files
- Small security risk

# SQL Configuration

MAX Server Memory - maximum amount of memory SQL Server process can consume

<u>Total Server Memory</u>	<u>MAX Server Value</u>
<= 32 GB	OS Memory - 2 GB
>= 32 GB <= 96 GB	OS Memory - 4 GB
> 96 GB	OS Memory - 6 GB

MAX degree of parallelism

- Maximum number of worker threads that can be created during a queries execution
- Per operation not per query (you can exceed value set)
- Day to Day Operation = 1
- Maintenance = # of physical processors (not hyper-threaded) on a NUMA boundary

Optimize for ad hoc workloads

- Single-use ad hoc query plans consume a minimum of 16K
- Reduces to 300 bytes
- Dynamics doesn't do this but . . .

# SQL Configuration Continued . .

## TempDB

- Create .25 to 1 data files for each CPU (max 8\*)
- Equally sized (proportional fill algorithm)

## Autogrowth

- Change to by MB
- Value between 512 – 1024 MB

## Anti-Virus - <https://support.microsoft.com/en-us/kb/309422>

- IO filter drivers installed by Anti-Virus scanners can have a detrimental impact on IO performance
- SQL Server is extremely sensitive to this
- Exclude
  - File extensions (.mdf, .ndf, .ldf, .bak, .trn, .sql, .trc)
  - Full-Text Catalog Files
  - SQLServer.exe
  - ReportingServicesService.Exe
  - MSMDSrv.exe

# SQL Configuration Continued . .

- Power Plan – Set to HIGH PERFORMANCE on both physical and virtual
- High Availability and Disaster Recovery – Think about it, plan for it and test it

High Availability and Disaster Recovery SQL Server Solution	Potential Data Loss (RPO)	Potential Recovery Time (RTO)	Automatic Failover	Readable Secondaries
AlwaysOn Availability Group – sync - commit	Zero	Seconds	Yes <sup>(4)</sup>	0 - 2
AlwaysOn Availability Group – async - commit	Seconds	Minutes	No	0 - 4
AlwaysOn Failover Cluster Instance	NA	Seconds-to-minutes	Yes	NA
Database Mirroring - High-safety (sync + witness)	Zero	Seconds	Yes	NA
Database Mirroring - High-performance (async)	Seconds	Minutes	No	NA
Log Shipping	Minutes	Minutes-to-hours	No	Not during a restore
Backup, Copy, Restore	Hours	Hours-to-days	No	Not during a restore

# Top 10 SQL tuning tips

- Tune top 1 queries by category (if possible)
  - Be aware of parameter sniffing issues
  - Scans and Key lookups in query plans should be targeted
- Indexing
  - Have a clustered index on every table, overall ensure all your queries are index supported
  - Don't create indexes directly on SQL (testing is the exception)
  - If index keys are a leading subset of another index, index can probably be dropped
  - In AX 2012 use included columns to your advantage
  - Support sortation with correct indexing
- Evaluate compression to reduce IO footprint (higher CPU tradeoff)
- Use Archiving (IDMF) to keep your data small

# Questions?

Gracias  
MERCİ  
ARIGATO  
*thank you*