The Road To Autonomous Databases

BIG THANKS

- TO ORGANISERS

- TO SPONSORS

About Me

MCSE: Data Management and Analytics Expert

Microsoft Professional Degree in Data Science

MCSE: Data Platform Expert

MCSD: Azure Solutions Architect

Agenda

- **General Definitions**
- **Building Blocks**
  - Security Intelligence
  - Performance Intelligence

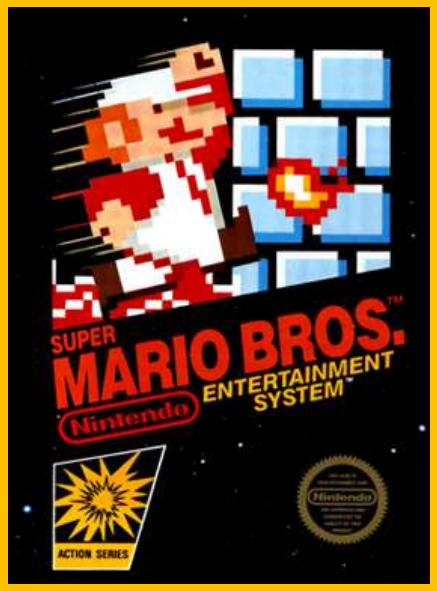
Intelligence

Ion Stoica

Good decision:

- Based on most recent data
- Faster is better than slower
- Personalised
- Robust
- Explainable

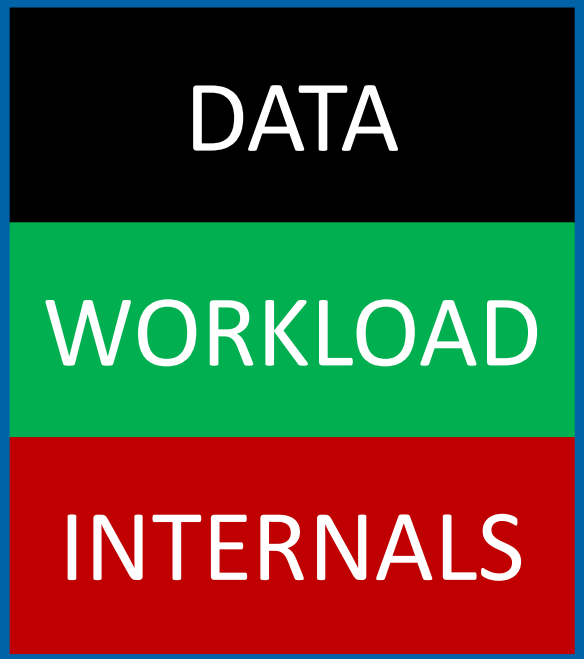
Reasoning - demo



MARIO MARIO

LUIGI MARIO

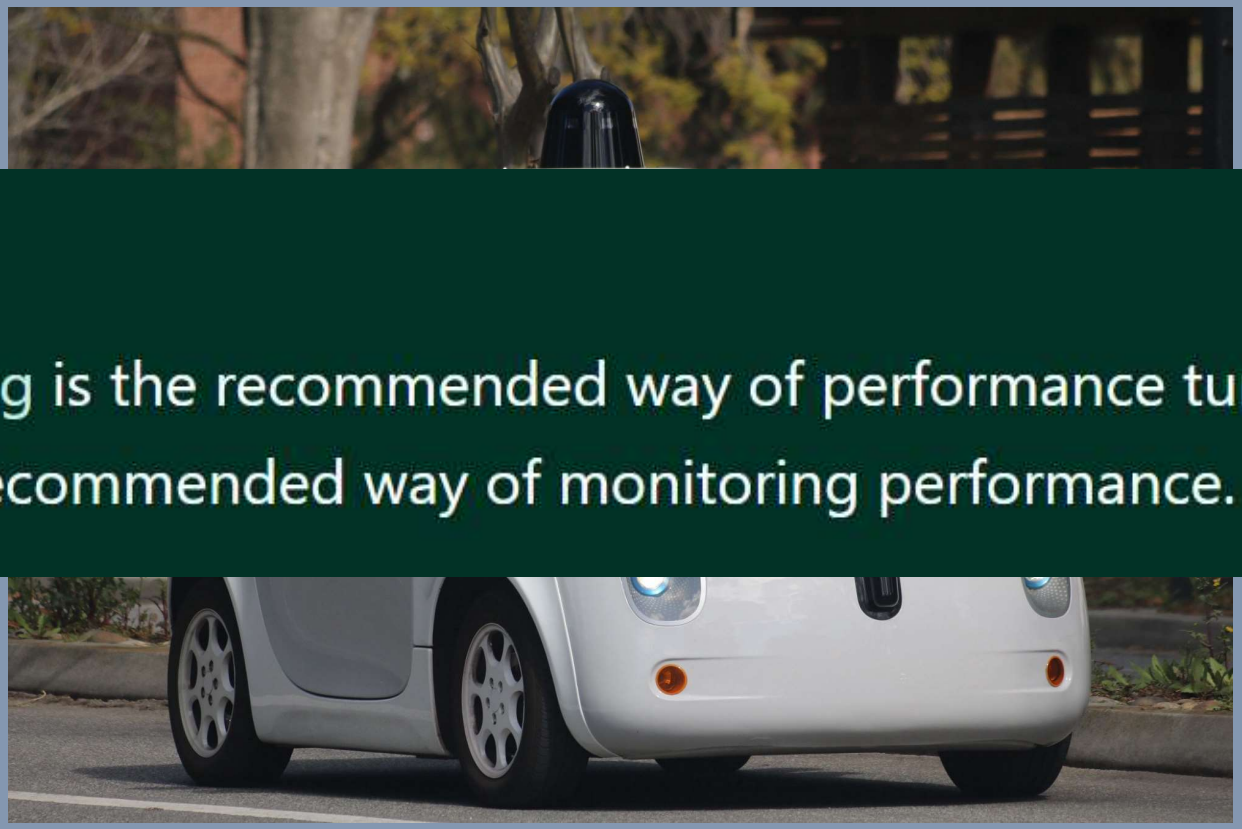
Database Performance Intelligence



Real-time

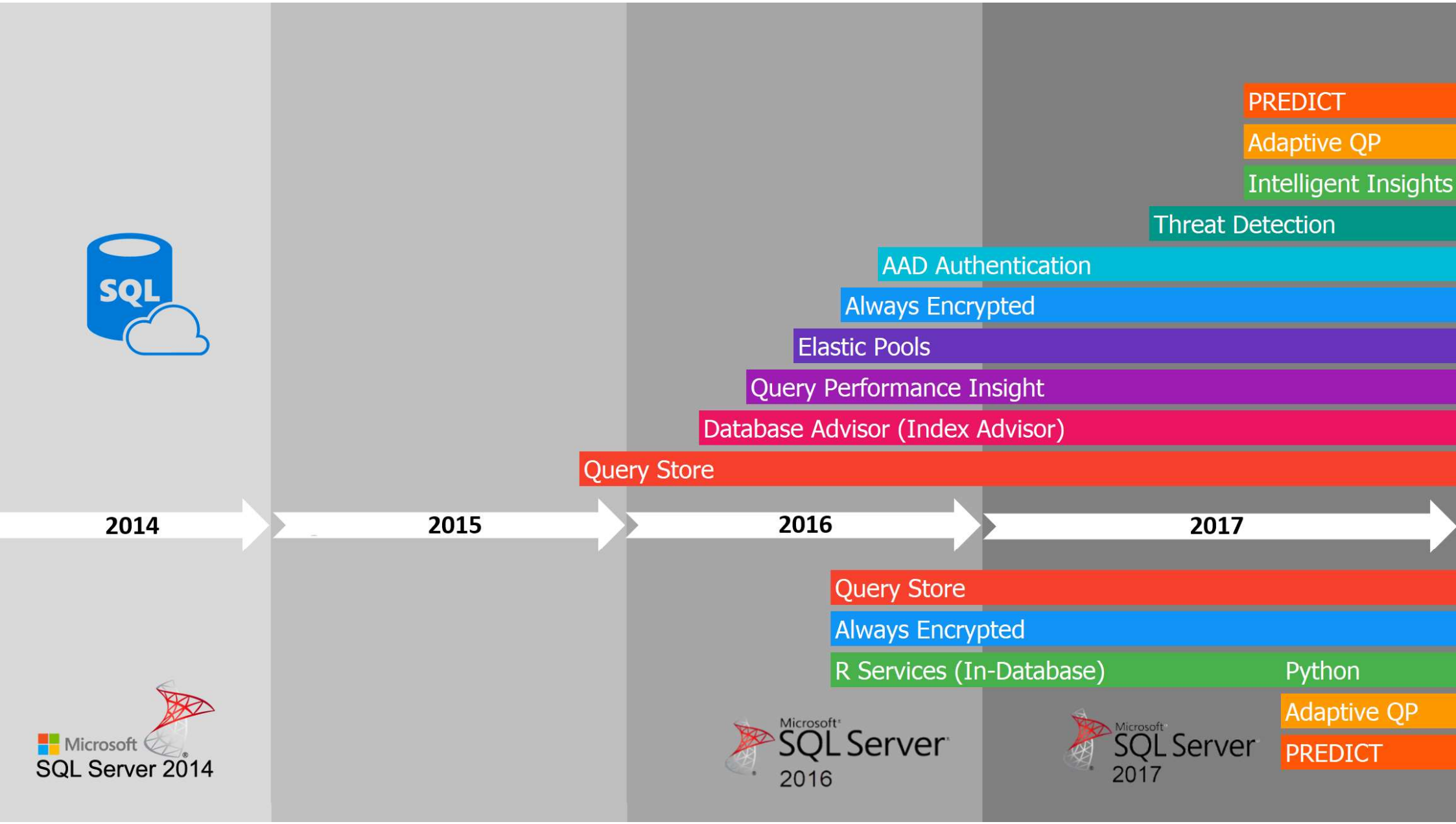
Dr. Ralph Kimball

Autonomous



Tip

Automatic tuning is the recommended way of performance tuning. Intelligent Insights is the recommended way of monitoring performance.


SQL
PREDICT
Adaptive QP
Intelligent Insights
Threat Detection
AAD Authentication
Always Encrypted
Elastic Pools
Query Performance Insight
Database Advisor (Index Advisor)
Query Store
2014
2015
2016
2017
Query Store
Always Encrypted
R Services (In-Database)
Python
Adaptive QP
PREDICT
Microsoft SQL Server 2014
Microsoft SQL Server 2016
Microsoft SQL Server 2017

Building Blocks

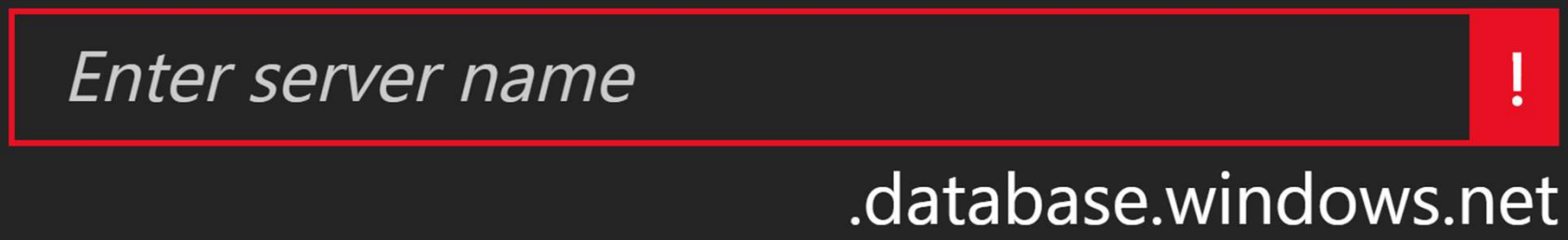
SECURITY INTELLIGENCE

- Sql Server vs Azure Sql Database
- Public Cloud
- Vulnerability Assessment
- Auditing & Threat Detection

PERFORMANCE INTELLIGENCE

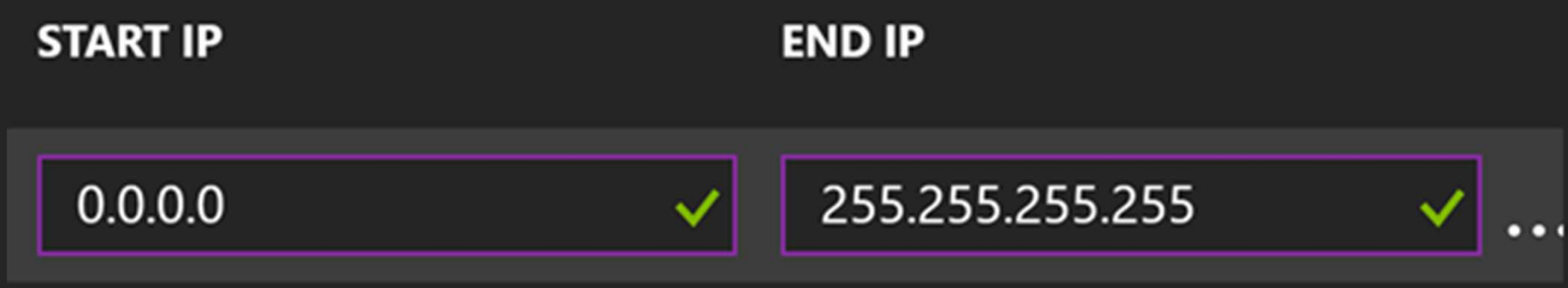
Sql Server
Azure Sql DB/DW

Azure Sql DB/DW - public cloud philosophy



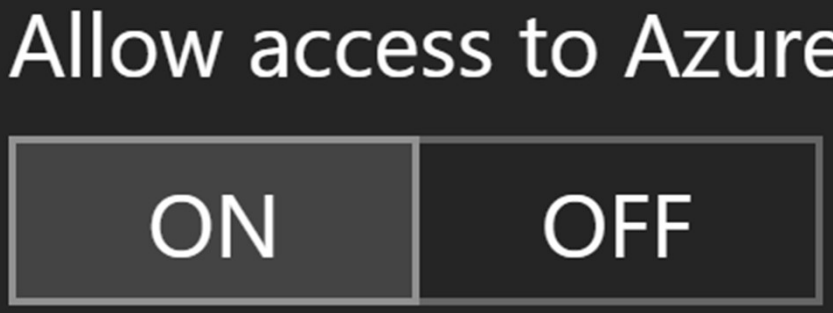
PsPing/Test-NetConnection **~1700**

Azure Sql DB/DW - public cloud philosophy



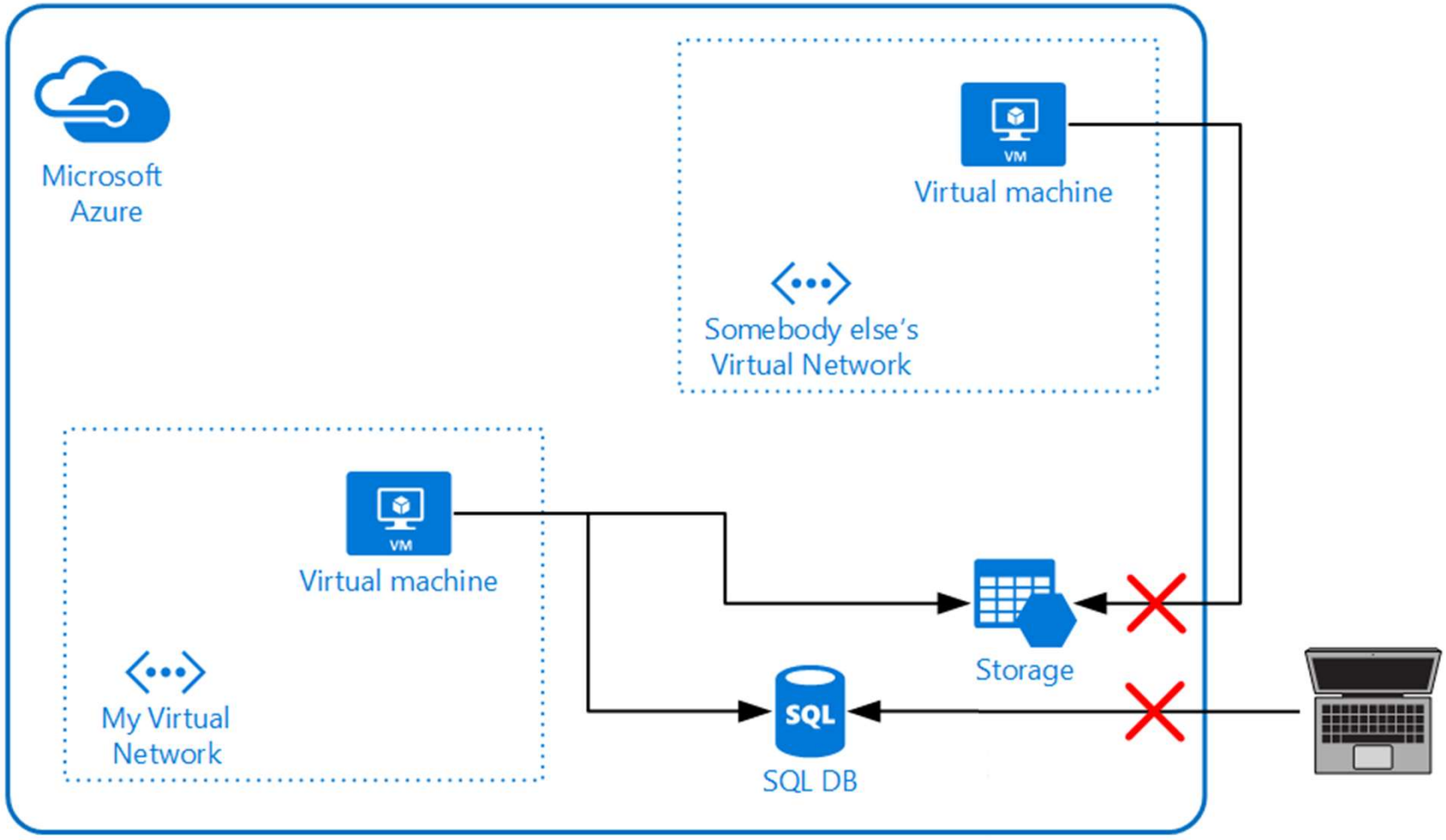
55%

Azure Sql DB/DW - public cloud philosophy



99%

VNET Service Points



Vulnerability Assessment

INPUT:

Security configuration – static data

OBJECTIVE FUNCTION:

Assess Risk

OUTPUT:

Security Recommendations

Vulnerability Assessment

Total security checks

52

Total failing checks

8

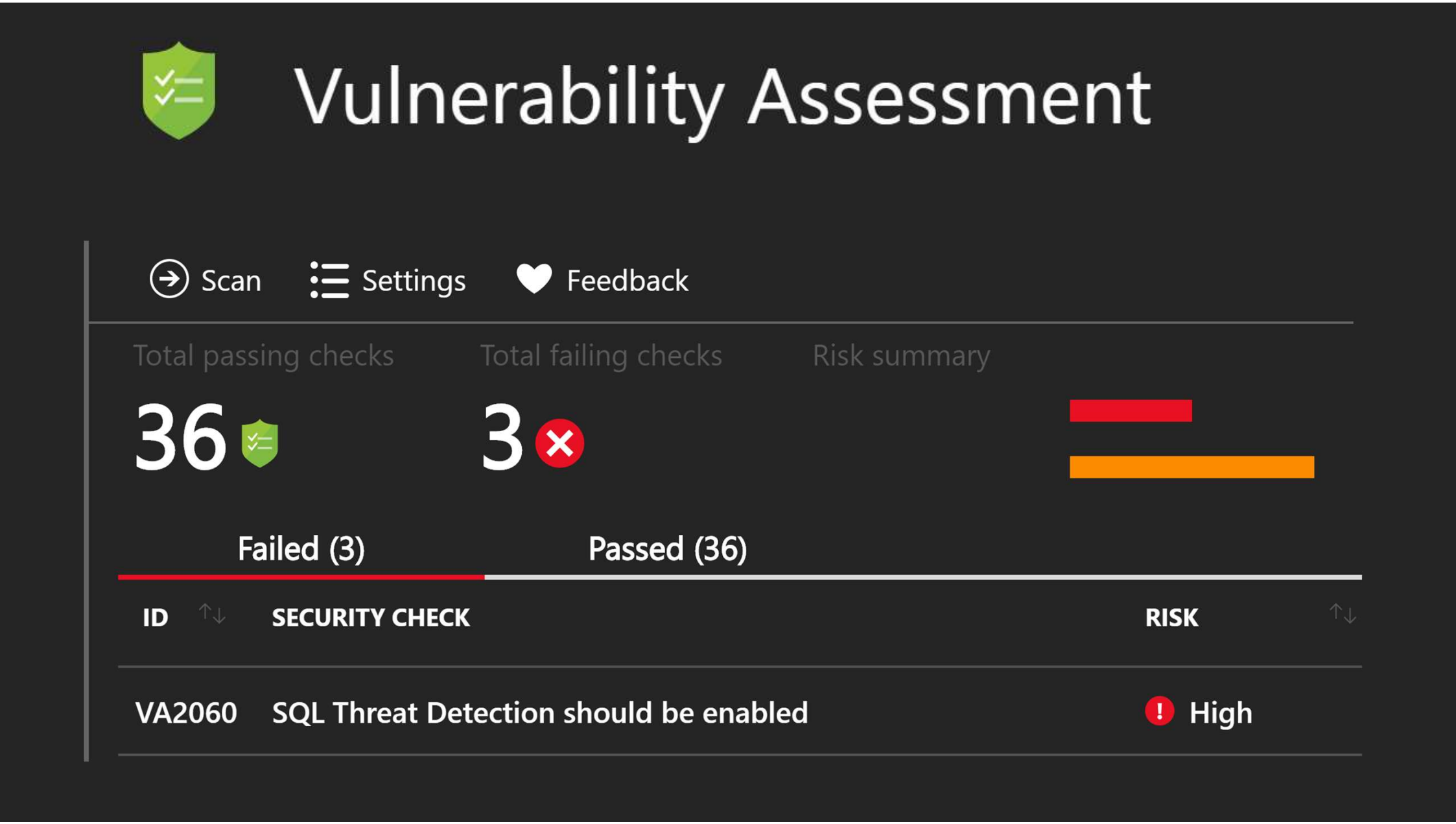
High Risk 1

Medium Risk 2

Low Risk 5

Failed (8) Passed (44)

ID	Security Check
VA1245	The dbo information should be consistent between the target DB and master
VA1285	Sensitive data columns should be identified
VA1219	Transparent data encryption should be enabled


Vulnerability Assessment
Scan
Settings
Feedback
Total passing checks
36
Total failing checks
3
Risk summary
Failed (3)
Passed (36)
ID
SECURITY CHECK
RISK
VA2060
SQL Threat Detection should be enabled
High

Auditing & Threat Detection

INPUT:

Logins requests, batches – dynamic data

OBJECTIVE FUNCTION:

Detect Threats

OUTPUT:

Notifications

Auditing & Threat Detection

Threat Detection

ON OFF

Threat Detection types
All

Send alerts to

Email addresses

Email service and co-administrators

Microsoft

Azure SQL database

An unfamiliar principal successfully logged on to SQL server [redacted]

View recent SQL alerts

Activity details

Subscription	[redacted]
Server	[redacted]
Database	[redacted]
Principal name	[redacted]

SECURITY INTELLIGENCE

- Sql Server != Azure Sql Database
- Disable ‘Allow access to Azure Services’
- VNET Service Points
- Vulnerability Assessment & Threat Detection
- Server Names
- MFA enabled for all accounts

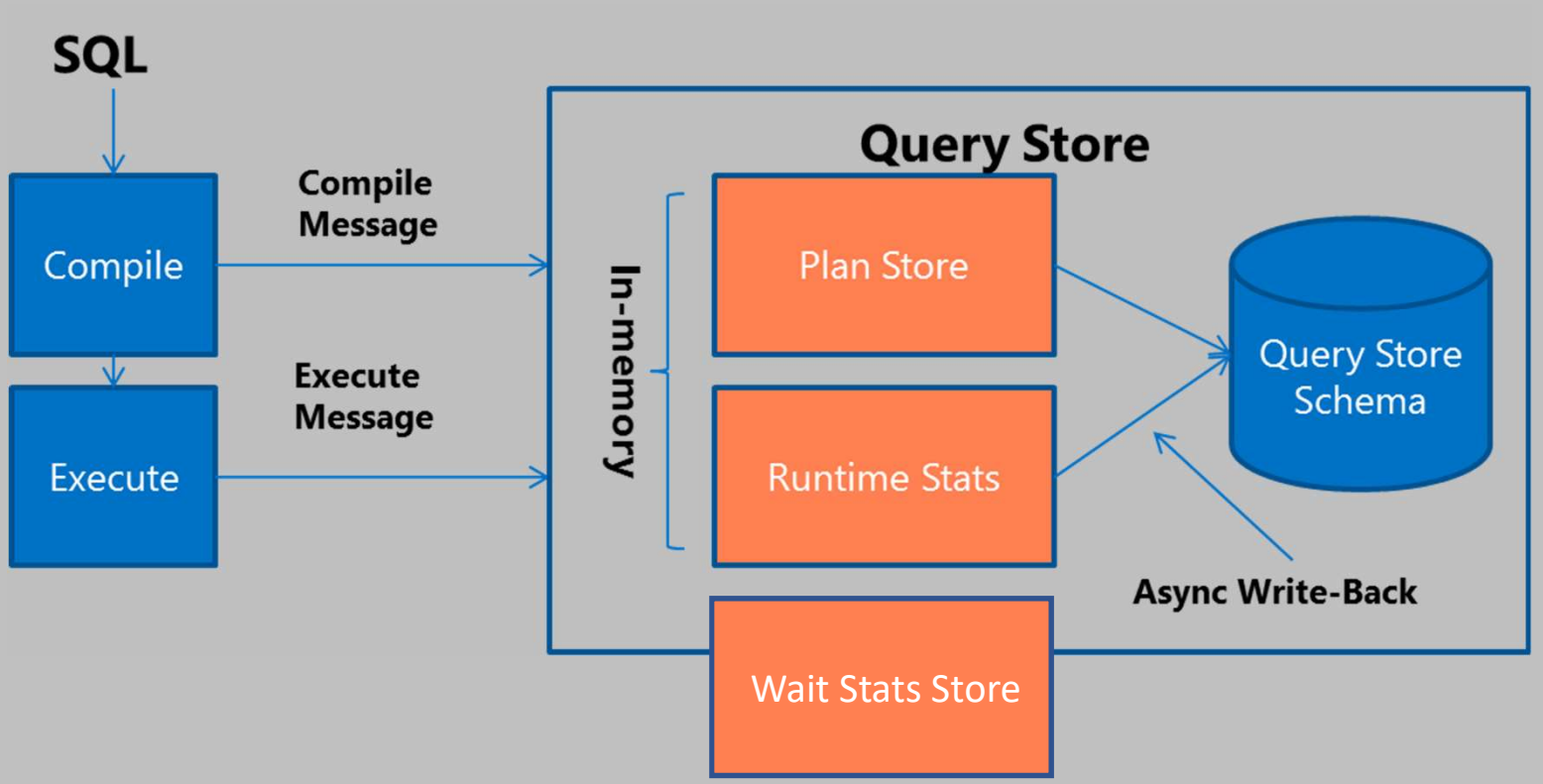
Building Blocks

SECURITY INTELLIGENCE

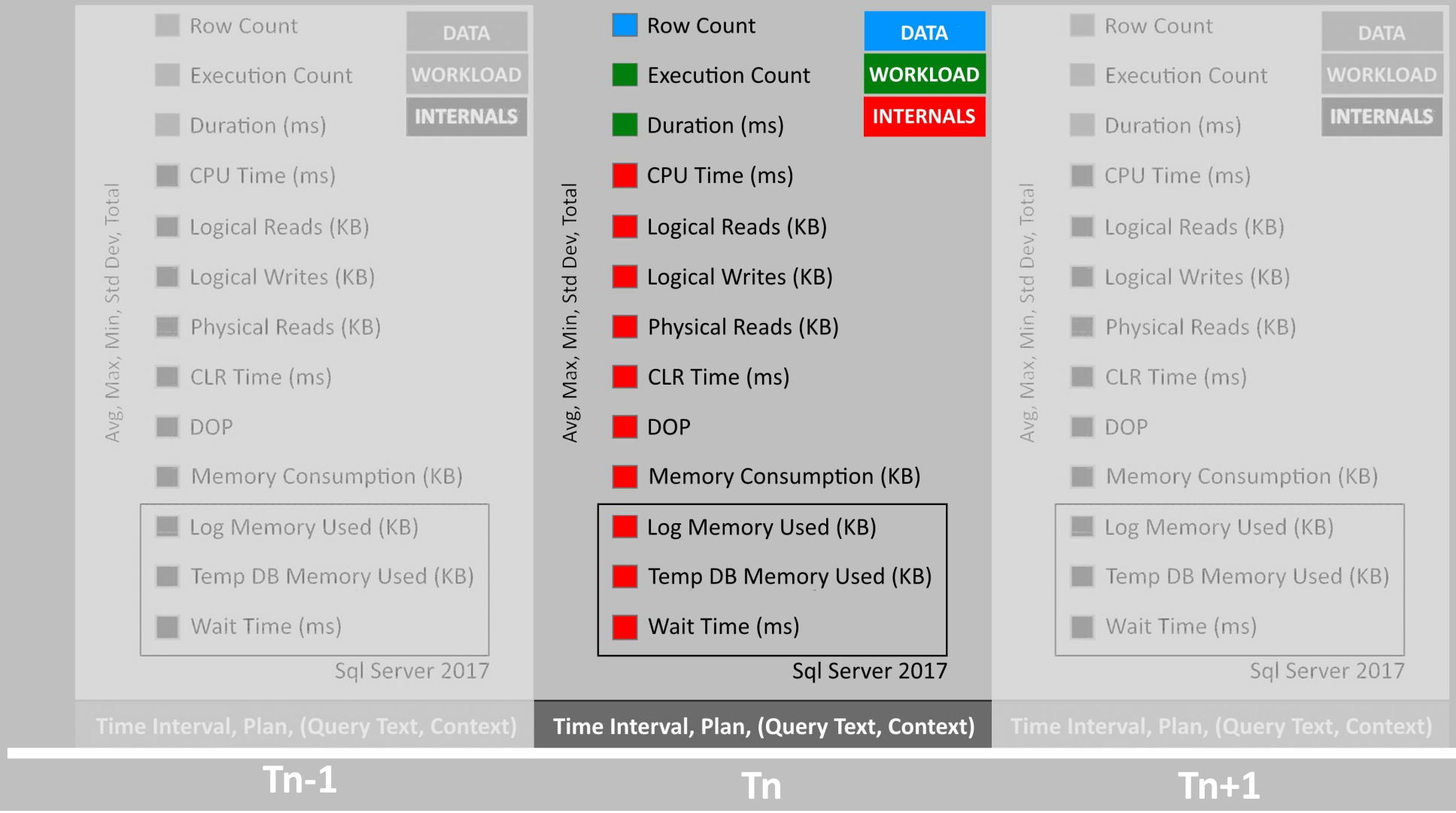
PERFORMANCE INTELLIGENCE

- Query Store
- Performance Recommendations
- Automatic Tuning
- Adaptive Query Processing

Query Store - INPUT



Query Store – OUTPUT



Query Store - configuration

```
ALTER DATABASE CURRENT SET QUERY_STORE
{
      = OFF
    | = ON [ ( <query_store_option_list> [,... n] ) ]
    | ( < query_store_option_list> [,... n] )
    | CLEAR [ ALL ]
}
<query_store_option_list> ::=
{
      OPERATION_MODE = { READ_WRITE | READ_ONLY }
    | CLEANUP_POLICY = ( STALE_QUERY_THRESHOLD_DAYS = number )
    | DATA_FLUSH_INTERVAL_SECONDS = number
    | MAX_STORAGE_SIZE_MB = number
    | INTERVAL_LENGTH_MINUTES = number
    | SIZE_BASED_CLEANUP_MODE = [ AUTO | OFF ]
    | QUERY_CAPTURE_MODE = [ ALL | AUTO | NONE ]
    | MAX_PLANS_PER_QUERY = number
    | WAIT_STATS_CAPTURE_MODE = [ ON | OFF ]
}
```

	SQL Server	Sql Database
	OFF	ON
OPERATION_MODE	READ_WRITE	READ_WRITE
CLEANUP_POLICY	30	7/30/30
DATA_FLUSH_INTERVAL_SECONDS	900	900
MAX_STORAGE_SIZE_MB	100	10/100/1024
INTERVAL_LENGTH_MINUTES	60	60
SIZE_BASED_CLEANUP_MODE	AUTO	AUTO
QUERY_CAPTURE_MODE	[ALL]	AUTO
MAX_PLANS_PER_QUERY	200	200
WAIT_STATS_CAPTURE_MODE	ON	ON

Performance recommendations

FORCE PLAN

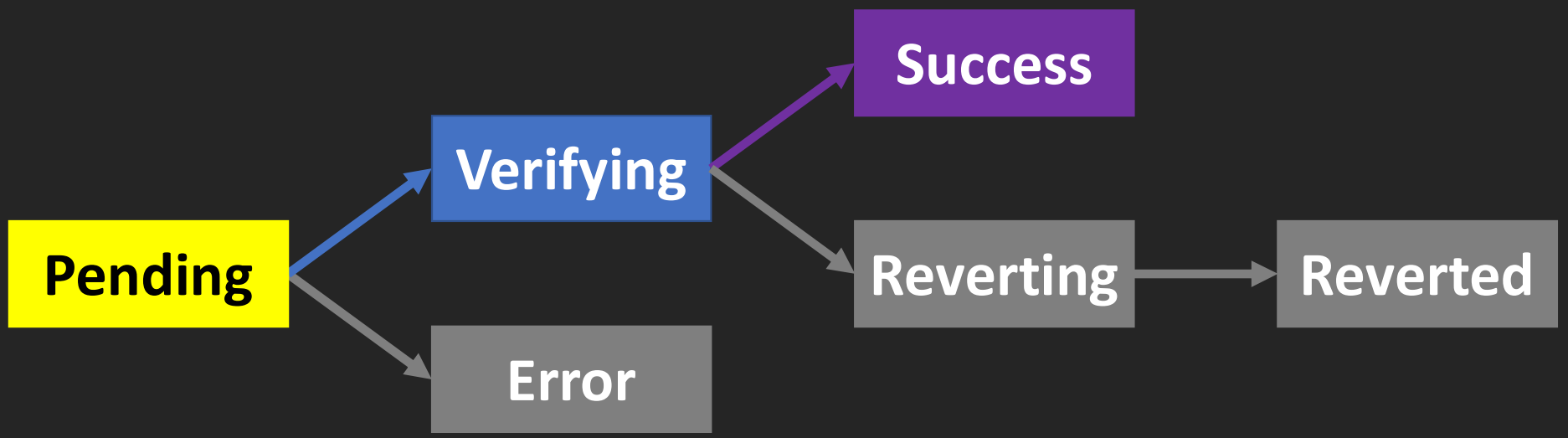
DROP INDEX

CREATE INDEX

INDEX MAINTENANCE

Automatic tuning

Automatic tuning



FORCE PLAN

INPUT:

Query.Plan1 {Total CPU Time, Execution Count}

Query.Plan2 {Total CPU Time, Execution Count}

OBJECTIVE FUNCTION: Minimise CPU time

OUTPUT:

USE PLAN

FORCE PLAN

DEMO

CREATE INDEX

INPUT:

sys.dm_db_missing_index_* + ?

QueryStore

OBJECTIVE FUNCTION: Complex

OUTPUT:

CREATE INDEX

DROP INDEX

INPUT:

sys.dm_db_index_*

QueryStore

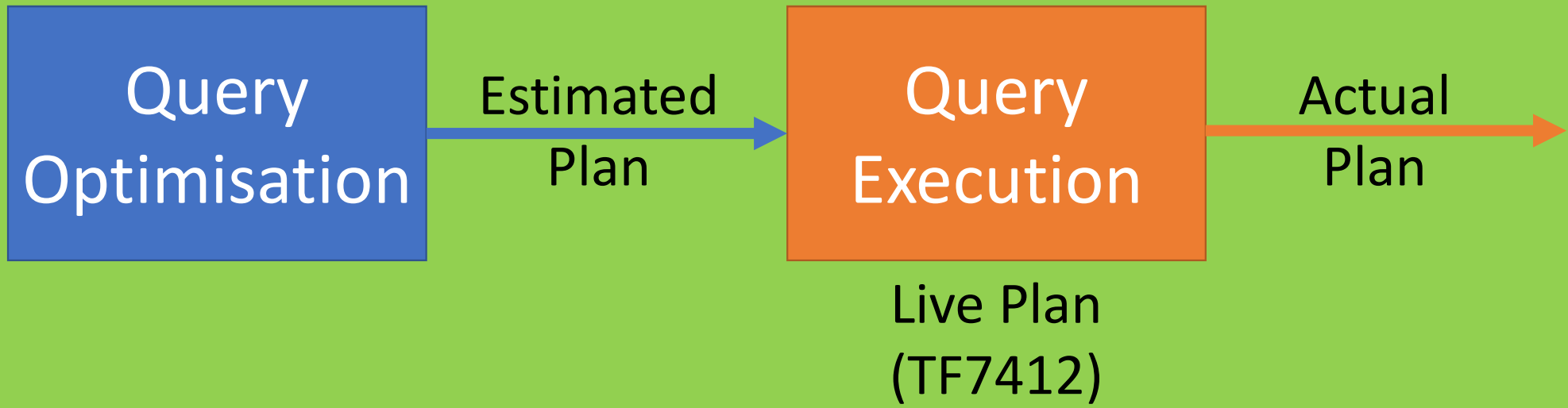
OBJECTIVE FUNCTION: Complex

OUTPUT:

DROP INDEX

~~Adaptive~~ Query Processing

Before Sql Server 2017



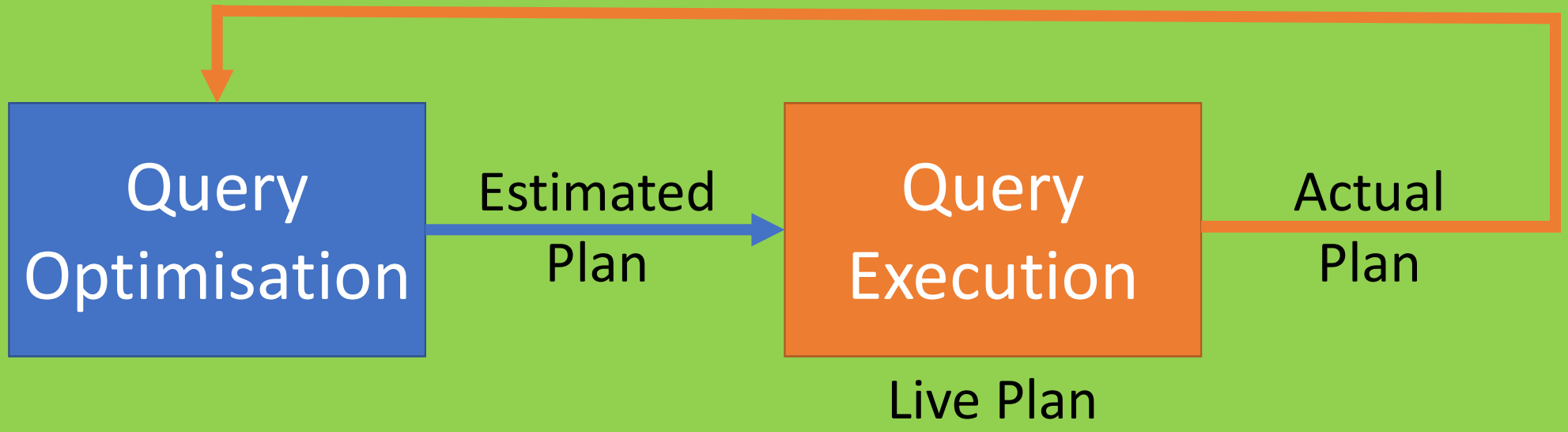
Adaptive Query Processing

```
CREATE COLUMNSTORE INDEX [NCCX_Index]
ON [Schema].[Table]([Column])
WHERE [Column] = 1
   AND [Column] = 2
```

Requirements:

- COMPATIBILITY_LEVEL = 140
- COLUMNSTORE INDEX (Azure Sql Database?)

Memory Grant Feedback

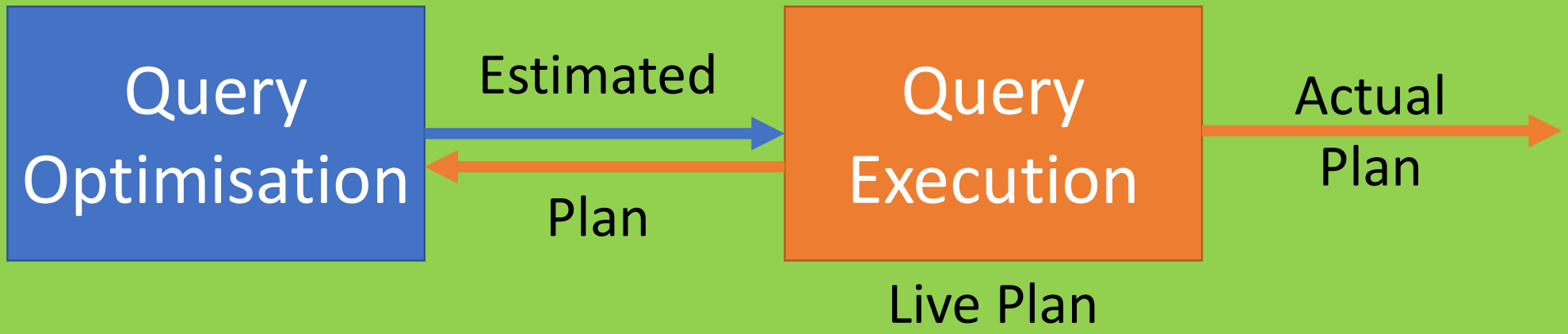


- **SqlServer 2012 -** Columnstore, Batch mode
- **SqlServer 2016 -** Sort uses Batch Mode
- **SqlServer 2017 -** Memory Grant Feedback

Memory Grant Feedback

DEMO

Interleaved Execution



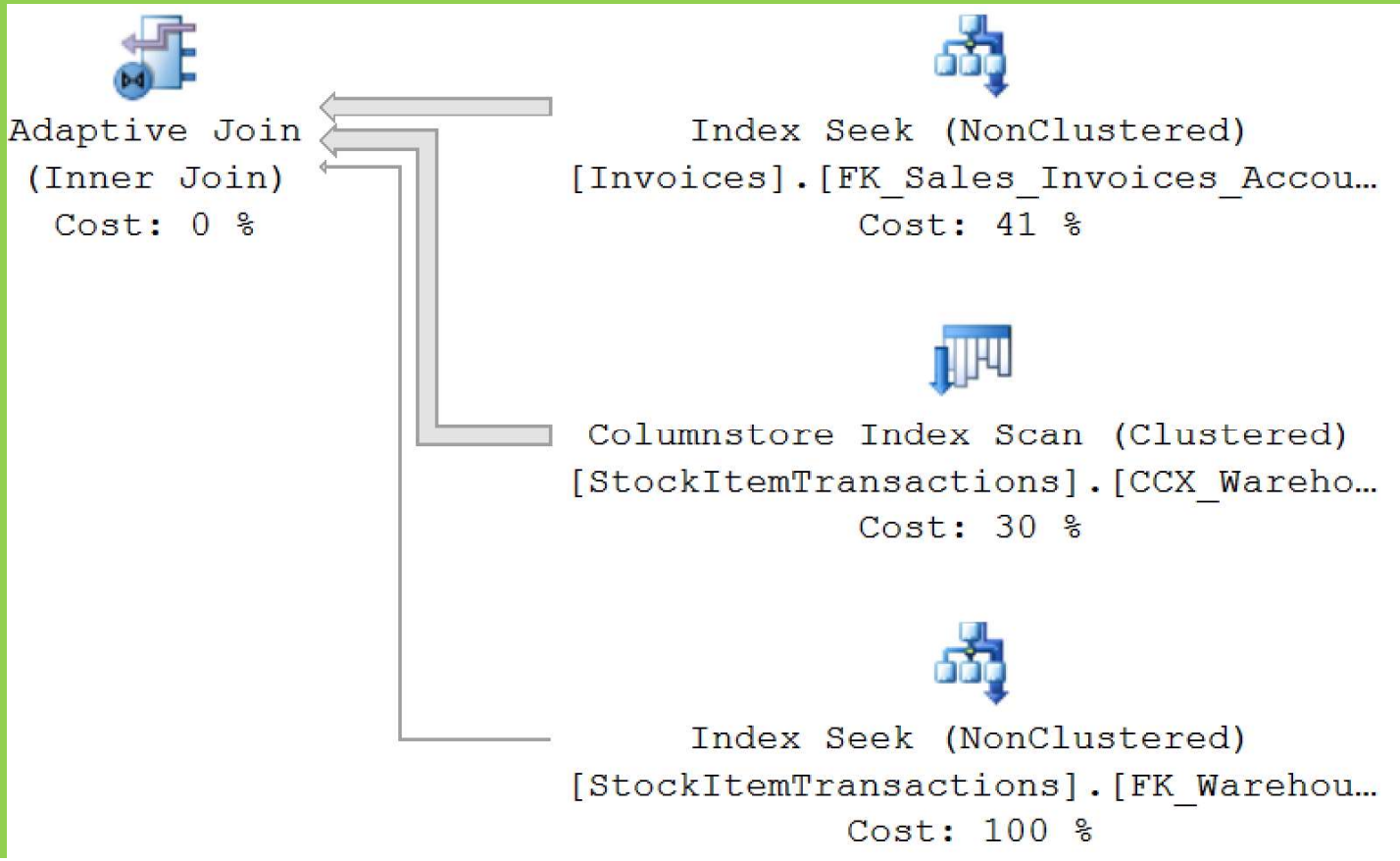
- Multi Statement Table Valued Functions

Interleaved Execution

DEMO

Adaptive Join

Query Optimisation



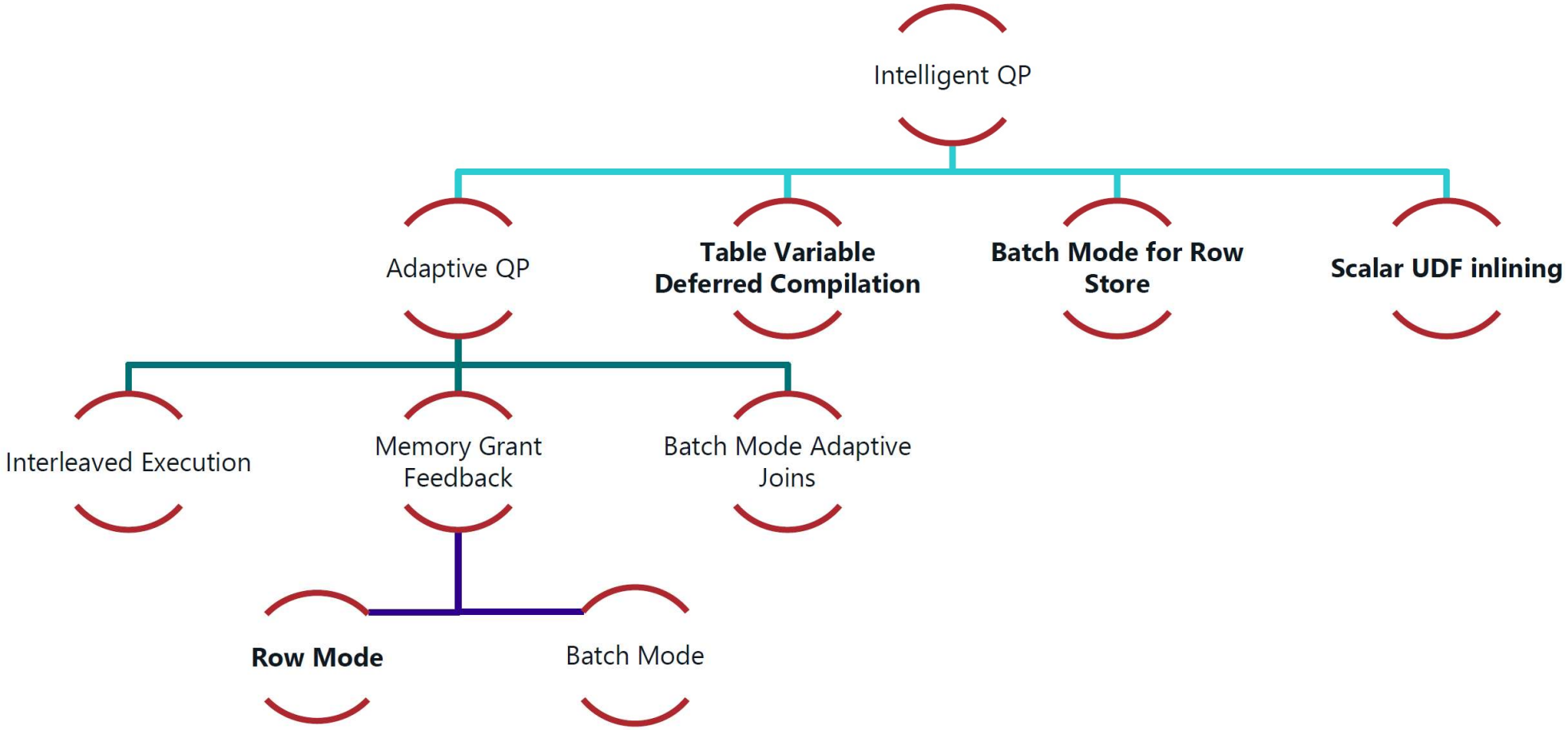
Adaptive Join

DEMO

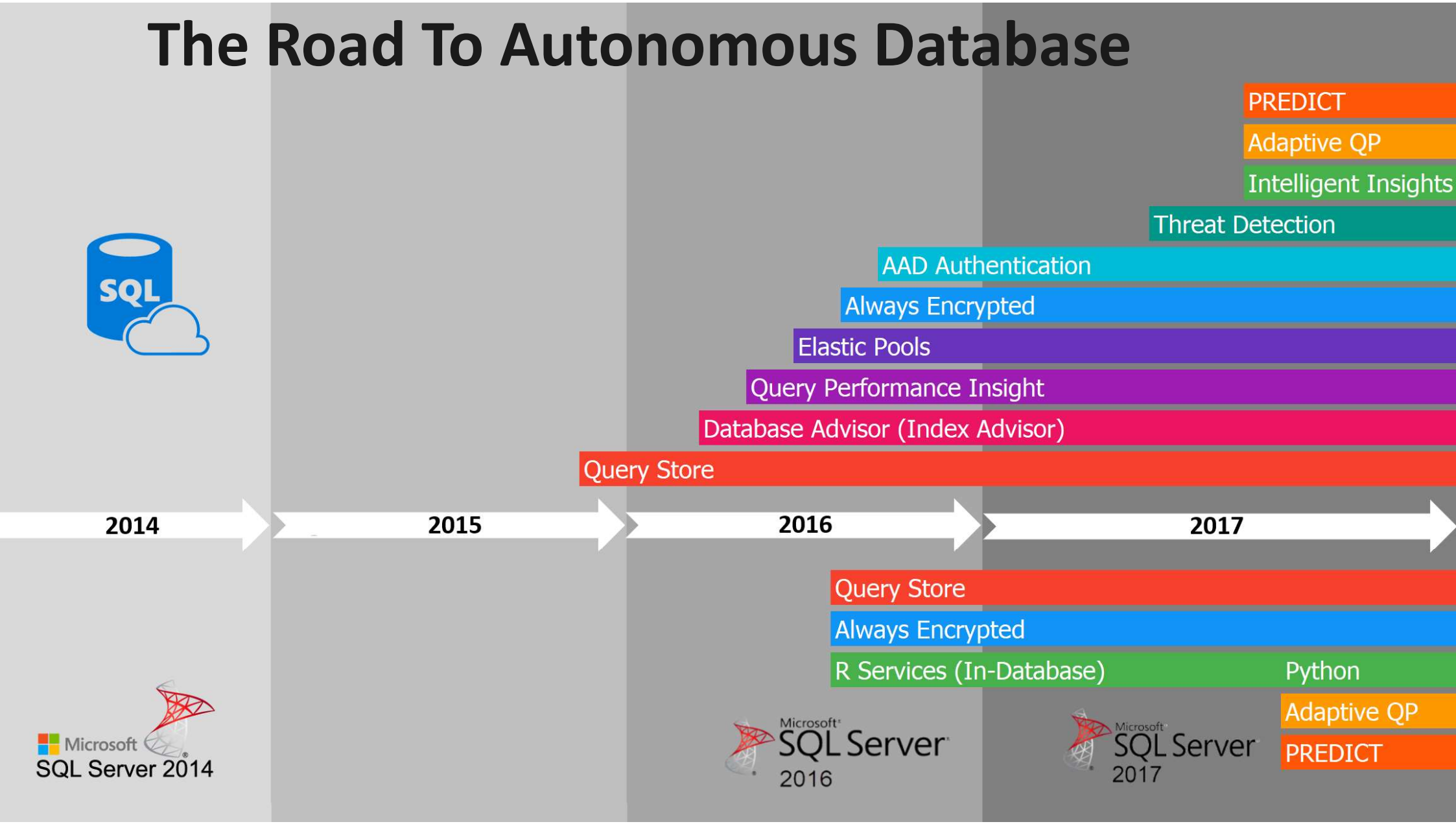
Adaptive Query Processing

Feature	Enterprise	Standard
Automatic Tuning	Yes	No
Batch Mode Adaptive Joins	Yes	No
Batch Mode Memory Grant Feedback	Yes	No
Interleaved Execution for Multi-Statement Table Valued Functions	Yes	Yes

Adaptive Query Processing - Roadmap



The Road To Autonomous Database



THANK YOU

LinkedIn /jrokicki
@DataSic
www.DataSic.com