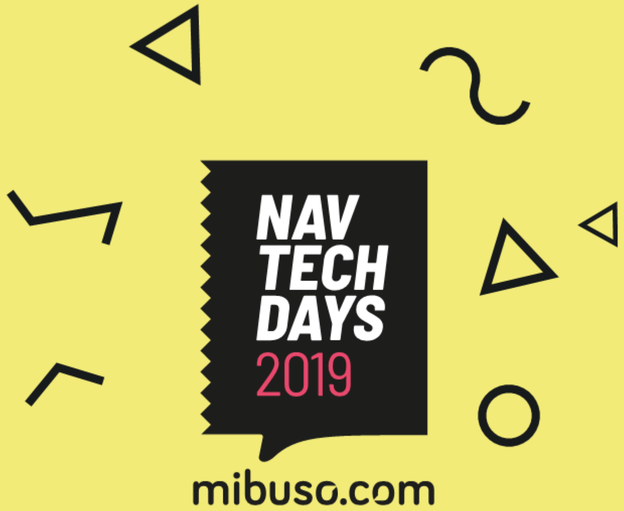

How to run faster in SaaS

Bardur Knudsen, Aleksandr Malafeev, Henrik Frovst Madsen
MICROSOFT DEVELOPMENT CENTER COPENHAGEN

When you are passionate about
Microsoft Dynamics NAV/365 Business Central

How to run faster in SaaS

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- By
  - Aleksandr Malafeev
  - Bardur Knudsen
  - Henrik Frovst Madsen

  - Agenda
    - Demystify the Cloud
    - Telemetry
    - Profiling
    - Performance regression Testing
    - New features to improve performance
    - Coding for Performance in AL
    - Q&A

Demystify the Cloud

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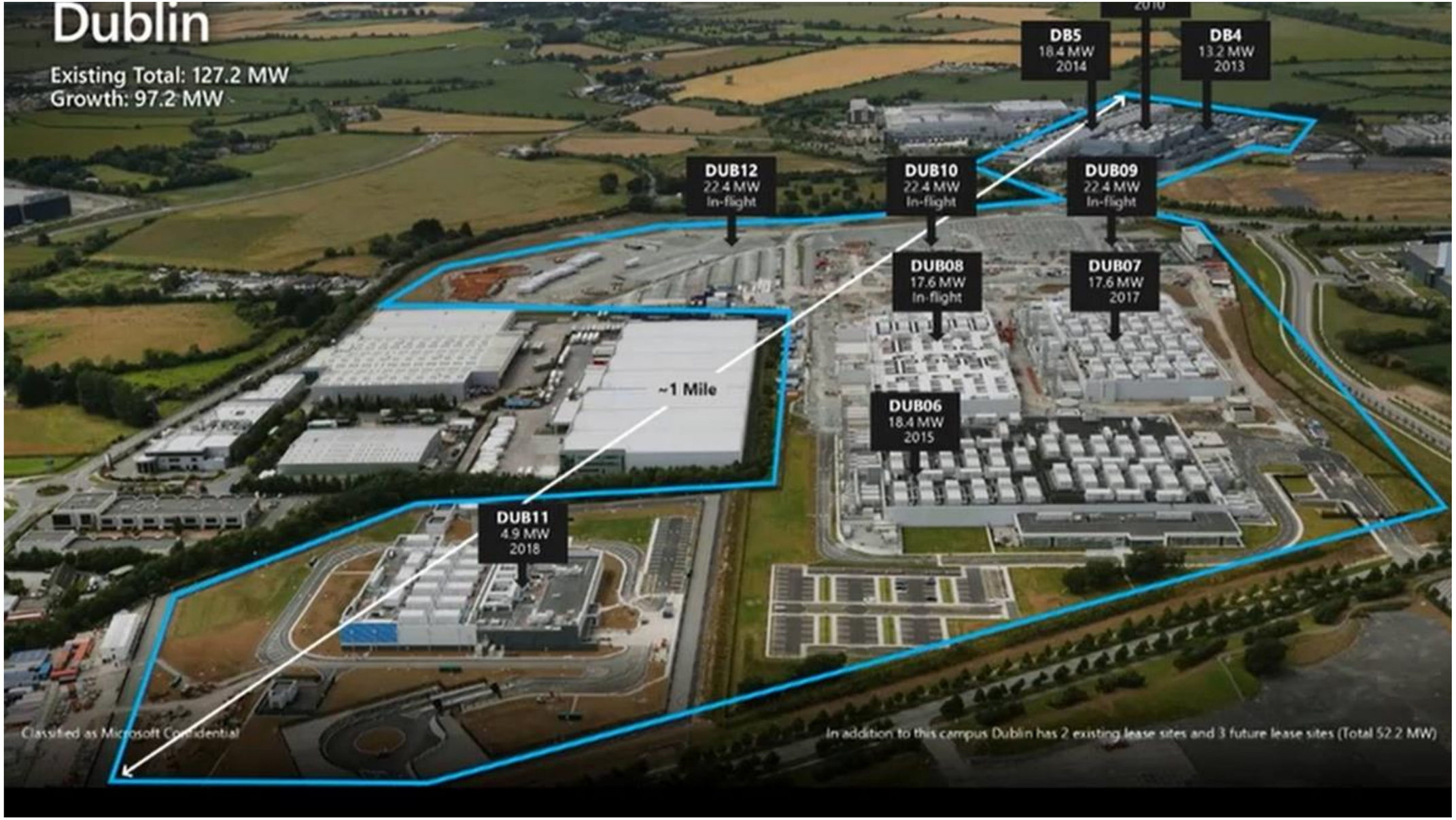
This is what it really looks like



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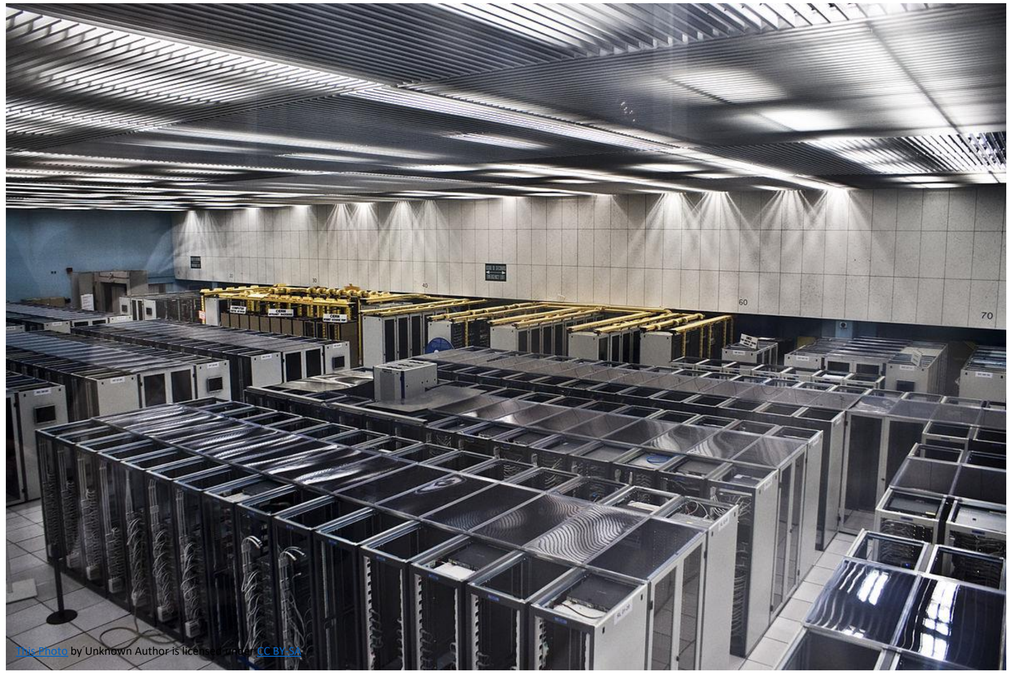
Virtual Machines

Mainstream Intel Xeon and AMD Epyc multi-core CPUs



DSv2-series

ACU: 210-250

Premium Storage: Supported

Premium Storage caching: Supported

DSv2-Series sizes run on the Intel® Xeon® 8171M 2.1GHz (Skylake) or the the Intel® Xeon® E5-2673 v4 2.3 GHz (Broadwell) or the Intel® Xeon® E5-2673 v3 2.4 GHz (Haswell) processors with Intel Turbo Boost Technology 2.0 and use premium storage.

Size	vCPU	Memory: GiB	Temp storage (SSD) GiB	Max data disks	Max cached and temp storage throughput: IOPS / MBps (cache size in GiB)	Max uncached disk throughput: IOPS / MBps	Max NICs / Expected network bandwidth (Mbps)
Standard_DS1_v2	1	3.5	7	4	4000 / 32 (43)	3200 / 48	2 / 750
Standard_DS2_v2	2	7	14	8	8000 / 64 (86)	6400 / 96	2 / 1500
Standard_DS3_v2	4	14	28	16	16000 / 128 (172)	12800 / 192	4 / 3000
Standard_DS4_v2	8	28	56	32	32000 / 256 (344)	25600 / 384	8 / 6000
Standard_DS5_v2	16	56	112	64	64000 / 512 (688)	51200 / 768	8 / 12000

Dv2-series

ACU: 210-250

Premium Storage: Not Supported

Premium Storage caching: Not Supported

DSv2-Series sizes run on the Intel® Xeon® 8171M 2.1GHz (Skylake) or the the Intel® Xeon® E5-2673 v4 2.3 GHz (Broadwell) or the Intel® Xeon® E5-2673 v3 2.4 GHz (Haswell) processors with Intel Turbo Boost Technology 2.0.

Size	vCPU	Memory: GiB	Temp storage (SSD) GiB	Max temp storage throughput: IOPS / Read MBps / Write MBps	Max data disks	Throughput: IOPS	Max NICs / Expected network bandwidth (Mbps)
Standard_D1_v2	1	3.5	50	3000 / 46 / 23	4	4x500	2 / 750
Standard_D2_v2	2	7	100	6000 / 93 / 46	8	8x500	2 / 1500
Standard_D3_v2	4	14	200	12000 / 187 / 93	16	16x500	4 / 3000
Standard_D4_v2	8	28	400	24000 / 375 / 187	32	32x500	8 / 6000
Standard_D5_v2	16	56	800	48000 / 750 / 375	64	64x500	8 / 12000

https://docs.microsoft.com/en-us/azure/virtual-machines/windows/sizes-general

SQL Elastic Pool

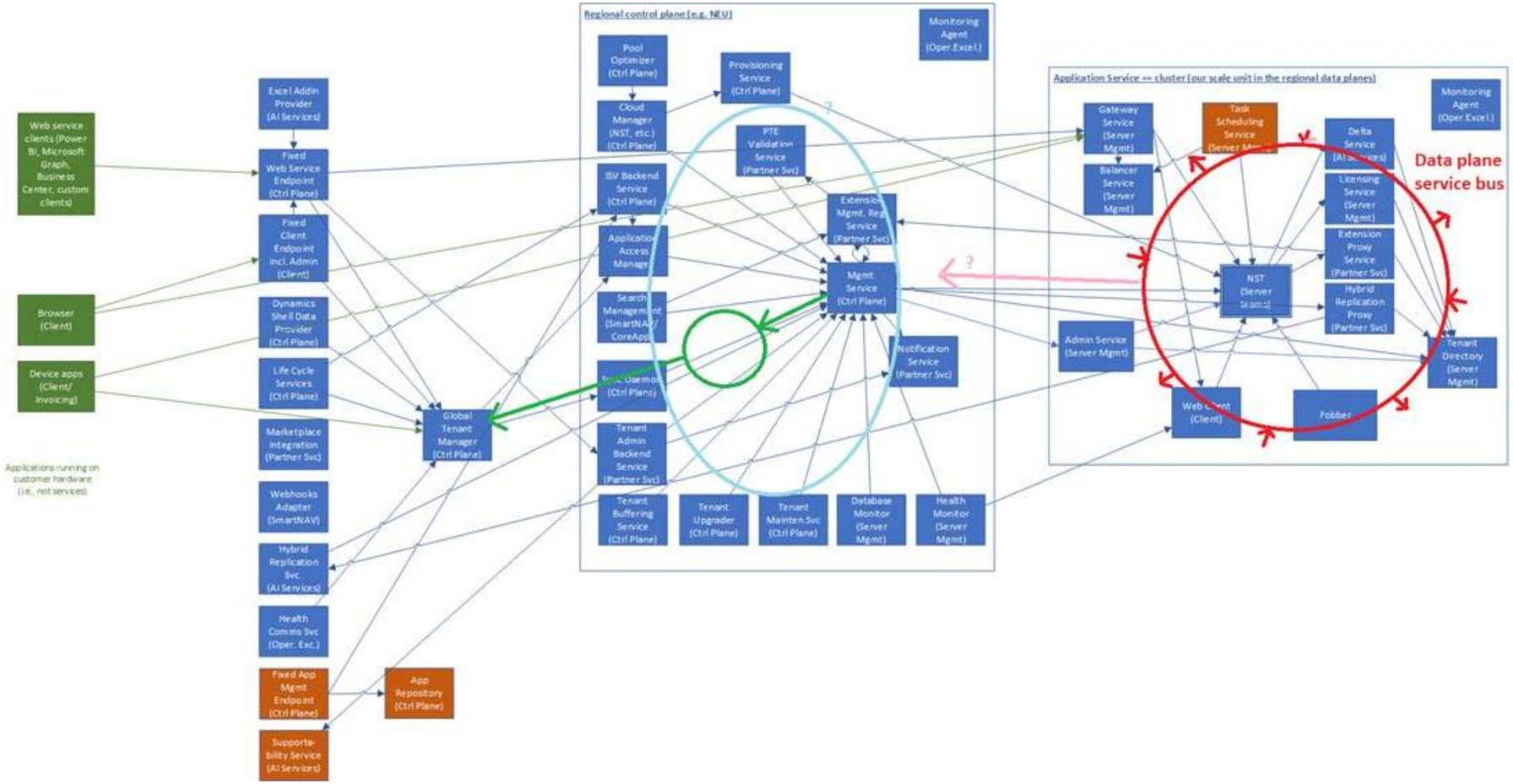
- eDTU (Elastic Database Transaction Unit)
- SSD disks (P-databases)
- Pool limit
- Individual DB limit
- No. of databases varies

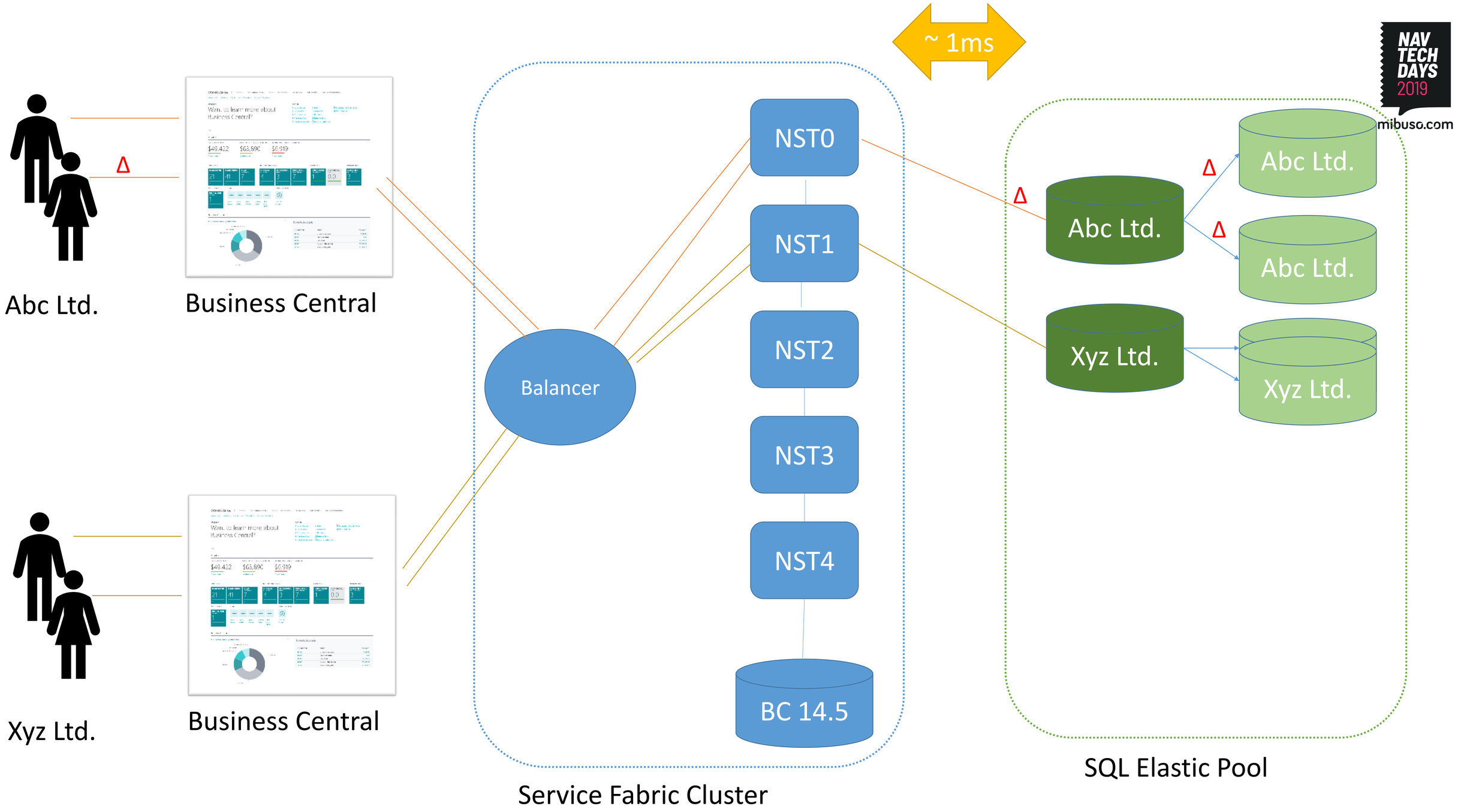
T

P

	Basic	Standard	Premium
Target workload	Development and production	Development and production	Development and production
Uptime SLA	99.99%	99.99%	99.99%
Maximum backup retention	7 days	35 days	35 days
CPU	Low	Low, Medium, High	Medium, High
IO throughput (approximate)	1-5 IOPS per DTU	1-5 IOPS per DTU	25 IOPS per DTU
IO latency (approximate)	5 ms (read), 10 ms (write)	5 ms (read), 10 ms (write)	2 ms (read/write)
Columnstore indexing	N/A	S3 and above	Supported
In-memory OLTP	N/A	N/A	Supported

Inside Business Central




~ 1ms
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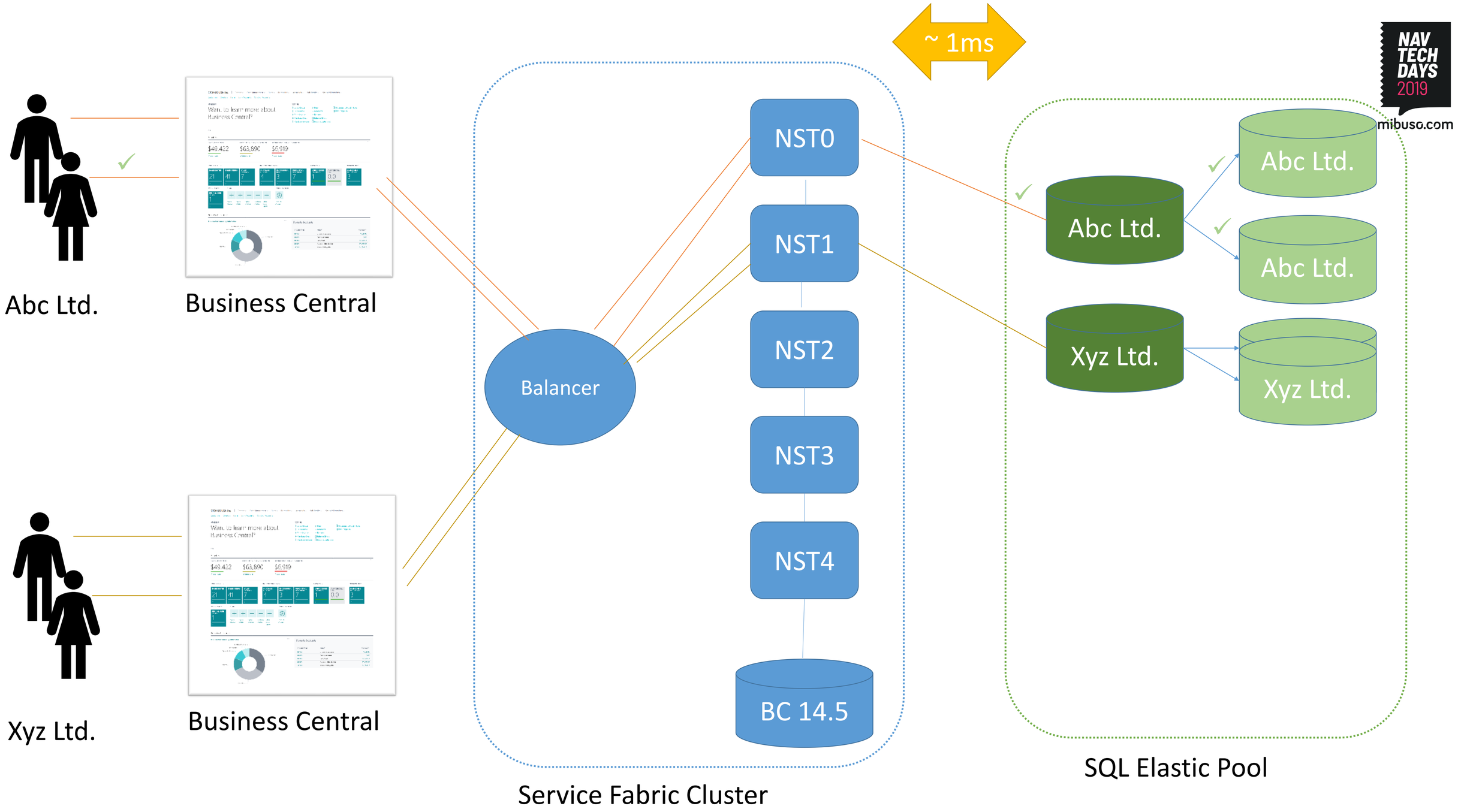
Abc Ltd.
Business Central
Xyz Ltd.
Business Central
Balancer
NST0
NST1
NST2
NST3
NST4
BC 14.5
Service Fabric Cluster
Abc Ltd.
Abc Ltd.
Abc Ltd.
Xyz Ltd.
Xyz Ltd.
SQL Elastic Pool


~ 1ms
NAV TECH DAYS 2019
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Abc Ltd.
Business Central
Xyz Ltd.
Business Central
Balancer
NST0
NST1
NST2
NST3
NST4
BC 14.5
Service Fabric Cluster
Abc Ltd.
Abc Ltd.
Abc Ltd.
Xyz Ltd.
Xyz Ltd.
SQL Elastic Pool

How Many Tenants on One Cluster?

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- Depends
- How many tenants are active (not dormant trials)?
- How many users?
- How active are they?
- As a result, we monitor usage and load, and sometimes either split clusters or move tenants to their own cluster.

A closer look at AL execution

- AL code with no database access or web access: ~300.000 statements/sec.
- SQL Access: ~300 queries/sec.
- Ratio between AL and DB calls in codeunits: ~10:1

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NST Thread Scheduler

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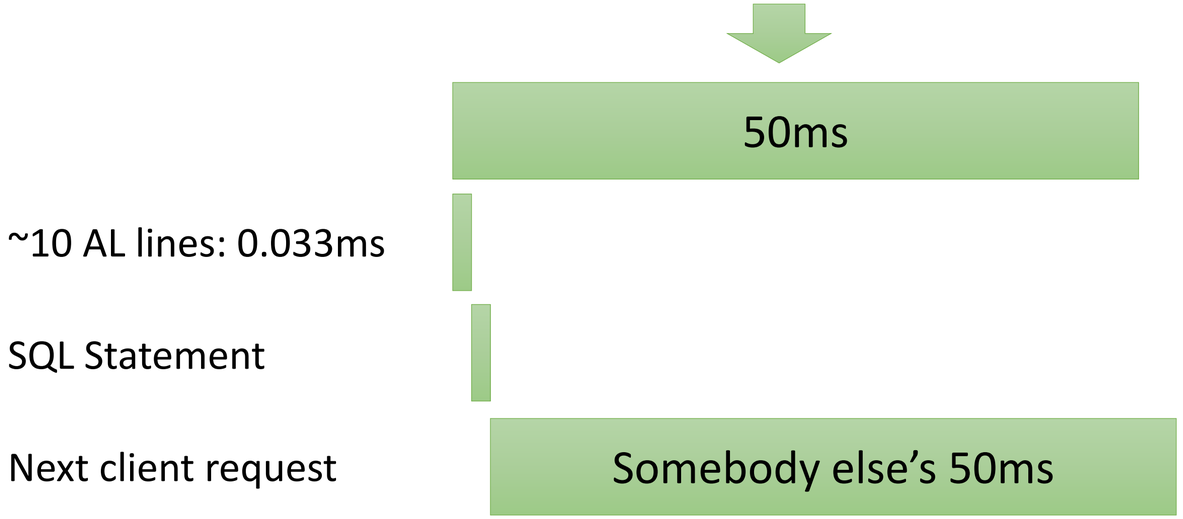
With thread scheduling - 1 task

Session	50ms	100ms	150ms	200ms	250ms	300ms	350ms	400ms	450ms	500ms	550ms	600ms	.....
Client session 1 - request	Done (15)												
Heavy long running	Run (5)	Run/StopRe	Stopped	Waiting	Waiting	Run/StopRequ	Stopped	Run (25)	Run/StopRe	Stopped / R	Run	Run	Run
Client session 1 - request 2		Waiting	Run/Done										
Odata call		Waiting	Run (35)	Run / StopR	Stopped	Waiting	Run/StopRe	Stopped	Waiting	Run/Done (5)			
Client session 2			Waiting	Waiting	Run/StopRe	Stopped	Waiting	Run/Done (25)					



Cloud service performance

- Service compute
- Database
- Application

Application Service Utilization

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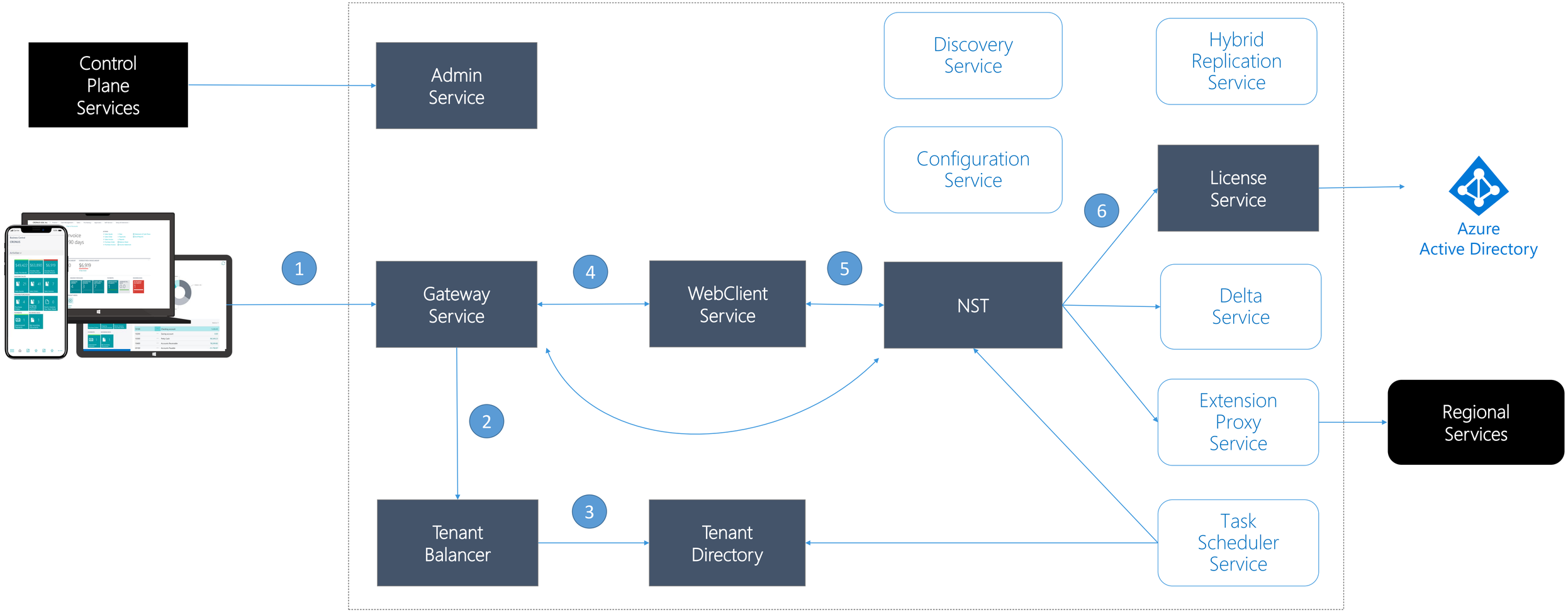
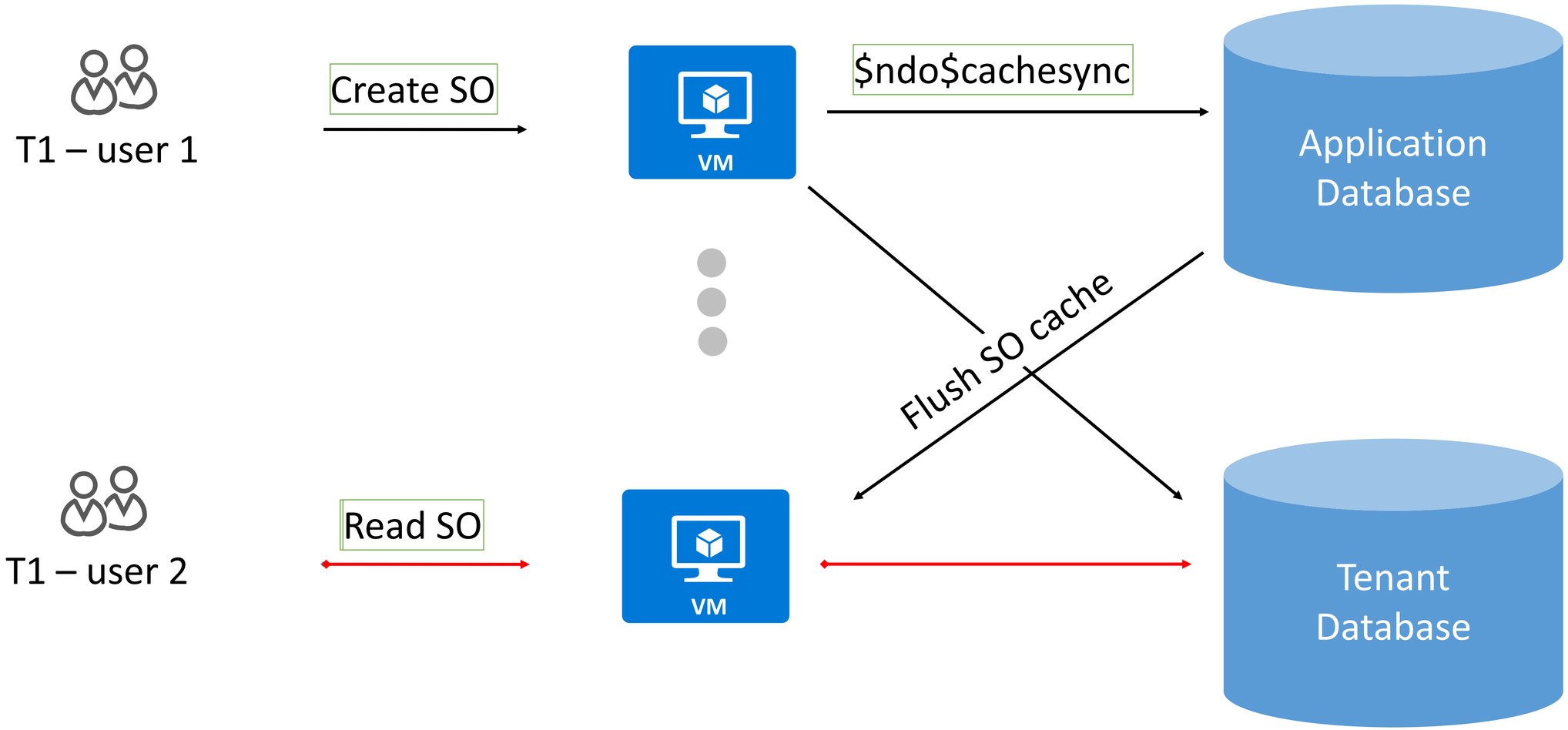
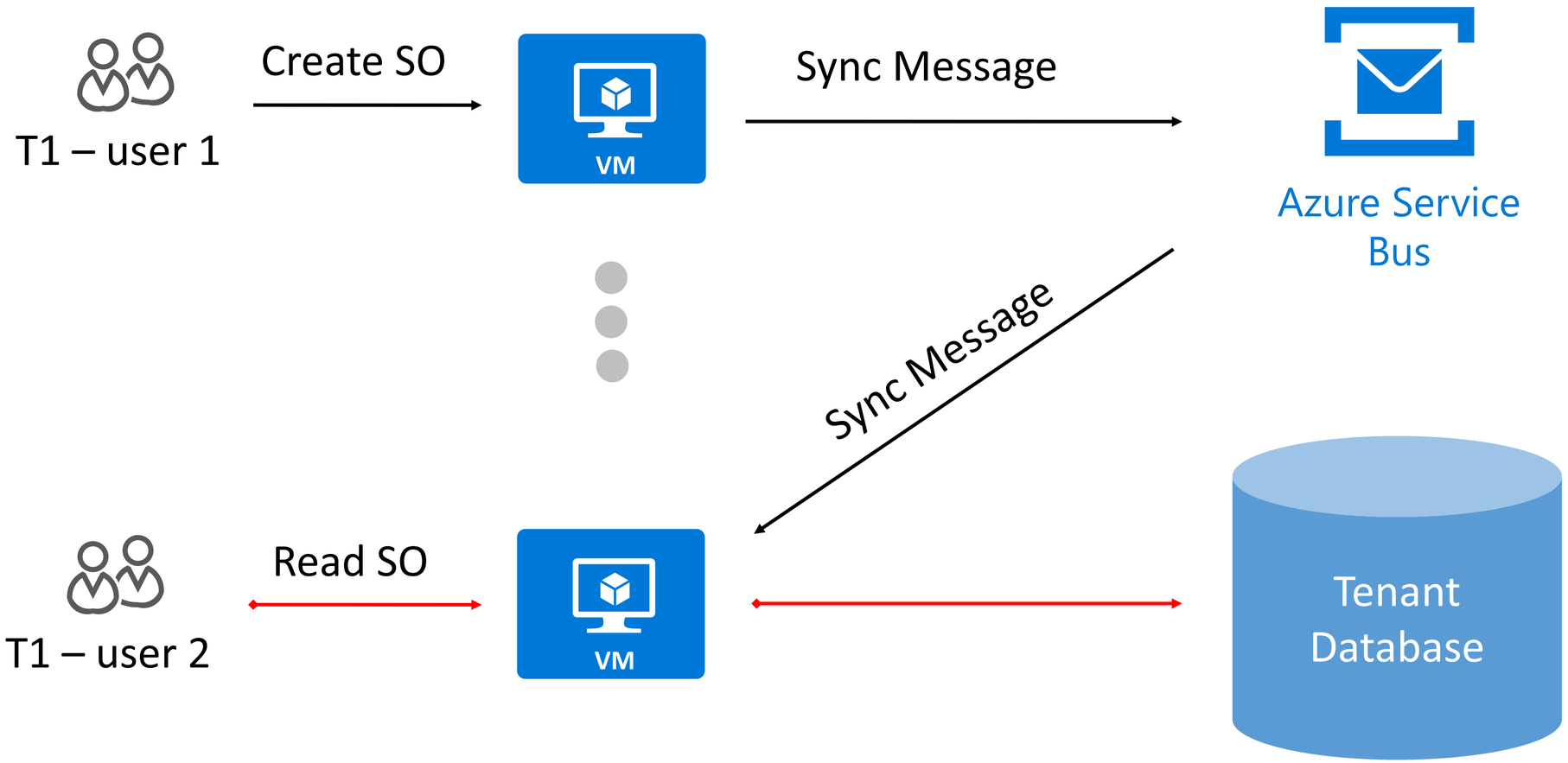
Data Plane Services



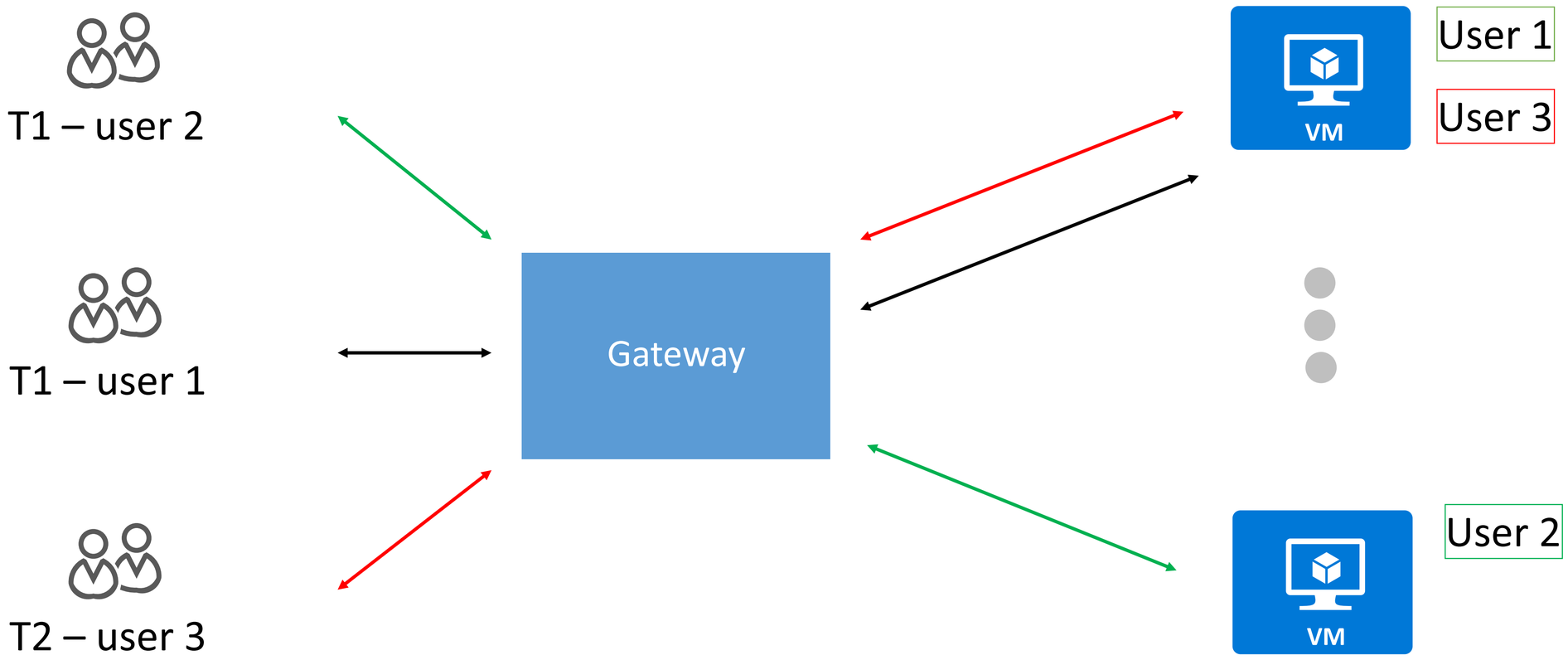
Cache synchronization



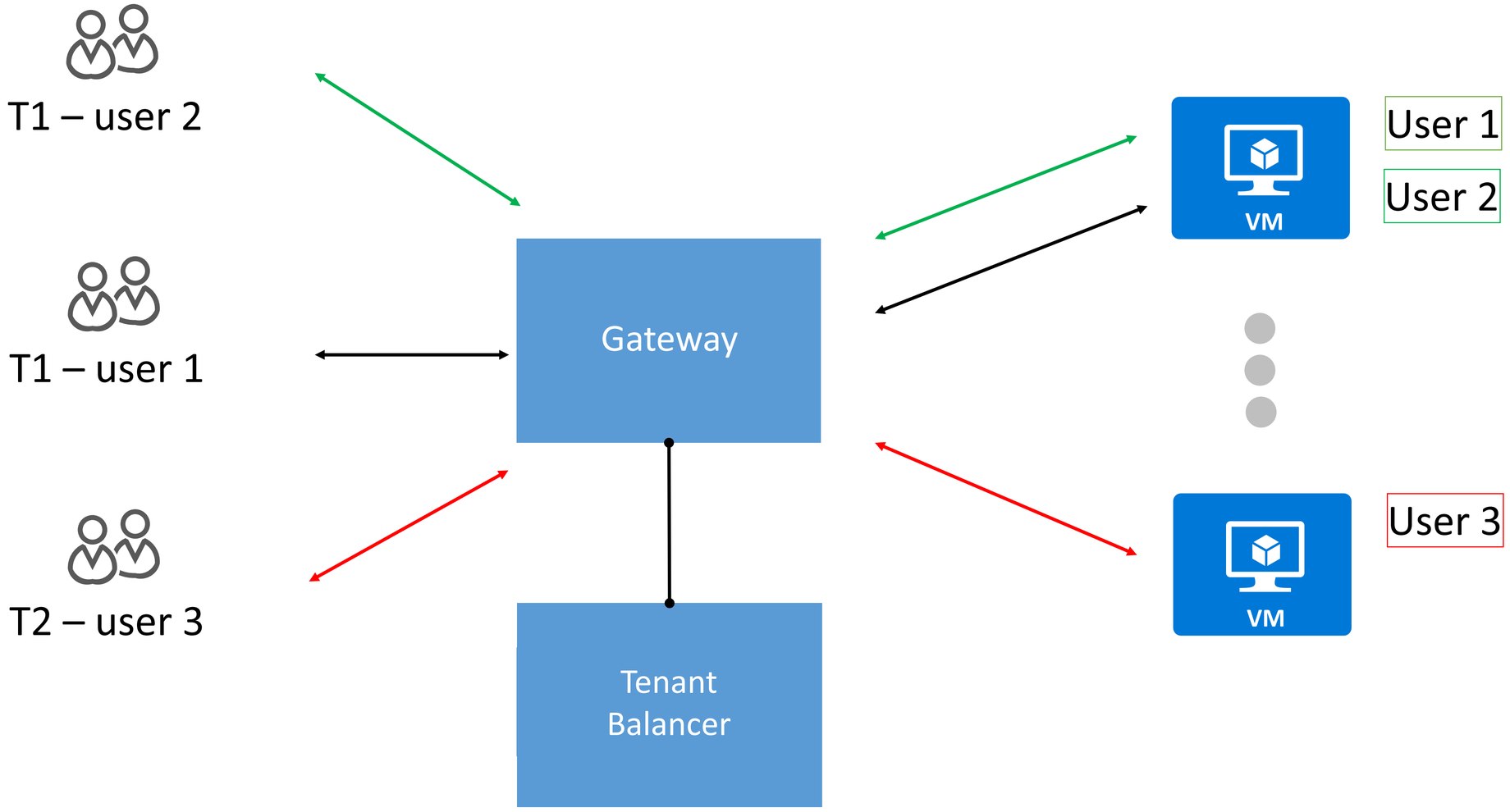
Cache synchronization



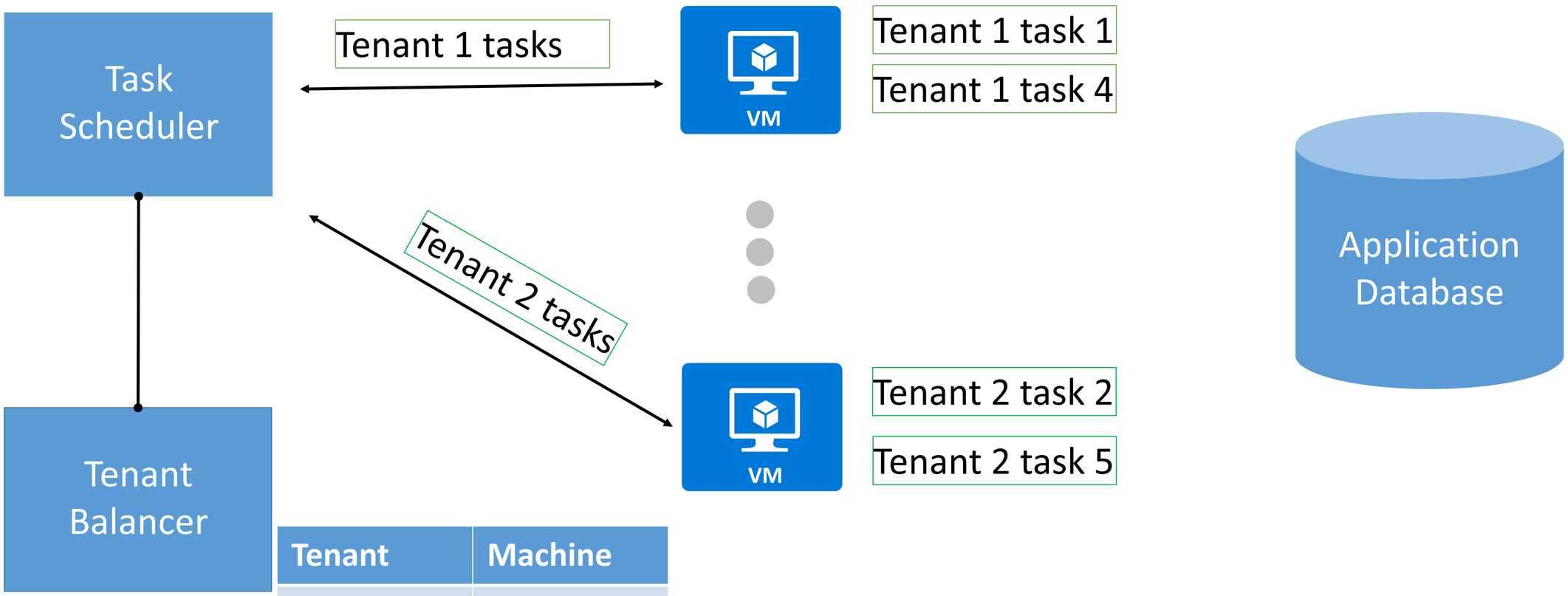
Balancing v1



Balancing v2



Task scheduling



Tenant	Machine
Tenant 1	Machine 1
Tenant 2	Machine 2

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Telemetry

What does it look like?

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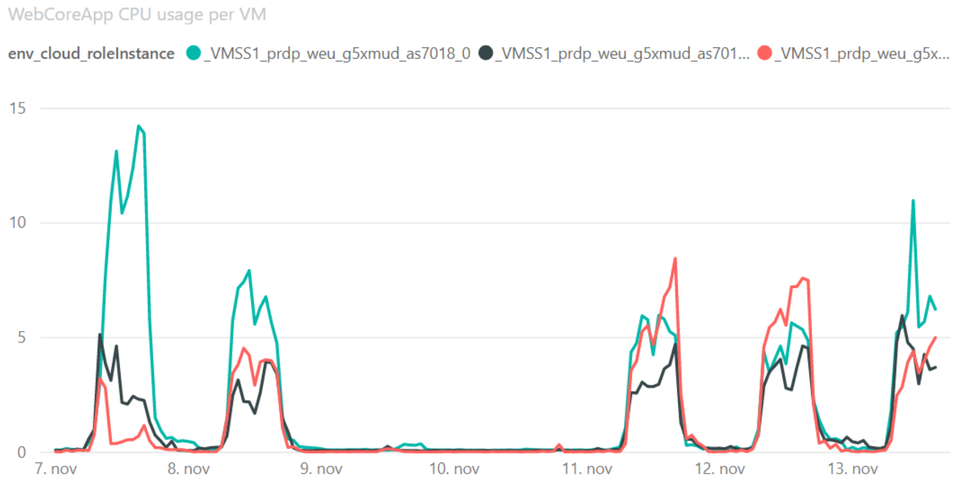
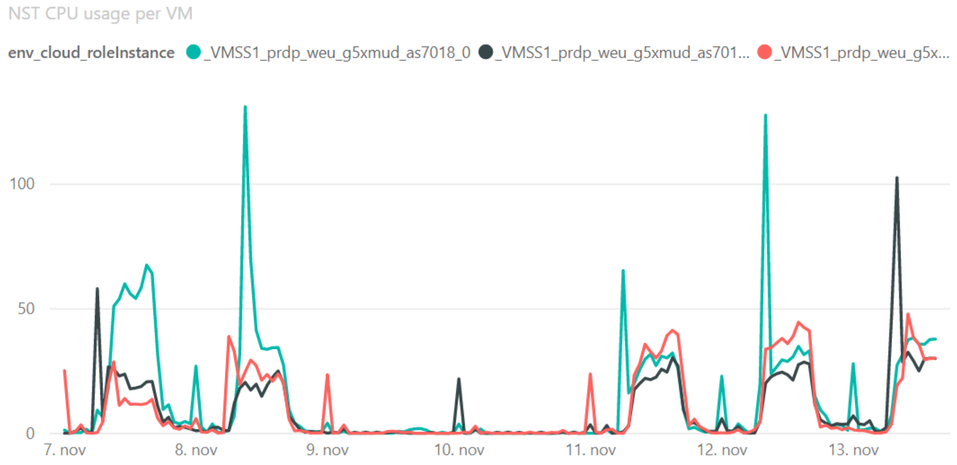
Cluster Performance (example)

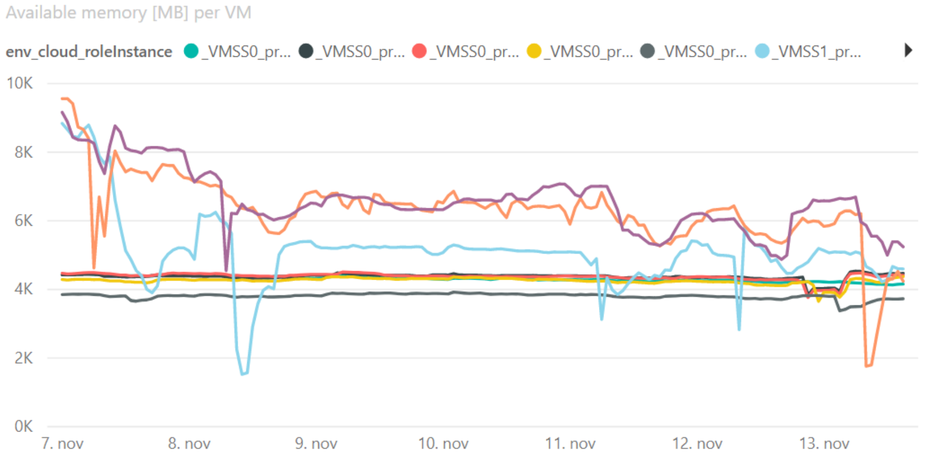


AS7018

TIMESTAMP

07-11-2019 13-11-2019





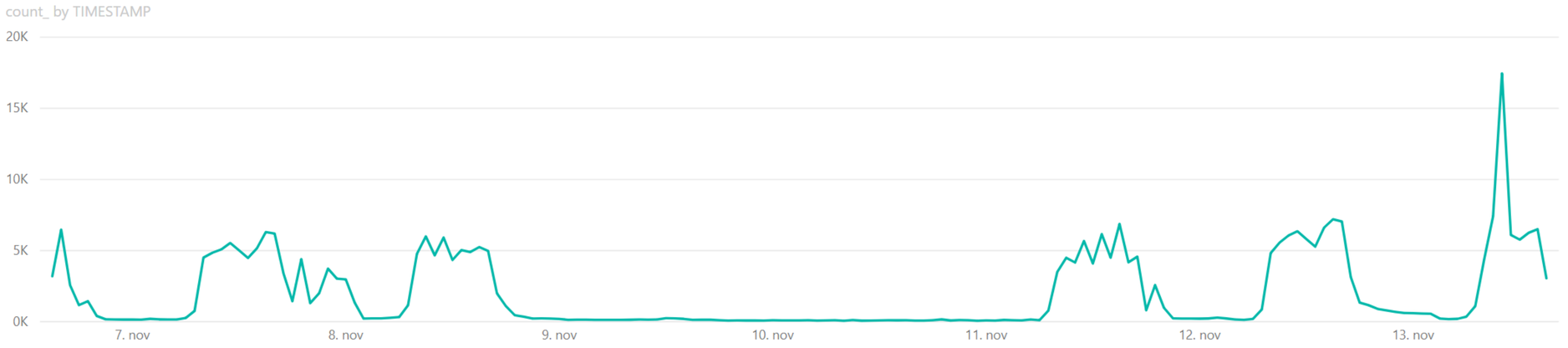
Performance Counters | OpenCompany | Sessions | Long Operations | Queries | Job Queue | ReportExecution | GetPageTiming | OnAfterGetCurrRecordTiming | NewRecord | GetNavigationFrame | FAQ | SOAPCalls | SQL stats

OnOpenCompany (example)

alternateTenantName	navTenantId	env_cloud_role	AppServiceId	platformVersion	count_	AvgOpenCompany
[redacted]	[redacted]	CustomerCluster	AS7018	14.0.37683.0	328281	8,10
Total					**328281**	**8,10**

TIMESTAMP

06-11-2019 13-11-2019



Performance Counters | OpenCompany | Sessions | Long Operations | Queries | Job Queue | ReportExecution | GetPageTiming | OnAfterGetCurrRecordTiming | NewRecord | GetNavigationFrame | FAQ | SOAPCalls | SQL stats

Sessions (example)

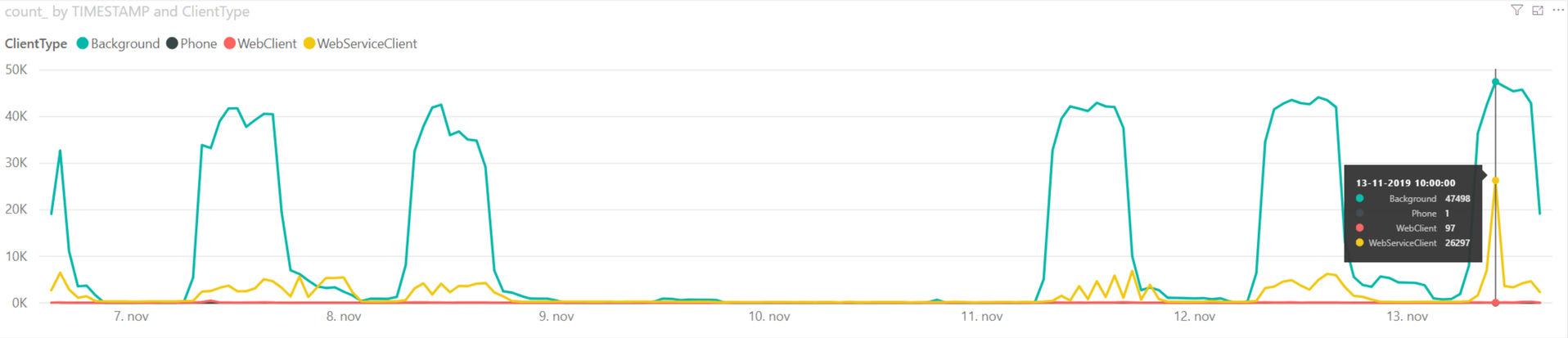
ClientType	count_
Background	2010084
Phone	56
WebClient	5779
WebServiceClient	269924
Total	**2285843**

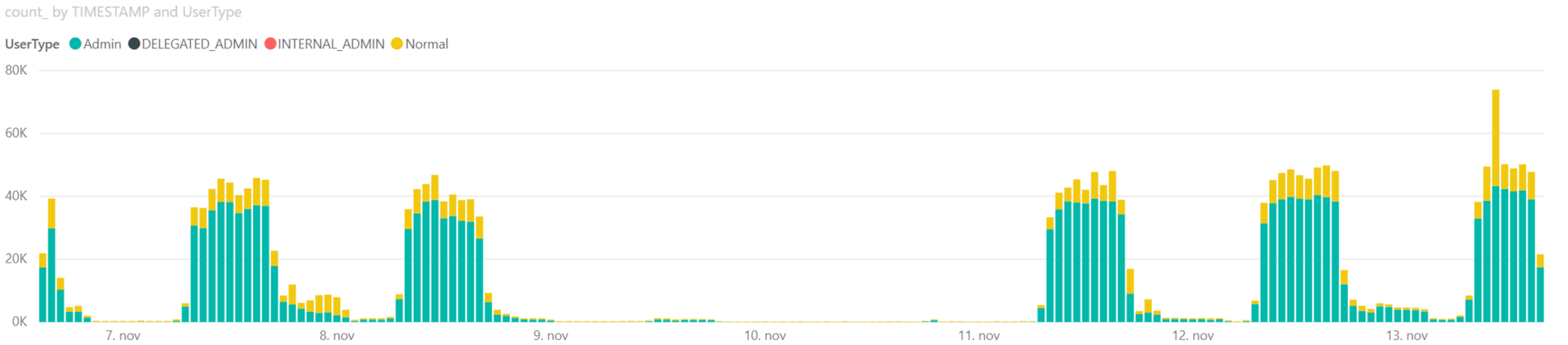
UserType	count_
Admin	1832104
DELEGATED_ADMIN	23
INTERNAL_ADMIN	212
Normal	453504
Total	**2285843**

alternateTenantIds	navTenantId	env_cloud_role	AppServiceId	platformVersion	count_	envName	envType
[redacted]	[redacted]	CustomerCluster	AS7018	14.0.37683.0	2285843		
Total					**2285843**		

TIMESTAMP

06-11-2019 13-11-2019





Filters

Performance Counters | OpenCompany | Sessions | Long Operations | Queries | Job Queue | ReportExecution | GetPageTiming | OnAfterGetCurrRecordTiming | NewRecord | GetNavigationFrame | FAQ | SOAPCalls | SQL stats

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Database Performance (example)

Report execution (example)

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Report execution time in milliseconds

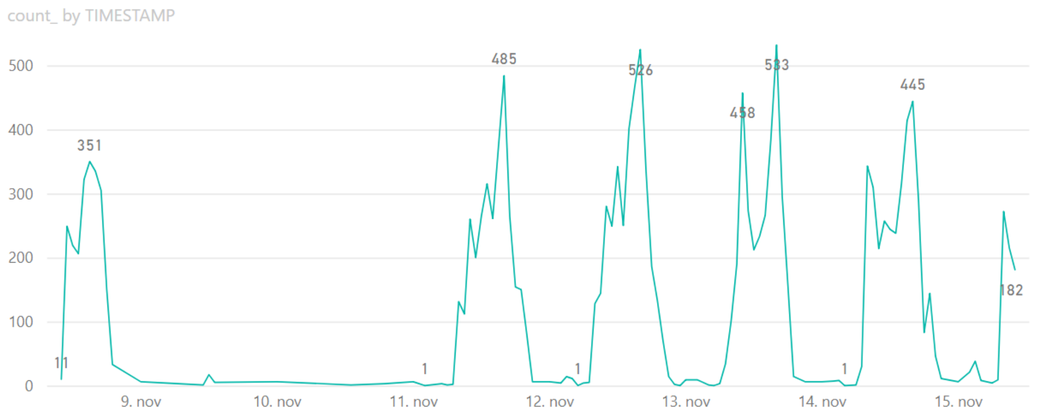
ReportId	ReportName	Count	Average	Sum	Tenants	MaxTime
53000		49	184.377,88	9035K	1	1010909
51042		2226	1.302,49	2899K	1	528505
51043		1882	601,00	1131K	1	5964
7304	Get Outbound Source Documents	581	1.941,06	1128K	1	30166
51027		2025	536,62	1087K	1	2778
51045		10	62.409,20	624K	1	84535
292	Copy Sales Document	115	4.442,17	511K	1	32440
5754	Create Pick	495	684,87	339K	1	6549
5753	Get Source Documents	1855	138,57	257K	1	2623
51100		1021	205,18	209K	1	2381
51030		2	82.356,50	165K	1	86669
699	Calculate Plan - Req. Wksh.	1	134.150,00	134K	1	134150
51025		1277	103,63	132K	1	1952
51026		1366	78,51	107K	1	1360
493	Carry Out Action Msg. - Req.	80	954,58	76K	1	8251
51020		5	14.535,00	73K	1	71439
120		1	59.024,00	59K	1	59024
393	Suggest Vendor Payments	4	12.425,00	50K	1	23940
7309	Whse. - Posted Shipment	3	15.137,67	45K	1	45343
1320	Notification Email	2394	15,93	38K	1	520
51028		273	87,69	24K	1	454
7318	Whse.-Shipment - Create Pick	125	121,41	15K	1	1087
51200		113	74,09	8K	1	455
1307	Standard Sales - Credit Memo	90	88,86	8K	1	900
51040		17	391,88	7K	1	727
2	General Journal - Test	10	598,30	6K	1	1076
51024		1	5.042,00	5K	1	5042
1316	Standard Statement	12	327,17	4K	1	963
51041		5	701,80	4K	1	1241
400	Remittance Advice - Entries	12	198,33	2K	1	1193
51044		88	24,83	2K	1	75
50130		4	289,25	1K	1	553
7317	Whse. - Shipment	73	14,84	1K	1	53
406	Purchase - Invoice	12	87,67	1K	1	314
408	Purchase - Receipt	5	202,20	1K	1	764
5703	Transfer Order	8	88,50	1K	1	413
Total		**16303**	**1.116,08**	**18195K**	**1**	**1010909**

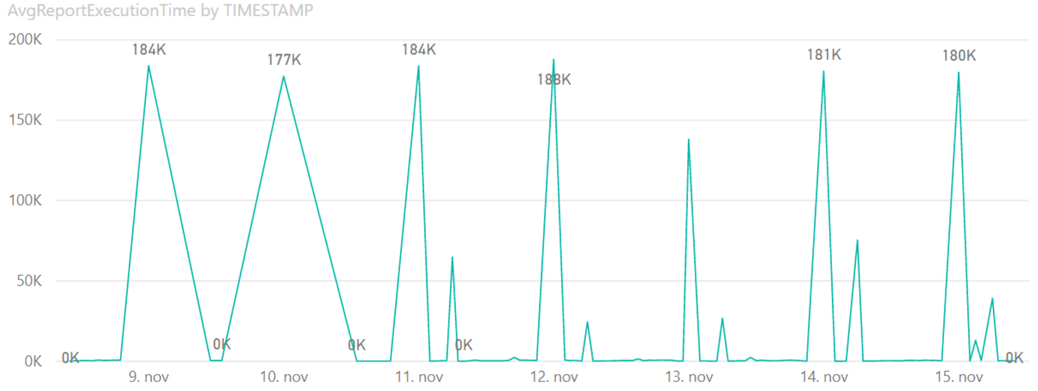
Report execution time in ms - per tenant

alternateTenantName	navTenantId	Count	Average	Sum	platformVersion	AppServiceId
[redacted]	[redacted]	16303	1.116,08	18195394	14.0.37683.0	[redacted]
Total		**16303**	**1.116,08**	**18195394**		

TIMESTAMP

08-11-2019 15-11-2019





Performance Counters | OpenCompany | Sessions | Long Operations | Queries | Job Queue | ReportExecution | GetPageTiming | OnAfterGetCurrRecordTiming | NewRecord | GetNavigationFrame | FAQ | SOAPCalls | SQL stats

OnAfterGetRecord (example)

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OnAfterGetCurrRecord

PageId	PageName	Sum	Count	Avg
370		402	1	402,00
21		561228	2663	210,75
26		115259	582	198,04
300		30339	214	141,77
5050		414	3	138,00
5703		3032	25	121,28
9850		6132	224	27,38
42		433698	16870	25,71
381		35	2	17,50
256		5690	337	16,88
30		46999	2863	16,42
41		146307	9386	15,59
51		16587	1107	14,98
50		79652	5680	14,02
52		683	52	13,13
6640		88	7	12,57
Total		**3521480**	**723974**	**4,86**

alternateTenantName	navTenantId	env_cloud_role	AppServiceId	platformVersion	Count	AvgExecutionTime
[redacted]		CustomerCluster	AS7018	14.0.37683.0	723974	4,86
Total					**723974**	**4,86**

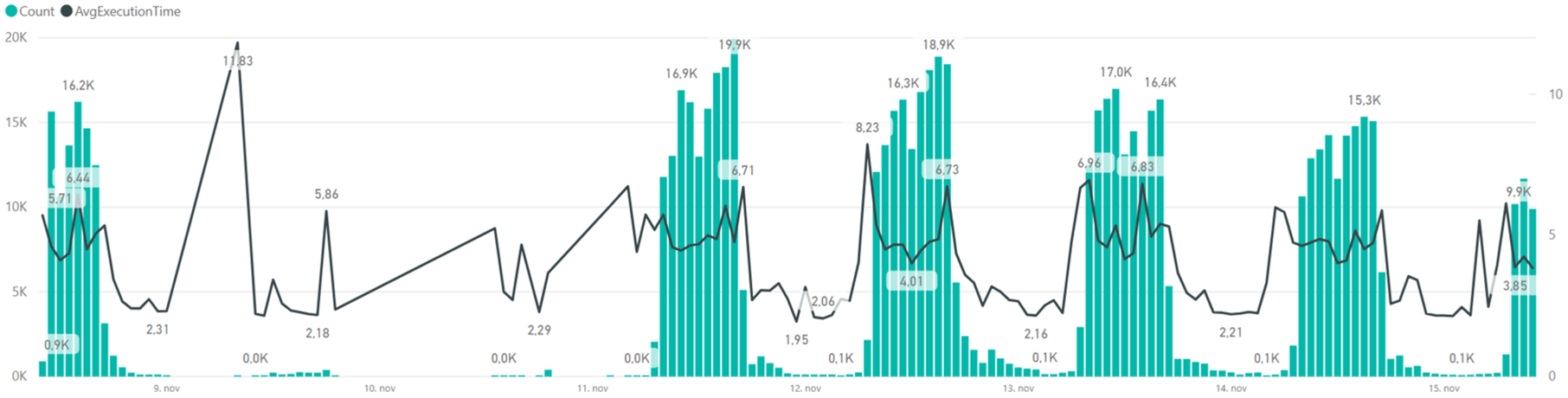
TIMESTAMP

05-11-2019 15-11-2019

#Telemetry entries

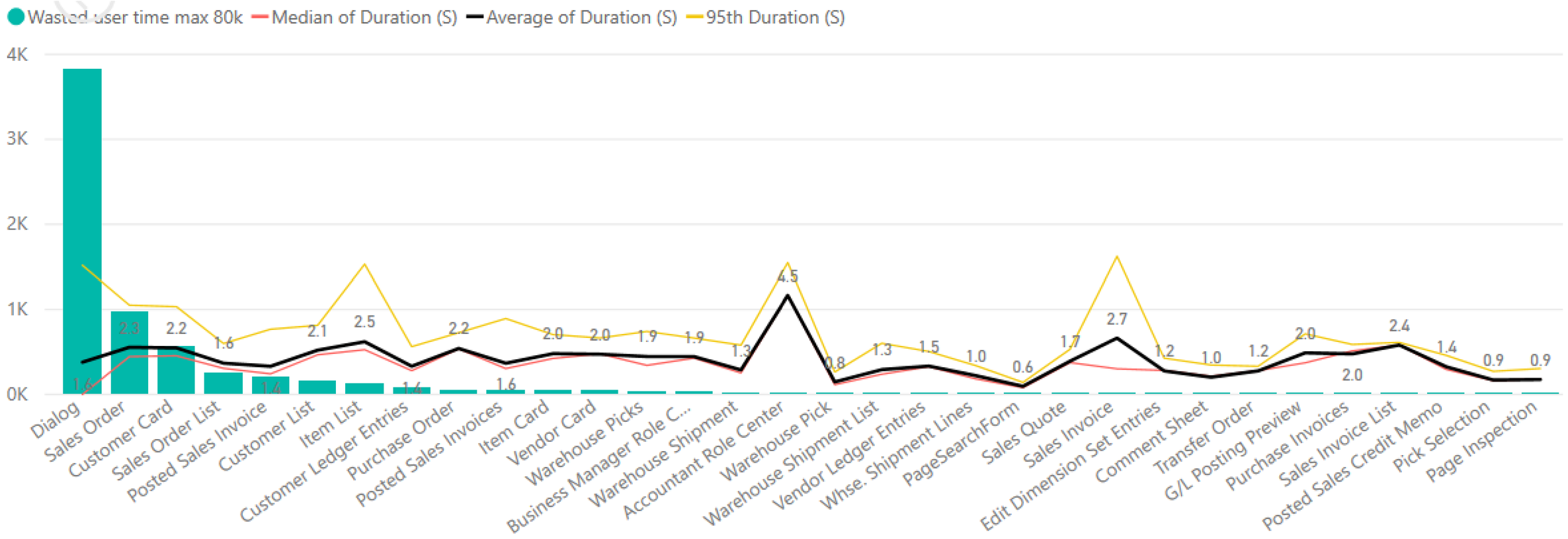
14.0.37683.0

Count and AvgExecutionTime by TIMESTAMP

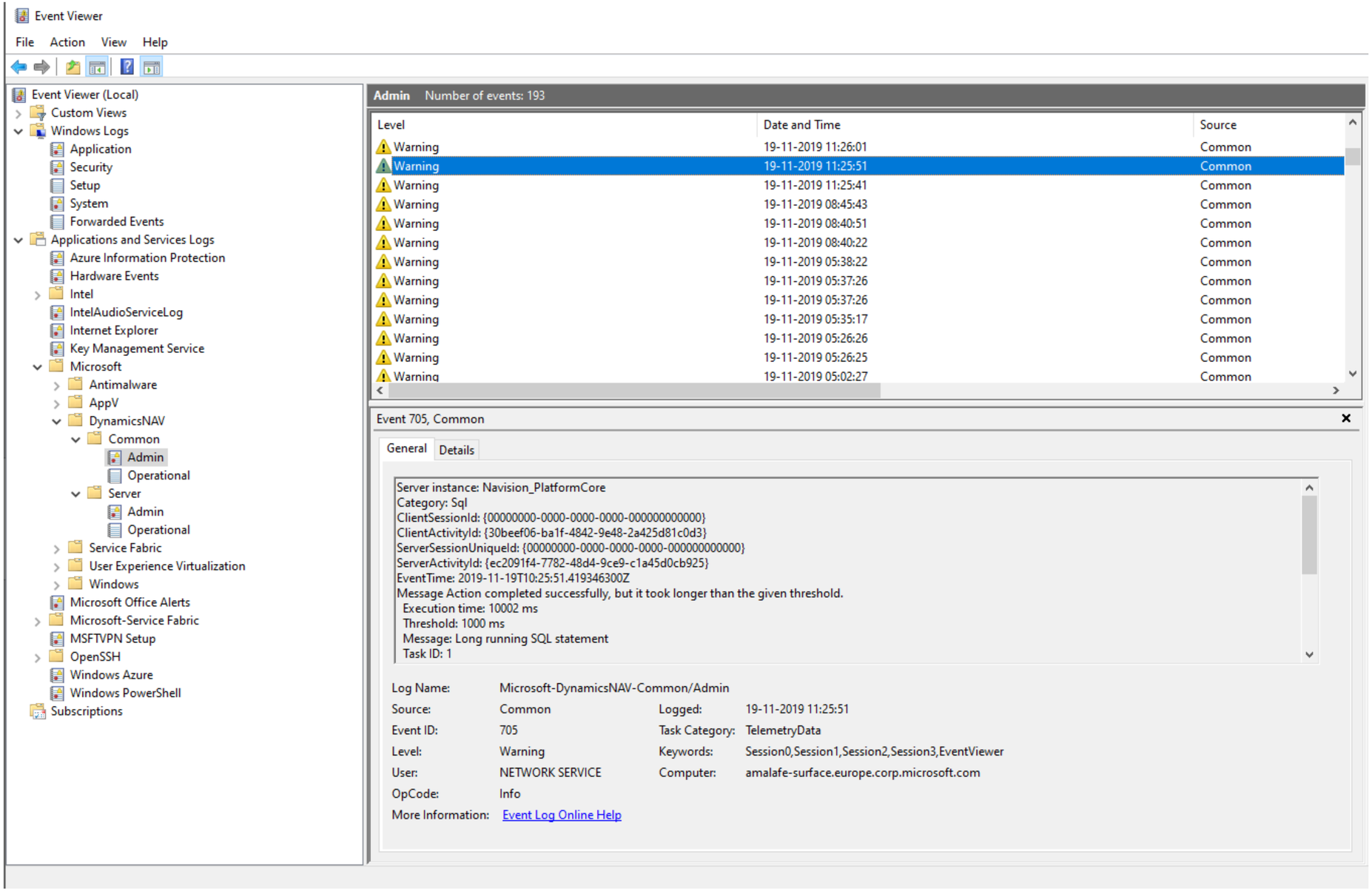


Performance Counters | OpenCompany | Sessions | Long Operations | Queries | Job Queue | ReportExecution | GetPageTiming | OnAfterGetCurrRecordTiming | NewRecord | GetNavigationFrame | FAQ | SOAPCalls | SQL stats

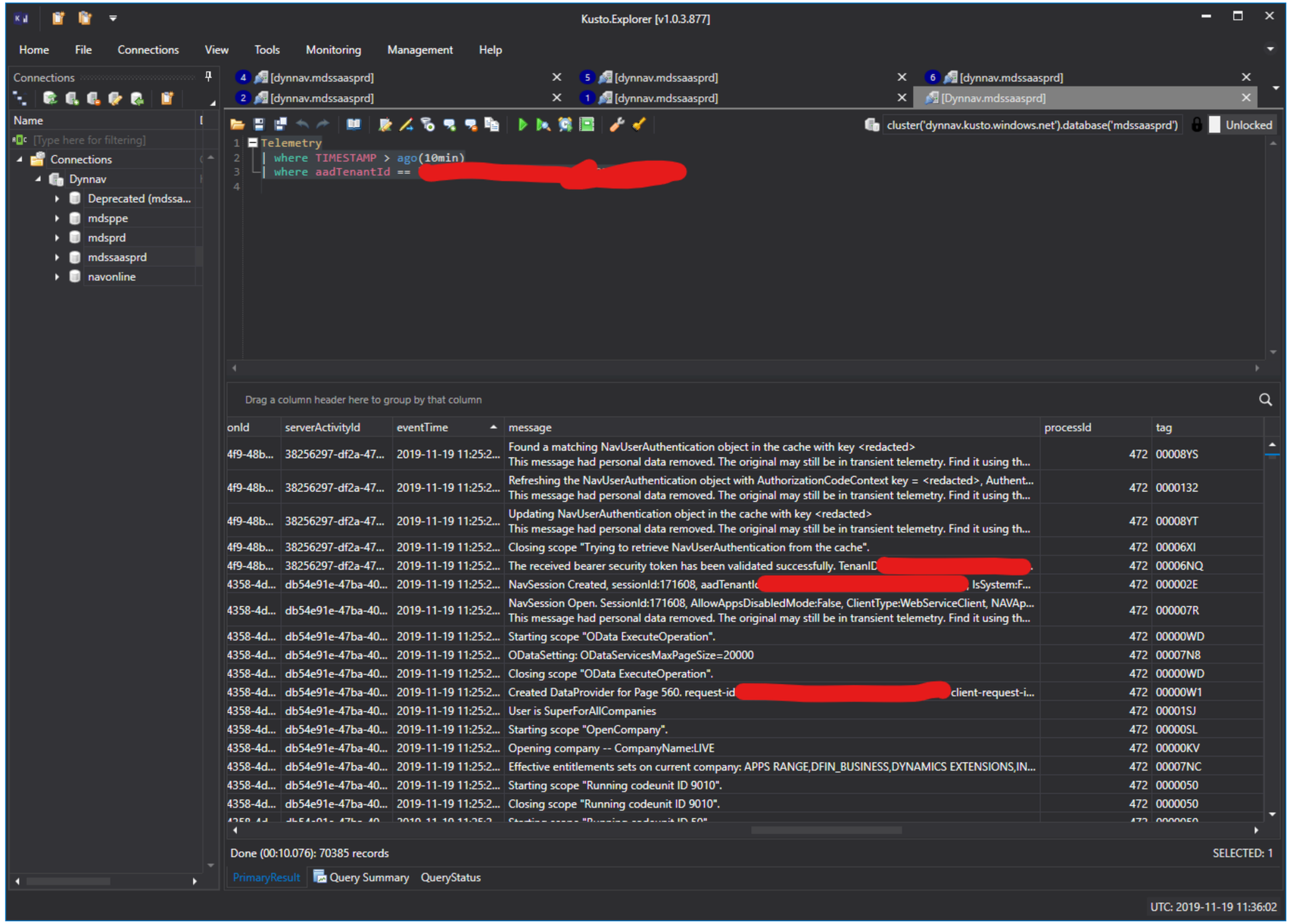
Application Performance (example)



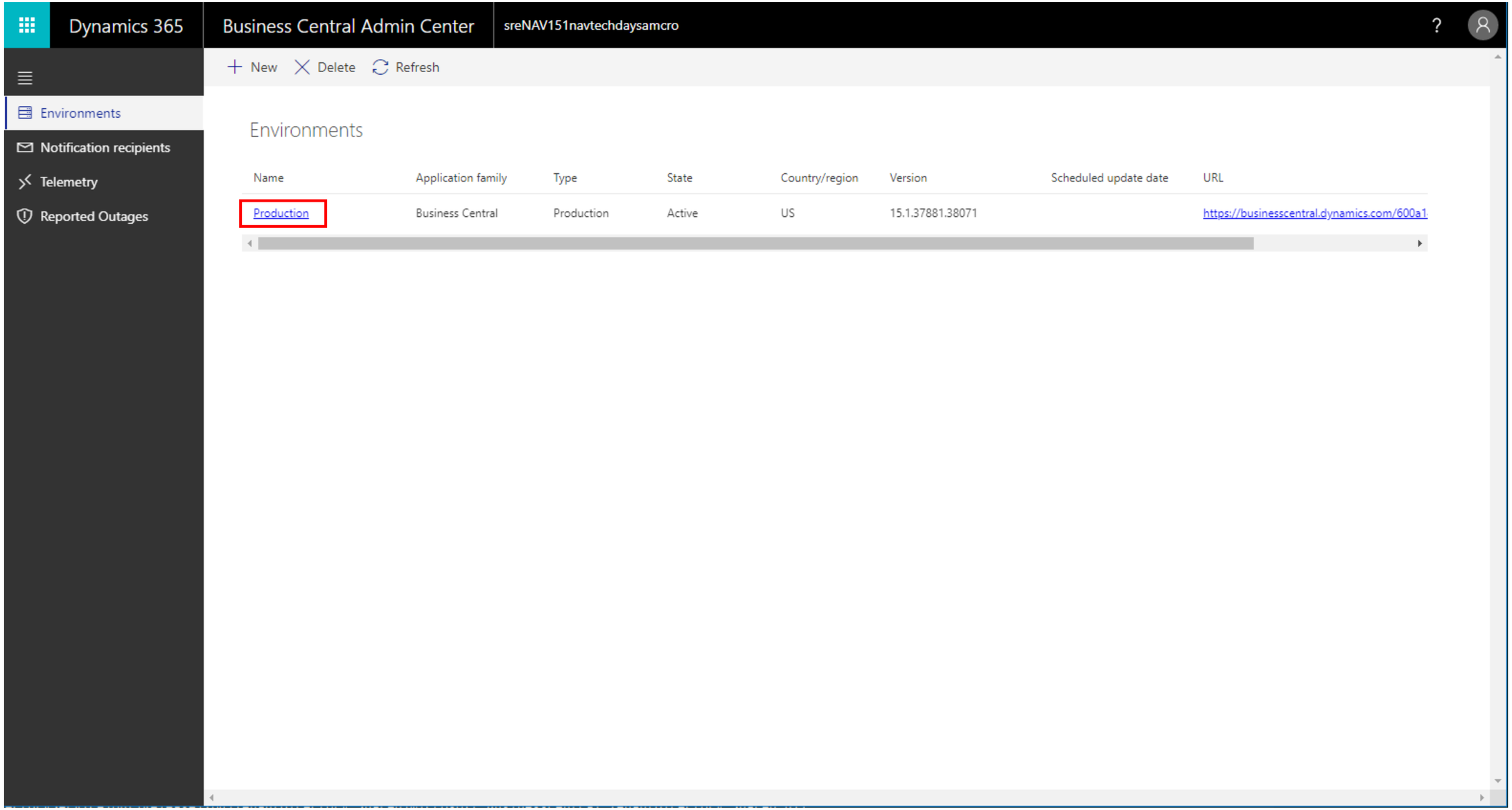
Internal telemetry



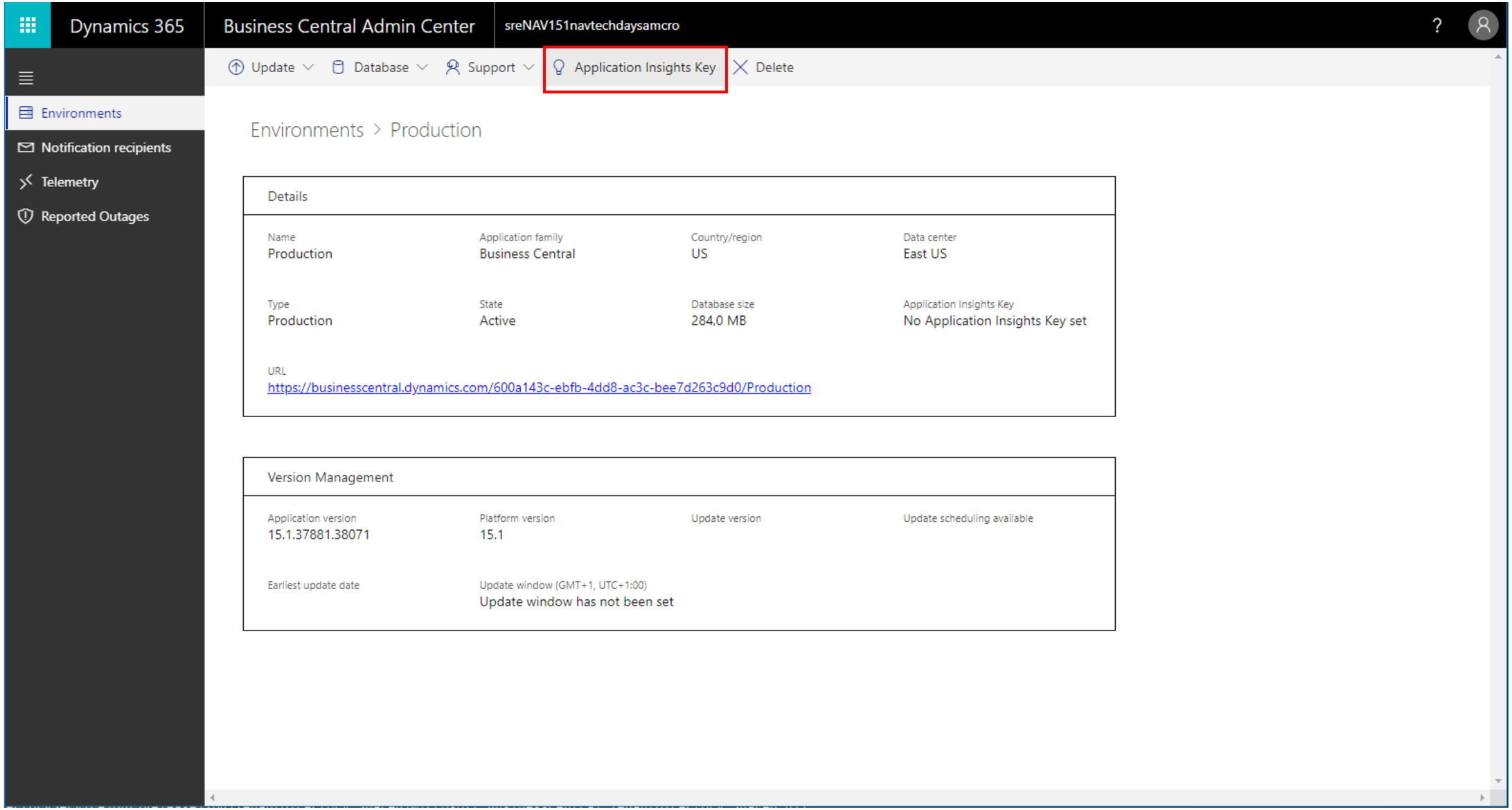
Internal telemetry



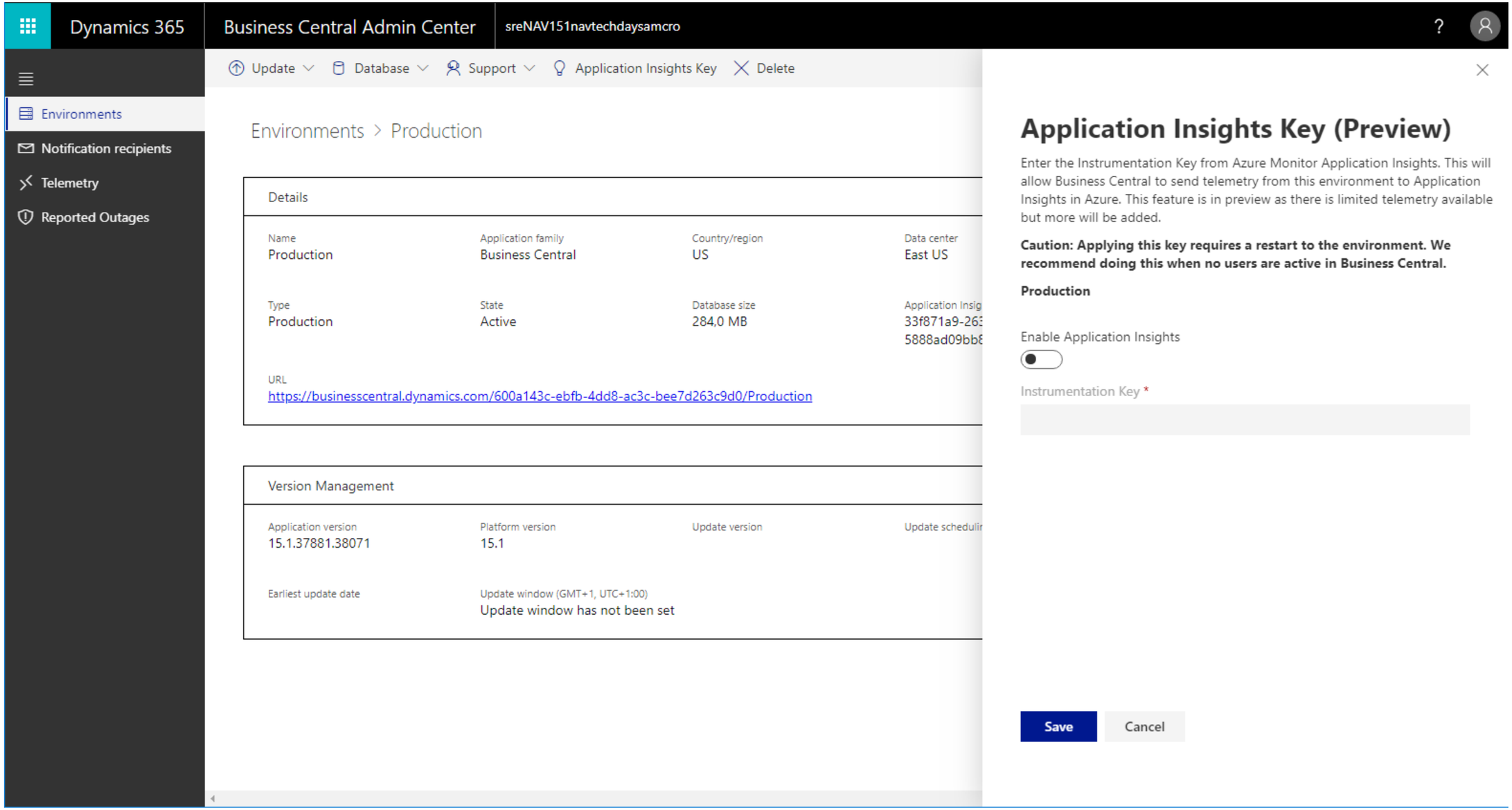
Partner telemetry



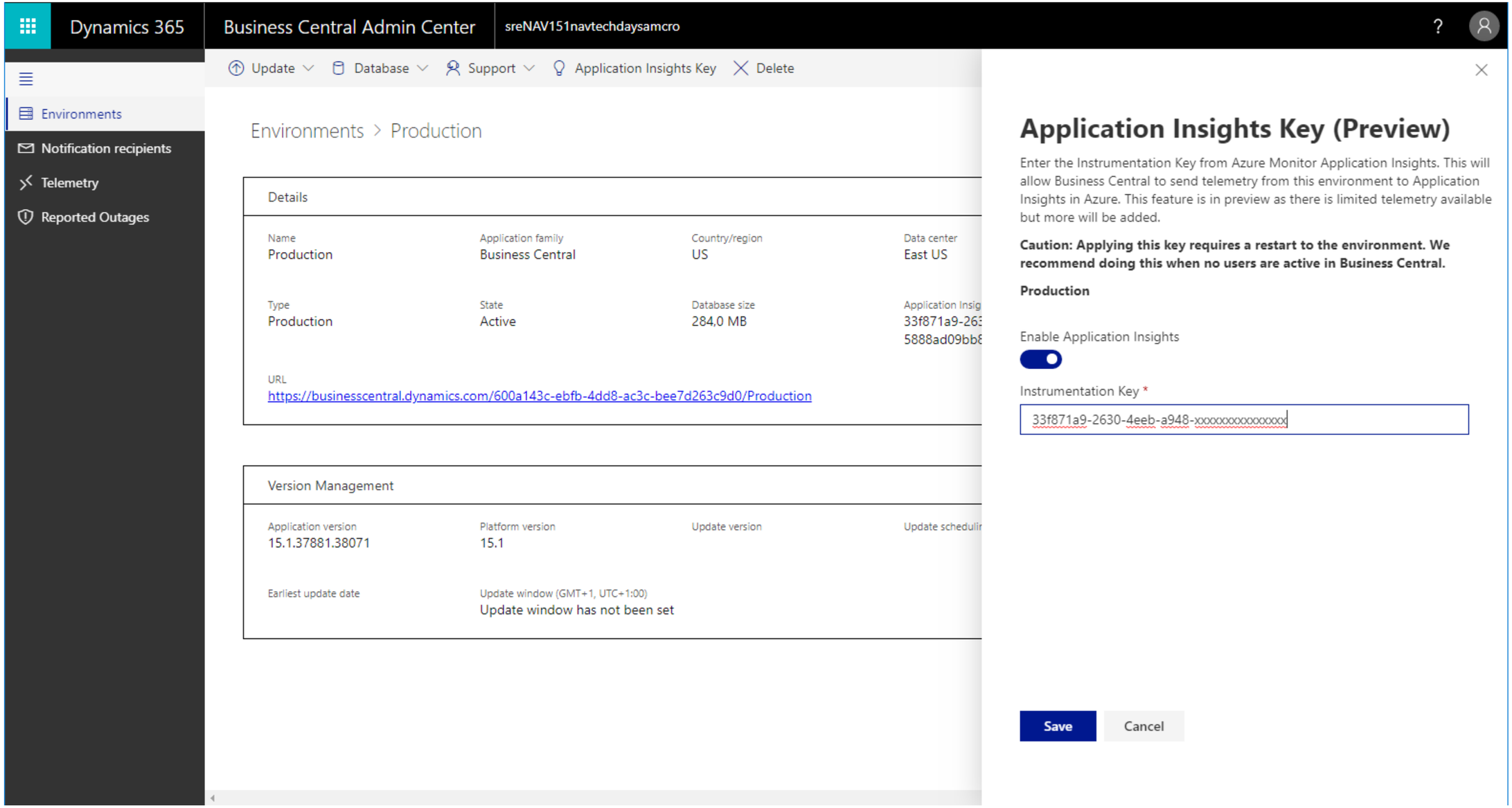
Partner telemetry



Partner telemetry



Partner telemetry



Instrumentation key

Microsoft Azure (Preview) | Report a bug | Search resources, services, and docs (G+/) | amalafe@microsoft.com MICROSOFT

Dashboard > NavTechDays2019

NavTechDays2019
Application Insights

Search (Ctrl+/)

- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

Investigate

- Application map
- Smart Detection
- Live Metrics Stream
- Search
- Availability
- Failures
- Performance
- Servers
- Browser
- Troubleshooting guides (pre...

Monitoring

- Alerts
- Metrics
- Logs (Analytics)
- Workbooks

Application Dashboard | Getting started | Search | Logs (Analytics) | Monitor resource group | Feedback | Favorites | Rename | Delete

Search and Logs (Analytics) will be removed from the top commands bar. They can be accessed from the left menu bar.

Resource group (change) : test
Location : West US 2
Subscription (change) : NAVOnlineDevAmalafe
Subscription ID : 505419c6-42c5-44bd-84d7-a61b32878ac5
Tags (change) : Click here to add tags

Instrumentation Key : 33f871a9-2630-4eeb-a948-5888ad09bb81
Connection String : InstrumentationKey=33f871a9-2630-4eeb-a948-5888ad09bb81

Show data for last: 30 minutes | 1 hour | 6 hours | 12 hours | 1 day | 3 days | 7 days | 30 days

Failed requests
100 80 60 40 20 0
8:45 AM 9 AM 9:15 AM 9:30 AM
Failed requests (Count)
navtechdays2019
0

Server response time
100ms 80ms 60ms 40ms 20ms 0ms
8:45 AM 9 AM 9:15 AM 9:30 AM
Server response time (Avg)
navtechdays2019
--

Server requests
100 80 60 40 20 0
8:45 AM 9 AM 9:15 AM 9:30 AM
Server requests (Count)
navtechdays2019
0

Availability
100% 80% 60%

Analyze telemetry

Microsoft Azure (Preview) | Report a bug | Search resources, services, and docs (G+/) | amalafe@microsoft.com MICROSOFT

Dashboard > NavTechDays2019 - Logs (Analytics)

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Usage

- Users
- Sessions

New Query 1* | Help | Settings | Sample queries | Query explorer

NavTechDays2019 | Select Scope | Run | Time range : Set in query | Save | Copy | Export | New alert rule | Pin to dashboard

Schema | Filter | Explore

Filter by name or type...

Collapse all

Active

- NavTechDays2019
  - APPLICATION INSIGHTS
    - traces
    - customEvents
    - pageViews
    - requests
    - dependencies
    - exceptions
    - availabilityResults
    - customMetrics
    - performanceCounters
    - browserTimings
  - Functions

Favorite applications

```
traces | where timestamp > ago(3d)
```

Completed | 00:00:00.998 | 1 records

Table | Chart | Columns | Display time (UTC+00:00)

Drag a column header and drop it here to group by that column

timestamp [UTC]	message	severityLevel	itemType	customDimensions

Component	Dynamics 365 Business Central Server
Component version	15.0.37898.0
Environment name	Production
Environment type	Production
Execution time (ms)	1573
Long running log threshold (ms)	1000
SQL statement	SELECT TOP (@0) ISNULL("Sales Header"."timestamp",@2) AS "timestamp",ISNULL("Sales Header"."Document Type",@3) AS "
Telemetry schema version	0.1
operation_Name	Long Running Operation (SQL Query)
operation_Id	619b6ae2-f856-4ad1-9ed2-bc0e9b993446

Page 1 of 1 | 50 items per page | 1 - 1 of 1 items

Platform telemetry

Now:

- Get live insights into performance issues due to Long Running SQL queries

Future:

- Errors
- Report execution times
- Page load times

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Telemetry vNext

- Let us know what would you like to see in telemetry?

- Add/vote here https://experience.dynamics.com/ideas/categories/list/?category=20a47b05-7928-e911-a95a-000d3a4f3883&forum=e288ef32-82ed-e611-8101-5065f38b21f1

Profiling

- Application logic
- Database access

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SQL Profiler is your friend

SQL Server Profiler - [Untitled - 5 (AMALAFE-SURFACE)]

File Edit View Replay Tools Window Help

EventClass	TextData	ApplicationName	NTUserName	LoginName	CPU	Reads	Writes	Duration	ClientProcessID	SPID	StartTime	EndTime	BinaryData
RPC:Completed	exec sp_execute 96,@0=1,@1=N'101005'	Microsoft Dy...	NETWORK...	NT AUT...	0	4	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 99,@0=1,@1=N'104008'...	Microsoft Dy...	NETWORK...	NT AUT...	0	3	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 100,@0=1,@1=N'104008'	Microsoft Dy...	NETWORK...	NT AUT...	0	3	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	declare @p1 int set @p1=102 exec s...	Microsoft Dy...	NETWORK...	NT AUT...	47	426	0	42	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 14,@timestamp=0X0000...	Microsoft Dy...	NETWORK...	NT AUT...	0	4	0	0	8508	68	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 96,@0=1,@1=N'6002'	Microsoft Dy...	NETWORK...	NT AUT...	0	4	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	declare @p1 int set @p1=16 exec sp...	Microsoft Dy...	NETWORK...	NT AUT...	0	52	0	1	8508	68	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	declare @p1 int set @p1=103 exec s...	Microsoft Dy...	NETWORK...	NT AUT...	16	835	0	7	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 54,@0=1,@1=0X2400000...	Microsoft Dy...	NETWORK...	NT AUT...	0	325	0	2	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 91,@0='00000000-0000...	Microsoft Dy...	NETWORK...	NT AUT...	0	0	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 38,@0=193	Microsoft Dy...	NETWORK...	NT AUT...	0	0	0	0	8508	56	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 38,@0='00000000-0000...	Microsoft Dy...	NETWORK...	NT AUT...	0	0	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 55,@0=0	Microsoft Dy...	NETWORK...	NT AUT...	0	1013	0	3	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 56,@0=N'101005',@1='...	Microsoft Dy...	NETWORK...	NT AUT...	15	32	0	2	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	declare @p1 int set @p1=104 exec s...	Microsoft Dy...	NETWORK...	NT AUT...	32	474	1	33	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 58,@0='3B19D46B-7DFC...	Microsoft Dy...	NETWORK...	NT AUT...	0	180	0	3	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 59,@0=N'30000',@1=1,...	Microsoft Dy...	NETWORK...	NT AUT...	15	1833	0	10	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 60,@0=N'30000'	Microsoft Dy...	NETWORK...	NT AUT...	0	27	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 61,@0=1,@1=N'30000'	Microsoft Dy...	NETWORK...	NT AUT...	0	31	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...

```
Header"."Last Posting No_",@4) AS "Last Posting No_",ISNULL("Sales Header"."Prepayment No_",@4) AS "Prepayment No_",ISNULL("Sales Header"."Last Prepayment No_",@4) AS "Last Prepayment No_",ISNULL("Sales Header"."Prepmt_ Cr_ Memo No_",@4) AS "Prepmt_
Cr_ Memo No_",ISNULL("Sales Header"."Last Prepmt_ Cr_ Memo No_",@4) AS "Last Prepmt_ Cr_ Memo No_",ISNULL("Sales Header"."VAT Registration No_",@5) AS "VAT Registration No_",ISNULL("Sales Header"."Combine Shipments",@8) AS "Combine
Shipments",ISNULL("Sales Header"."Reason Code",@4) AS "Reason Code",ISNULL("Sales Header"."Gen_ Bus_ Posting Group",@4) AS "Gen_ Bus_ Posting Group",ISNULL("Sales Header"."EU 3-Party Trade",@8) AS "EU 3-Party Trade",ISNULL("Sales Header"."Transaction
Type",@4) AS "Transaction Type",ISNULL("Sales Header"."Transport Method",@4) AS "Transport Method",ISNULL("Sales Header"."VAT Country_Region Code",@4) AS "VAT Country_Region Code",ISNULL("Sales Header"."Sell-to Customer Name",@5) AS "Sell-to Customer
Name",ISNULL("Sales Header"."Sell-to Customer Name 2",@5) AS "Sell-to Customer Name 2",ISNULL("Sales Header"."Sell-to Address",@5) AS "Sell-to Address",ISNULL("Sales Header"."Sell-to Address 2",@5) AS "Sell-to Address 2",ISNULL("Sales Header"."Sell-to
City",@5) AS "Sell-to City",ISNULL("Sales Header"."Sell-to Contact",@5) AS "Sell-to Contact",ISNULL("Sales Header"."Bill-to Post Code",@4) AS "Bill-to Post Code",ISNULL("Sales Header"."Bill-to County",@5) AS "Bill-to County",ISNULL("Sales
Header"."Bill-to Country_Region Code",@4) AS "Bill-to Country_Region Code",ISNULL("Sales Header"."Sell-to Post Code",@4) AS "Sell-to Post Code",ISNULL("Sales Header"."Sell-to County",@5) AS "Sell-to County",ISNULL("Sales Header"."Sell-to
Country_Region Code",@4) AS "Sell-to Country_Region Code",ISNULL("Sales Header"."Ship-to Post Code",@4) AS "Ship-to Post Code",ISNULL("Sales Header"."Ship-to County",@5) AS "Ship-to County",ISNULL("Sales Header"."Ship-to Country_Region Code",@4) AS
"Ship-to Country_Region Code",ISNULL("Sales Header"."Bal_ Account Type",@3) AS "Bal_ Account Type",ISNULL("Sales Header"."Exit Point",@4) AS "Exit Point",ISNULL("Sales Header"."Correction",@8) AS "Correction",ISNULL("Sales Header"."Document Date",@6)
AS "Document Date",ISNULL("Sales Header"."External Document No_",@4) AS "External Document No_",ISNULL("Sales Header"."Area",@4) AS "Area",ISNULL("Sales Header"."Transaction Specification",@4) AS "Transaction Specification",ISNULL("Sales
Header"."Payment Method Code",@4) AS "Payment Method Code",ISNULL("Sales Header"."Shipping Agent Code",@4) AS "Shipping Agent Code",ISNULL("Sales Header"."Package Tracking No_",@5) AS "Package Tracking No_",ISNULL("Sales Header"."No_ Series",@4) AS
"No_ Series",ISNULL("Sales Header"."Posting No_ Series",@4) AS "Posting No_ Series",ISNULL("Sales Header"."Shipping No_ Series",@4) AS "Shipping No_ Series",ISNULL("Sales Header"."Tax Area Code",@4) AS "Tax Area Code",ISNULL("Sales Header"."Tax
Liable",@8) AS "Tax Liable",ISNULL("Sales Header"."VAT Bus_ Posting Group",@4) AS "VAT Bus_ Posting Group",ISNULL("Sales Header"."Reserve",@3) AS "Reserve",ISNULL("Sales Header"."Applies-to ID",@4) AS "Applies-to ID",ISNULL("Sales Header"."VAT Base
Discount _",@7) AS "VAT Base Discount _",ISNULL("Sales Header"."Status",@3) AS "Status",ISNULL("Sales Header"."Invoice Discount Calculation",@3) AS "Invoice Discount Calculation",ISNULL("Sales Header"."Invoice Discount Value",@7) AS "Invoice Discount
Value",ISNULL("Sales Header"."Send IC Document",@8) AS "Send IC Document",ISNULL("Sales Header"."IC Status",@3) AS "IC Status",ISNULL("Sales Header"."Sell-to IC Partner Code",@4) AS "Sell-to IC Partner Code",ISNULL("Sales Header"."Bill-to IC Partner
Code",@4) AS "Bill-to IC Partner Code",ISNULL("Sales Header"."IC Direction",@3) AS "IC Direction",ISNULL("Sales Header"."Prepayment _",@7) AS "Prepayment _",ISNULL("Sales Header"."Prepayment No_ Series",@4) AS "Prepayment No_ Series",ISNULL("Sales
Header"."Compress Prepayment",@8) AS "Compress Prepayment",ISNULL("Sales Header"."Prepayment Due Date",@6) AS "Prepayment Due Date",ISNULL("Sales Header"."Prepmt_ Cr_ Memo No_ Series",@4) AS "Prepmt_ Cr_ Memo No_ Series",ISNULL("Sales Header"."Prepmt_
Posting Description",@5) AS "Prepmt_ Posting Description",ISNULL("Sales Header"."Prepmt_ Pmt_ Discount Date",@6) AS "Prepmt_ Pmt_ Discount Date",ISNULL("Sales Header"."Prepmt_ Payment Terms Code",@4) AS "Prepmt_ Payment Terms Code",ISNULL("Sales
Header"."Prepmt_ Payment Discount _",@7) AS "Prepmt_ Payment Discount _",ISNULL("Sales Header"."Quote No_",@4) AS "Quote No_",ISNULL("Sales Header"."Quote Valid Until Date",@6) AS "Quote Valid Until Date",ISNULL("Sales Header"."Quote Sent to
Customer",@10) AS "Quote Sent to Customer",ISNULL("Sales Header"."Quote Accepted",@8) AS "Quote Accepted",ISNULL("Sales Header"."Quote Accepted Date",@6) AS "Quote Accepted Date",ISNULL("Sales Header"."Job Queue Status",@3) AS "Job Queue
Status",ISNULL("Sales Header"."Job Queue Entry ID",@11) AS "Job Queue Entry ID",ISNULL("Sales Header"."Incoming Document Entry No_",@9) AS "Incoming Document Entry No_",ISNULL("Sales Header"."IsTest",@8) AS "IsTest",ISNULL("Sales Header"."Sell-to
Phone No_",@5) AS "Sell-to Phone No_",ISNULL("Sales Header"."Sell-to E-Mail",@5) AS "Sell-to E-Mail",ISNULL("Sales Header"."Payment Instructions Id",@9) AS "Payment Instructions Id",DATALENGTH("Sales Header"."Work Description") AS "Work
Description",ISNULL("Sales Header"."Dimension Set ID",@9) AS "Dimension Set ID",ISNULL("Sales Header"."Payment Service Set ID",@9) AS "Payment Service Set ID",ISNULL("Sales Header"."Direct Debit Mandate ID",@4) AS "Direct Debit Mandate
ID",ISNULL("Sales Header"."Doc_ No_ Occurrence",@9) AS "Doc_ No_ Occurrence",ISNULL("Sales Header"."Campaign No_",@4) AS "Campaign No_",ISNULL("Sales Header"."Sell-to Customer Template Code",@4) AS "Sell-to Customer Template Code",ISNULL("Sales
Header"."Sell-to Contact No_",@4) AS "Sell-to Contact No_",ISNULL("Sales Header"."Bill-to Contact No_",@4) AS "Bill-to Contact No_",ISNULL("Sales Header"."Bill-to Customer Template Code",@4) AS "Bill-to Customer Template Code",ISNULL("Sales
Header"."Opportunity No_",@4) AS "Opportunity No_",ISNULL("Sales Header"."Responsibility Center",@4) AS "Responsibility Center",ISNULL("Sales Header"."Shipping Advice",@3) AS "Shipping Advice",ISNULL("Sales Header"."Posting from Whse_ Ref_",@9) AS
"Posting from Whse_ Ref_",ISNULL("Sales Header"."Requested Delivery Date",@6) AS "Requested Delivery Date",ISNULL("Sales Header"."Promised Delivery Date",@6) AS "Promised Delivery Date",ISNULL("Sales Header"."Shipping Time",@12) AS "Shipping
Time",ISNULL("Sales Header"."Outbound Whse_ Handling Time",@12) AS "Outbound Whse_ Handling Time",ISNULL("Sales Header"."Shipping Agent Service Code",@4) AS "Shipping Agent Service Code",ISNULL("Sales Header"."Receive",@8) AS "Receive",ISNULL("Sales
Header"."Return Receipt No_",@4) AS "Return Receipt No_",ISNULL("Sales Header"."Return Receipt No_ Series",@4) AS "Return Receipt No_ Series",ISNULL("Sales Header"."Last Return Receipt No_",@4) AS "Last Return Receipt No_",ISNULL("Sales Header"."Allow
Line Disc_",@8) AS "Allow Line Disc_",ISNULL("Sales Header"."Get Shipment Used",@8) AS "Get Shipment Used",ISNULL("Sales Header"."Id",@11) AS "Id",ISNULL("Sales Header"."Assigned User ID",@4) AS "Assigned User ID",ISNULL("Sales Header_e1"."MyText",@5)
AS "MyText",ISNULL("Sales Header"."$systemId",@11) AS "$systemId",ISNULL("SUB$Completely Shipped","Completely Shipped$Sales Line$MIN$Completely Shipped",@8) AS "Completely Shipped",ISNULL("SUB$Amt_ Ship_ Not Inv_ (LCY) Base"."Amt_ Ship_ Not Inv_ (LCY)
Base$Sales Line$SUM$Shipped Not Inv_ (LCY) No VAT",@7) AS "Amt_ Ship_ Not Inv_ (LCY) Base",ISNULL("SUB$Amt_ Ship_ Not Inv_ (LCY)"."Amt_ Ship_ Not Inv_ (LCY)$Sales Line$SUM$Shipped Not Invoiced (LCY)",@7) AS "Amt_ Ship_ Not Inv_
(LCY)",ISNULL("SUB$Amount"."Amount$Sales Line$SUM$Amount",@7) AS "Amount",ISNULL("SUB$Amount Including VAT"."Amount Including VAT$Sales Line$SUM$Amount Including VAT",@7) AS "Amount Including VAT" FROM "Navision_PlatformCore".dbo."CRONUS International
Ltd_$Sales Header$437dbf0e-84ff-417a-965d-ed2bb9650972" AS "Sales Header" WITH(READUNCOMMITTED)  JOIN "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Header$55a38a66-dce4-4aaa-abf1-d2abcc4e8dc0" "Sales Header_e1"  ON ("Sales
Header"."Document Type" = "Sales Header_e1"."Document Type") AND ("Sales Header"."No_" = "Sales Header_e1"."No_") OUTER APPLY (SELECT TOP (@13) ISNULL(MIN("Completely Shipped$Sales Line"."Completely Shipped"),@8) AS "Completely Shipped$Sales
Line$MIN$Completely Shipped" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Line$437dbf0e-84ff-417a-965d-ed2bb9650972" AS "Completely Shipped$Sales Line" WITH(READUNCOMMITTED)  WHERE ("Completely Shipped$Sales Line"."Document
Type"="Sales Header"."Document Type" AND "Completely Shipped$Sales Line"."Document No_"="Sales Header"."No_" AND ISNULL("Completely Shipped$Sales Line"."Type",@3)<>@14)) AS "SUB$Completely Shipped"  OUTER APPLY (SELECT TOP (@15) ISNULL(SUM("Amt_ Ship_
Not Inv_ (LCY) Base$Sales Line"."Shipped Not Inv_ (LCY) No VAT"),@7) AS "Amt_ Ship_ Not Inv_ (LCY) Base$Sales Line$SUM$Shipped Not Inv_ (LCY) No VAT" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales
Line$437dbf0e-84ff-417a-965d-ed2bb9650972" AS "Amt_ Ship_ Not Inv_ (LCY) Base$Sales Line" WITH(READUNCOMMITTED)  WHERE ("Amt_ Ship_ Not Inv_ (LCY) Base$Sales Line"."Document Type"="Sales Header"."Document Type" AND "Amt_ Ship_ Not Inv_ (LCY)
Base$Sales Line"."Document No_"="Sales Header"."No_")) AS "SUB$Amt_ Ship_ Not Inv_ (LCY) Base"  OUTER APPLY (SELECT TOP (@16) ISNULL(SUM("Amt_ Ship_ Not Inv_ (LCY)$Sales Line"."SUM$Shipped Not Invoiced (LCY)"),@7) AS "Amt_ Ship_ Not Inv_ (LCY)$Sales
Line$SUM$Shipped Not Invoiced (LCY)" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Line$437dbf0e-84ff-417a-965d-ed2bb9650972$VSIFT$Key8" AS "Amt_ Ship_ Not Inv_ (LCY)$Sales Line" WITH(READUNCOMMITTED,NOEXPAND)  WHERE ("Amt_ Ship_
Not Inv_ (LCY)$Sales Line"."Document Type"="Sales Header"."Document Type" AND "Amt_ Ship_ Not Inv_ (LCY)$Sales Line"."Document No_"="Sales Header"."No_")) AS "SUB$Amt_ Ship_ Not Inv_ (LCY)"  OUTER APPLY (SELECT TOP (@17) ISNULL(SUM("Amount$Sales
Line"."SUM$Amount"),@7) AS "Amount$Sales Line$SUM$Amount" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Line$437dbf0e-84ff-417a-965d-ed2bb9650972$VSIFT$Key8" AS "Amount$Sales Line" WITH(READUNCOMMITTED,NOEXPAND)  WHERE
("Amount$Sales Line"."Document Type"="Sales Header"."Document Type" AND "Amount$Sales Line"."Document No_"="Sales Header"."No_")) AS "SUB$Amount"  OUTER APPLY (SELECT TOP (@18) ISNULL(SUM("Amount Including VAT$Sales Line"."SUM$Amount Including
VAT"),@7) AS "Amount Including VAT$Sales Line$SUM$Amount Including VAT" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Line$437dbf0e-84ff-417a-965d-ed2bb9650972$VSIFT$Key8" AS "Amount Including VAT$Sales Line"
WITH(READUNCOMMITTED,NOEXPAND)  WHERE ("Amount Including VAT$Sales Line"."Document Type"="Sales Header"."Document Type" AND "Amount Including VAT$Sales Line"."Document No_"="Sales Header"."No_")) AS "SUB$Amount Including VAT"  WHERE ("Sales
Header"."Document Type"=@1) AND (ISNULL("Sales Header"."Document Type",@3)=@19 AND ISNULL("Sales Header"."No_",@4)>@20 OR ISNULL("Sales Header"."Document Type",@3)>@19) ORDER BY "Document Type" ASC,"No_" ASC OPTION(OPTIMIZE FOR UNKNOWN, FAST
50)',@0=50,@1=1,@2=0X0000000000000000,@3=0,@4=N'',@5=N'',@6='1753-01-01 00:00:00',@7=0,@8=0,@9=0,@10='1753-01-01 00:00:00',@11='00000000-0000-0000-0000-000000000000',@12='',@13=1,@14=0,@15=1,@16=1,@17=1,@18=1,@19=1,@20=N'104008'
select @p1
```

Trace is stopped. | Ln 1382, Col 2 | Rows: 1460

Connections: 1

NAV TECH DAYS 2019

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NAV TECH DAYS 2019

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SQL Server Profiler - [Untitled - 5 (AMALAFE-SURFACE)]

File Edit View Replay Tools Window Help

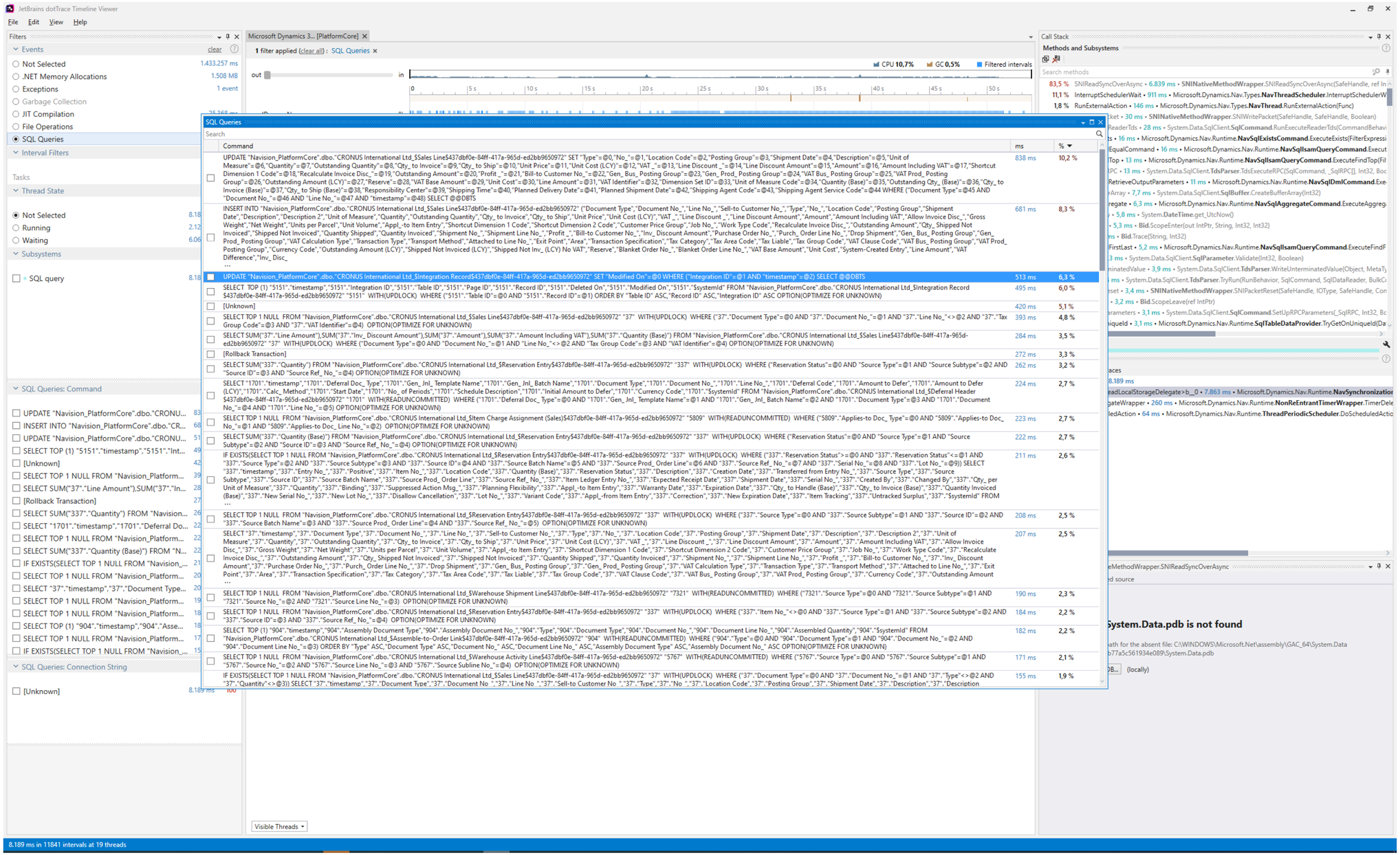
EventClass	TextData	ApplicationName	NTUserName	LoginName	CPU	Reads	Writes	Duration	ClientProcessID	SPID	StartTime	EndTime	BinaryData
RPC:Completed	exec sp_execute 96,@0=1,@1=N'101005'	Microsoft Dy...	NETWORK...	NT AUT...	0	4	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 99,@0=1,@1=N'104008'...	Microsoft Dy...	NETWORK...	NT AUT...	0	3	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 100,@0=1,@1=N'104008'	Microsoft Dy...	NETWORK...	NT AUT...	0	3	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	declare @p1 int set @p1=102 exec s...	Microsoft Dy...	NETWORK...	NT AUT...	47	426	0	42	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 14,@timestamp=0X0000...	Microsoft Dy...	NETWORK...	NT AUT...	0	4	0	0	8508	68	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 96,@0=1,@1=N'6002'	Microsoft Dy...	NETWORK...	NT AUT...	0	4	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	declare @p1 int set @p1=16 exec sp...	Microsoft Dy...	NETWORK...	NT AUT...	0	52	0	1	8508	68	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	declare @p1 int set @p1=103 exec s...	Microsoft Dy...	NETWORK...	NT AUT...	16	835	0	7	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 54,@0=1,@1=0X2400000...	Microsoft Dy...	NETWORK...	NT AUT...	0	325	0	2	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 91,@0='00000000-0000...	Microsoft Dy...	NETWORK...	NT AUT...	0	0	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 38,@0=193	Microsoft Dy...	NETWORK...	NT AUT...	0	0	0	0	8508	56	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 38,@0='00000000-0000...	Microsoft Dy...	NETWORK...	NT AUT...	0	0	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 55,@0=0	Microsoft Dy...	NETWORK...	NT AUT...	0	1013	0	3	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 56,@0=N'101005',@1='...	Microsoft Dy...	NETWORK...	NT AUT...	15	32	0	2	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	declare @p1 int set @p1=104 exec s...	Microsoft Dy...	NETWORK...	NT AUT...	32	474	1	33	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 58,@0='3B19D46B-7DFC...	Microsoft Dy...	NETWORK...	NT AUT...	0	180	0	3	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 59,@0=N'30000',@1=1,...	Microsoft Dy...	NETWORK...	NT AUT...	15	1833	0	10	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 60,@0=N'30000'	Microsoft Dy...	NETWORK...	NT AUT...	0	27	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...
RPC:Completed	exec sp_execute 61,@0=1,@1=N'30000'	Microsoft Dy...	NETWORK...	NT AUT...	0	31	0	0	8508	52	2019-11-19 12:29:01...	2019-11-19 12:29:01...	0X00000...

```
Header"."Last Posting No_",@4) AS "Last Posting No_",ISNULL("Sales Header"."Prepayment No_",@4) AS "Prepayment No_",ISNULL("Sales Header"."Last Prepayment No_",@4) AS "Last Prepayment No_",ISNULL("Sales Header"."Prepmt_ Cr_ Memo No_",@4) AS "Prepmt_
Cr_ Memo No_",ISNULL("Sales Header"."Last Prepmt_ Cr_ Memo No_",@4) AS "Last Prepmt_ Cr_ Memo No_",ISNULL("Sales Header"."VAT Registration No_",@5) AS "VAT Registration No_",ISNULL("Sales Header"."Combine Shipments",@8) AS "Combine
Shipments",ISNULL("Sales Header"."Reason Code",@4) AS "Reason Code",ISNULL("Sales Header"."Gen_ Bus_ Posting Group",@4) AS "Gen_ Bus_ Posting Group",ISNULL("Sales Header"."EU 3-Party Trade",@8) AS "EU 3-Party Trade",ISNULL("Sales Header"."Transaction
Type",@4) AS "Transaction Type",ISNULL("Sales Header"."Transport Method",@4) AS "Transport Method",ISNULL("Sales Header"."VAT Country_Region Code",@4) AS "VAT Country_Region Code",ISNULL("Sales Header"."Sell-to Customer Name",@5) AS "Sell-to Customer
Name",ISNULL("Sales Header"."Sell-to Customer Name 2",@5) AS "Sell-to Customer Name 2",ISNULL("Sales Header"."Sell-to Address",@5) AS "Sell-to Address",ISNULL("Sales Header"."Sell-to Address 2",@5) AS "Sell-to Address 2",ISNULL("Sales Header"."Sell-to
City",@5) AS "Sell-to City",ISNULL("Sales Header"."Sell-to Contact",@5) AS "Sell-to Contact",ISNULL("Sales Header"."Bill-to Post Code",@4) AS "Bill-to Post Code",ISNULL("Sales Header"."Bill-to County",@5) AS "Bill-to County",ISNULL("Sales
Header"."Bill-to Country_Region Code",@4) AS "Bill-to Country_Region Code",ISNULL("Sales Header"."Sell-to Post Code",@4) AS "Sell-to Post Code",ISNULL("Sales Header"."Sell-to County",@5) AS "Sell-to County",ISNULL("Sales Header"."Sell-to
Country_Region Code",@4) AS "Sell-to Country_Region Code",ISNULL("Sales Header"."Ship-to Post Code",@4) AS "Ship-to Post Code",ISNULL("Sales Header"."Ship-to County",@5) AS "Ship-to County",ISNULL("Sales Header"."Ship-to Country_Region Code",@4) AS
"Ship-to Country_Region Code",ISNULL("Sales Header"."Bal_ Account Type",@3) AS "Bal_ Account Type",ISNULL("Sales Header"."Exit Point",@4) AS "Exit Point",ISNULL("Sales Header"."Correction",@8) AS "Correction",ISNULL("Sales Header"."Document Date",@6)
AS "Document Date",ISNULL("Sales Header"."External Document No_",@4) AS "External Document No_",ISNULL("Sales Header"."Area",@4) AS "Area",ISNULL("Sales Header"."Transaction Specification",@4) AS "Transaction Specification",ISNULL("Sales
Header"."Payment Method Code",@4) AS "Payment Method Code",ISNULL("Sales Header"."Shipping Agent Code",@4) AS "Shipping Agent Code",ISNULL("Sales Header"."Package Tracking No_",@5) AS "Package Tracking No_",ISNULL("Sales Header"."No_ Series",@4) AS
"No_ Series",ISNULL("Sales Header"."Posting No_ Series",@4) AS "Posting No_ Series",ISNULL("Sales Header"."Shipping No_ Series",@4) AS "Shipping No_ Series",ISNULL("Sales Header"."Tax Area Code",@4) AS "Tax Area Code",ISNULL("Sales Header"."Tax
Liable",@8) AS "Tax Liable",ISNULL("Sales Header"."VAT Bus_ Posting Group",@4) AS "VAT Bus_ Posting Group",ISNULL("Sales Header"."Reserve",@3) AS "Reserve",ISNULL("Sales Header"."Applies-to ID",@4) AS "Applies-to ID",ISNULL("Sales Header"."VAT Base
Discount _",@7) AS "VAT Base Discount _",ISNULL("Sales Header"."Status",@3) AS "Status",ISNULL("Sales Header"."Invoice Discount Calculation",@3) AS "Invoice Discount Calculation",ISNULL("Sales Header"."Invoice Discount Value",@7) AS "Invoice Discount
Value",ISNULL("Sales Header"."Send IC Document",@8) AS "Send IC Document",ISNULL("Sales Header"."IC Status",@3) AS "IC Status",ISNULL("Sales Header"."Sell-to IC Partner Code",@4) AS "Sell-to IC Partner Code",ISNULL("Sales Header"."Bill-to IC Partner
Code",@4) AS "Bill-to IC Partner Code",ISNULL("Sales Header"."IC Direction",@3) AS "IC Direction",ISNULL("Sales Header"."Prepayment _",@7) AS "Prepayment _",ISNULL("Sales Header"."Prepayment No_ Series",@4) AS "Prepayment No_ Series",ISNULL("Sales
Header"."Compress Prepayment",@8) AS "Compress Prepayment",ISNULL("Sales Header"."Prepayment Due Date",@6) AS "Prepayment Due Date",ISNULL("Sales Header"."Prepmt_ Cr_ Memo No_ Series",@4) AS "Prepmt_ Cr_ Memo No_ Series",ISNULL("Sales Header"."Prepmt_
Posting Description",@5) AS "Prepmt_ Posting Description",ISNULL("Sales Header"."Prepmt_ Pmt_ Discount Date",@6) AS "Prepmt_ Pmt_ Discount Date",ISNULL("Sales Header"."Prepmt_ Payment Terms Code",@4) AS "Prepmt_ Payment Terms Code",ISNULL("Sales
Header"."Prepmt_ Payment Discount _",@7) AS "Prepmt_ Payment Discount _",ISNULL("Sales Header"."Quote No_",@4) AS "Quote No_",ISNULL("Sales Header"."Quote Valid Until Date",@6) AS "Quote Valid Until Date",ISNULL("Sales Header"."Quote Sent to
Customer",@10) AS "Quote Sent to Customer",ISNULL("Sales Header"."Quote Accepted",@8) AS "Quote Accepted",ISNULL("Sales Header"."Quote Accepted Date",@6) AS "Quote Accepted Date",ISNULL("Sales Header"."Job Queue Status",@3) AS "Job Queue
Status",ISNULL("Sales Header"."Job Queue Entry ID",@11) AS "Job Queue Entry ID",ISNULL("Sales Header"."Incoming Document Entry No_",@9) AS "Incoming Document Entry No_",ISNULL("Sales Header"."IsTest",@8) AS "IsTest",ISNULL("Sales Header"."Sell-to
Phone No_",@5) AS "Sell-to Phone No_",ISNULL("Sales Header"."Sell-to E-Mail",@5) AS "Sell-to E-Mail",ISNULL("Sales Header"."Payment Instructions Id",@9) AS "Payment Instructions Id",DATALENGTH("Sales Header"."Work Description") AS "Work
Description",ISNULL("Sales Header"."Dimension Set ID",@9) AS "Dimension Set ID",ISNULL("Sales Header"."Payment Service Set ID",@9) AS "Payment Service Set ID",ISNULL("Sales Header"."Direct Debit Mandate ID",@4) AS "Direct Debit Mandate
ID",ISNULL("Sales Header"."Doc_ No_ Occurrence",@9) AS "Doc_ No_ Occurrence",ISNULL("Sales Header"."Campaign No_",@4) AS "Campaign No_",ISNULL("Sales Header"."Sell-to Customer Template Code",@4) AS "Sell-to Customer Template Code",ISNULL("Sales
Header"."Sell-to Contact No_",@4) AS "Sell-to Contact No_",ISNULL("Sales Header"."Bill-to Contact No_",@4) AS "Bill-to Contact No_",ISNULL("Sales Header"."Bill-to Customer Template Code",@4) AS "Bill-to Customer Template Code",ISNULL("Sales
Header"."Opportunity No_",@4) AS "Opportunity No_",ISNULL("Sales Header"."Responsibility Center",@4) AS "Responsibility Center",ISNULL("Sales Header"."Shipping Advice",@3) AS "Shipping Advice",ISNULL("Sales Header"."Posting from Whse_ Ref_",@9) AS
"Posting from Whse_ Ref_",ISNULL("Sales Header"."Requested Delivery Date",@6) AS "Requested Delivery Date",ISNULL("Sales Header"."Promised Delivery Date",@6) AS "Promised Delivery Date",ISNULL("Sales Header"."Shipping Time",@12) AS "Shipping
Time",ISNULL("Sales Header"."Outbound Whse_ Handling Time",@12) AS "Outbound Whse_ Handling Time",ISNULL("Sales Header"."Shipping Agent Service Code",@4) AS "Shipping Agent Service Code",ISNULL("Sales Header"."Receive",@8) AS "Receive",ISNULL("Sales
Header"."Return Receipt No_",@4) AS "Return Receipt No_",ISNULL("Sales Header"."Return Receipt No_ Series",@4) AS "Return Receipt No_ Series",ISNULL("Sales Header"."Last Return Receipt No_",@4) AS "Last Return Receipt No_",ISNULL("Sales Header"."Allow
Line Disc_",@8) AS "Allow Line Disc_",ISNULL("Sales Header"."Get Shipment Used",@8) AS "Get Shipment Used",ISNULL("Sales Header"."Id",@11) AS "Id",ISNULL("Sales Header"."Assigned User ID",@4) AS "Assigned User ID",ISNULL("Sales Header_e1"."MyText",@5)
AS "MyText",ISNULL("Sales Header"."$systemId",@11) AS "$systemId",ISNULL("SUB$Completely Shipped".."Completely Shipped$Sales Line$MIN$Completely Shipped",@8) AS "Completely Shipped",ISNULL("SUB$Amt_ Ship_ Not Inv_ (LCY) Base"."Amt_ Ship_ Not Inv_ (LCY)
Base$Sales Line$SUM$Shipped Not Inv_ (LCY) No VAT",@7) AS "Amt_ Ship_ Not Inv_ (LCY) Base",ISNULL("SUB$Amt_ Ship_ Not Inv_ (LCY)"."Amt_ Ship_ Not Inv_ (LCY)$Sales Line$SUM$Shipped Not Invoiced (LCY)",@7) AS "Amt_ Ship_ Not Inv_
(LCY)",ISNULL("SUB$Amount"."Amount$Sales Line$SUM$Amount",@7) AS "Amount",ISNULL("SUB$Amount Including VAT$Sales Line$SUM$Amount Including VAT",@7) AS "Amount Including VAT" FROM "Navision_PlatformCore".dbo."CRONUS International
Ltd_$Sales Header$437dbf0e-84ff-417a-965d-ed2bb9650972" AS "Sales Header" WITH(READUNCOMMITTED)  JOIN "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Header$55a38a66-dce4-4aaa-abf1-d2abcc4e8dc0" "Sales Header_e1"  ON ("Sales
Header"."Document Type" = "Sales Header_e1"."Document Type") AND ("Sales Header"."No_" = "Sales Header_e1"."No_")  OUTER APPLY (SELECT TOP (@13) ISNULL(MIN("Completely Shipped$Sales Line"."Completely Shipped",@8) AS "Completely Shipped$Sales
Line$MIN$Completely Shipped" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Line$437dbf0e-84ff-417a-965d-ed2bb9650972" AS "Completely Shipped$Sales Line" WITH(READUNCOMMITTED)  WHERE ("Completely Shipped$Sales Line"."Document
Type"="Sales Header"."Document Type" AND "Completely Shipped$Sales Line"."Document No_"="Sales Header"."No_" AND ISNULL("Completely Shipped$Sales Line"."Type",@3)<>@14)) AS "SUB$Completely Shipped"  OUTER APPLY (SELECT TOP (@15) ISNULL(SUM("Amt_ Ship_
Not Inv_ (LCY) Base$Sales Line"."Shipped Not Inv_ (LCY) No VAT"),@7) AS "Amt_ Ship_ Not Inv_ (LCY) Base$Sales Line$SUM$Shipped Not Inv_ (LCY) No VAT" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales
Line$437dbf0e-84ff-417a-965d-ed2bb9650972" AS "Amt_ Ship_ Not Inv_ (LCY) Base$Sales Line" WITH(READUNCOMMITTED)  WHERE ("Amt_ Ship_ Not Inv_ (LCY) Base$Sales Line"."Document Type"="Sales Header"."Document Type" AND "Amt_ Ship_ Not Inv_ (LCY)
Base$Sales Line"."Document No_"="Sales Header"."No_")) AS "SUB$Amt_ Ship_ Not Inv_ (LCY) Base"  OUTER APPLY (SELECT TOP (@16) ISNULL(SUM("Amt_ Ship_ Not Inv_ (LCY)$Sales Line"."SUM$Shipped Not Invoiced (LCY)",@7) AS "Amt_ Ship_ Not Inv_ (LCY)$Sales
Line$SUM$Shipped Not Invoiced (LCY)" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Line$437dbf0e-84ff-417a-965d-ed2bb9650972$VSIFT$Key8" AS "Amt_ Ship_ Not Inv_ (LCY)$Sales Line" WITH(READUNCOMMITTED,NOEXPAND)  WHERE ("Amt_ Ship_
Not Inv_ (LCY)$Sales Line"."Document Type"="Sales Header"."Document Type" AND "Amt_ Ship_ Not Inv_ (LCY)$Sales Line"."Document No_"="Sales Header"."No_")) AS "SUB$Amt_ Ship_ Not Inv_ (LCY)"  OUTER APPLY (SELECT TOP (@17) ISNULL(SUM("Amount$Sales
Line"."SUM$Amount"),@7) AS "Amount$Sales Line$SUM$Amount" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Line$437dbf0e-84ff-417a-965d-ed2bb9650972$VSIFT$Key8" AS "Amount$Sales Line" WITH(READUNCOMMITTED,NOEXPAND)  WHERE
("Amount$Sales Line"."Document Type"="Sales Header"."Document Type" AND "Amount$Sales Line"."Document No_"="Sales Header"."No_")) AS "SUB$Amount"  OUTER APPLY (SELECT TOP (@18) ISNULL(SUM("Amount Including VAT$Sales Line"."SUM$Amount Including
VAT",@7) AS "Amount Including VAT$Sales Line$SUM$Amount Including VAT" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Line$437dbf0e-84ff-417a-965d-ed2bb9650972$VSIFT$Key8" AS "Amount Including VAT$Sales Line"
WITH(READUNCOMMITTED,NOEXPAND)  WHERE ("Amount Including VAT$Sales Line"."Document Type"="Sales Header"."Document Type" AND "Amount Including VAT$Sales Line"."Document No_"="Sales Header"."No_")) AS "SUB$Amount Including VAT"  WHERE ("Sales
Header"."Document Type"=@1) AND (ISNULL("Sales Header"."Document Type",@3)=@19 AND ISNULL("Sales Header"."No_",@4)>@20 OR ISNULL("Sales Header"."Document Type",@3)>@19) ORDER BY "Document Type" ASC,"No_" ASC OPTION(OPTIMIZE FOR UNKNOWN, FAST
50),@0=50,@1=1,@2=0X0000000000000000,@3=0,@4=N'',@5=N'',@6='1753-01-01 00:00:00',@7=0,@8=0,@9=0,@10='1753-01-01 00:00:00',@11='00000000-0000-0000-0000-000000000000',@12='',@13=1,@14=0,@15=1,@16=1,@17=1,@18=1,@19=1,@20=N'104008'
select @p1
```

Ready. Rows: 66

Connections: 1

Timeline profiler



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Timeline profiler

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UPDATE "Navision_PlatformCore".dbo."CRONUS International Ltd_$Integration Record$437dbf0e-84ff-417a-965d-ed2bb9650972" SET "Modified On"=@0 WHERE ("Integration ID"=@1 AND "timestamp"=@2) SELECT @@DBTS	513 ms	6,3 %
SELECT TOP (1) "5151"."timestamp","5151"."Integration ID","5151"."Table ID","5151"."Page ID","5151"."Record ID","5151"."Deleted On","5151"."Modified On","5151"."$systemId" FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Integration Record$437dbf0e-84ff-417a-965d-ed2bb9650972" "5151" WITH(UPDLOCK) WHERE ("5151"."Table ID"=@0 AND "5151"."Record ID"=@1) ORDER BY "Table ID" ASC,"Record ID" ASC,"Integration ID" ASC OPTION(OPTIMIZE FOR UNKNOWN)	495 ms	6,0 %

Timeline profiler

SELECT SUM("37"."Line Amount"),SUM("37"."Inv_ Discount Amount"),SUM("37"."Amount"),SUM("37"."Amount Including VAT"),SUM("37"."Quantity (Base)") FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Line$437dbf0e-84ff-417a-965d-ed2bb9650972" "37" WITH(UPDLOCK) WHERE ("Document Type"=@0 AND "Document No_"=@1 AND "Line No_"<>@2 AND "Tax Group Code"=@3 AND "VAT Identifier"=@4) OPTION(OPTIMIZE FOR UNKNOWN)	284 ms	3,5 %
[Rollback Transaction]	272 ms	3,3 %
SELECT SUM("337"."Quantity") FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Reservation Entry$437dbf0e-84ff-417a-965d-ed2bb9650972" "337" WITH(UPDLOCK) WHERE ("Reservation Status"=@0 AND "Source Type"=@1 AND "Source Subtype"=@2 AND "Source ID"=@3 AND "Source Ref_ No_"=@4) OPTION(OPTIMIZE FOR UNKNOWN)	262 ms	3,2 %
SELECT "1701" "timestamp" "1701" "Deferral Doc. Type" "1701" "Gen. Jnl. Template Name" "1701" "Gen. Jnl. Batch Name" "1701" "Document	224 ms	2,7 %

Timeline profiler

	SELECT TOP (@0) ISNULL("Sales Header"."timestamp",@2) AS "timestamp",ISNULL("Sales Header"."Document Type",@3) AS "Document Type",ISNULL("Sales Header"."No_",@4) AS "No_",ISNULL("Sales Header"."Sell-to Customer No_",@4) AS "Sell-to Customer No_",ISNULL("Sales Header"."Bill-to Customer No_",@4) ...	63 ms	0,8 %
☐	JOIN "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Header$55a38a66-dce4-4aaa-abf1-d2abcc4e8dc0" "Sales Header_e1" ON ("Sales Header"."Document Type" = "Sales Header_e1"."Document Type") AND ("Sales Header"."No_" = "Sales Header_e1"."No_") OUTER APPLY (SELECT TOP (@13) ISNULL(MIN("Completely Shipped$Sales Line"."Completely Shipped"),@8) AS "Completely Shipped$Sales Line$MIN$Completely Shipped" FROM ...		
	SELECT TOP (@0) ISNULL("Sales Header"."timestamp",@2) AS "timestamp",ISNULL("Sales Header"."Document Type",@3) AS "Document Type",ISNULL("Sales Header"."No_",@4) AS "No_",ISNULL("Sales Header"."Sell-to Customer No_",@4) AS "Sell-to Customer No_",ISNULL("Sales Header"."Bill-to Customer No_",@4) ...	62 ms	0,8 %
☐	JOIN "Navision_PlatformCore".dbo."CRONUS International Ltd_$Sales Header$55a38a66-dce4-4aaa-abf1-d2abcc4e8dc0" "Sales Header_e1" ON ("Sales Header"."Document Type" = "Sales Header_e1"."Document Type") AND ("Sales Header"."No_" = "Sales Header_e1"."No_") OUTER APPLY (SELECT TOP (@13) ISNULL(MIN("Completely Shipped$Sales Line"."Completely Shipped"),@8) AS "Completely Shipped$Sales Line$MIN$Completely Shipped" FROM ...		

Query store

```
select qqt.query_sql_text, res.* from sys.query_store_query_text qqt
join
(select top 50
qt.query_text_id,
q.query_id,
p.plan_id,
sum(total_query_wait_time_ms) as sum_total_wait_ms
from sys.query_store_wait_stats ws
join sys.query_store_plan p on ws.plan_id = p.plan_id
join sys.query_store_query q on p.query_id = q .query_id
join sys.query_store_query_text qt on q.query_text_id = qt.query_text_id
where  ws.wait_category=3 /*LOCK*/
Group by qt.query_text_id, q.query_id, p.plan_id
order by sum_total_wait_ms desc) res
on res.query_text_id = qqt.query_text_id
```

Results | Messages

	query_sql_text	query_text_id	query_id	plan_id	sum_total_wait_ms
1	(@0 int,@1 int,@2 int,@3 nvarchar(20),@4 int)SELECT SUM("337"."Quantity") FROM "Navision_PlatformCore".dbo."CRONUS International Ltd_$Reservation Entry$437dbf0e-84ff-417a-965d-ed2bb9650972" "337" WITH(UPDLOCK) WHERE ("Reservation Status"=...	11	183	11	64

Performance Regression Testing

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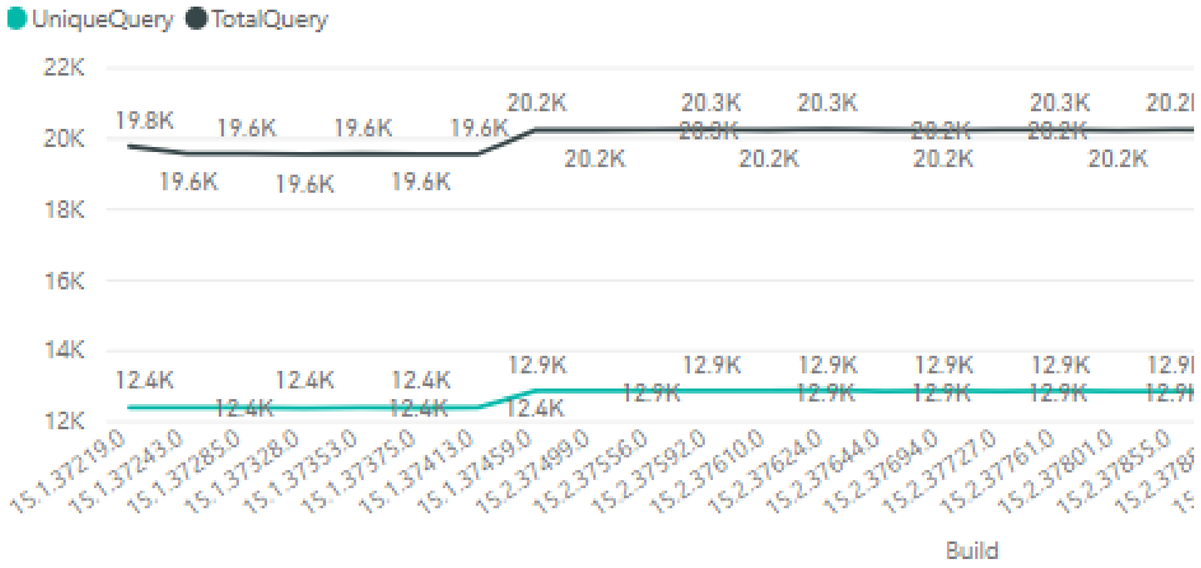
- What is performance regression testing in this context
- How to: Get up and running with Performance Regression Test in VSCode
- How to: Performance Regression Test of Sales Order creation
- How to: Interpret the data
- Future: Preview of new opened source Performance Regression Test Tool

Performance Regression Test

- Why use Performance Regression Test
  - Lightweight & easy to implement.
  - Discover regressions as they occur.
  - Tune code.
  - Introduce with existing test.



Performance Regression Testing AL Code

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- Count
  - Statement Executed hits
  - Row Read

```
IF SalesLine.FINDSET THEN
    REPEAT
      TempSalesLine := SalesLine;
      TempSalesLine.INSERT;
    UNTIL SalesLine.NEXT = 0;
```

- Re-run during development
  - Tune
  - Optimize

```
// Get the current SqlRowsRead as baseline
NoOfSalesOrders := 10;
SqlRowsReadCounterBefore := SessionInformation.SqlRowsRead;
SqlStatementsExecutedCountBefore := SessionInformation.SqlStatementsExecuted;
// Invoke the SalesOrder Page
for i := 1 to NoOfSalesOrders do begin
    Clear(SalesOrderHeader);
    //Call the createSalesOrder: SalesHeader, CustomerNo, Quantity, ItemNo (1000 biCycles), NoOfLines
    CreateSalesOrder(SalesOrderHeader, '10000', 10, '1000', 5);
end;

// Count the reads from SessionInformation and store in the local variable
SqlRowsReadCounterAfter := SessionInformation.SqlRowsRead;
SqlStatementsExecutedCountAfter := SessionInformation.SqlStatementsExecuted;


// Get the net Reads and statement hits
SqlRowsReadTotal := (SqlRowsReadCounterAfter - SqlRowsReadCounterBefore);
SqlStatementsExecutedTotal := (SqlStatementsExecutedCountAfter - SqlStatementsExecutedCountBefore);
```

- Add to test suite
  - Run as part of other Regression Test
  - Reduce problems in Production

Get up and running in VSCode

- In Docker import the test toolkit

  "Import-TestToolkitToNavContainer <container name>".

- Inside VSCode create a standard test case

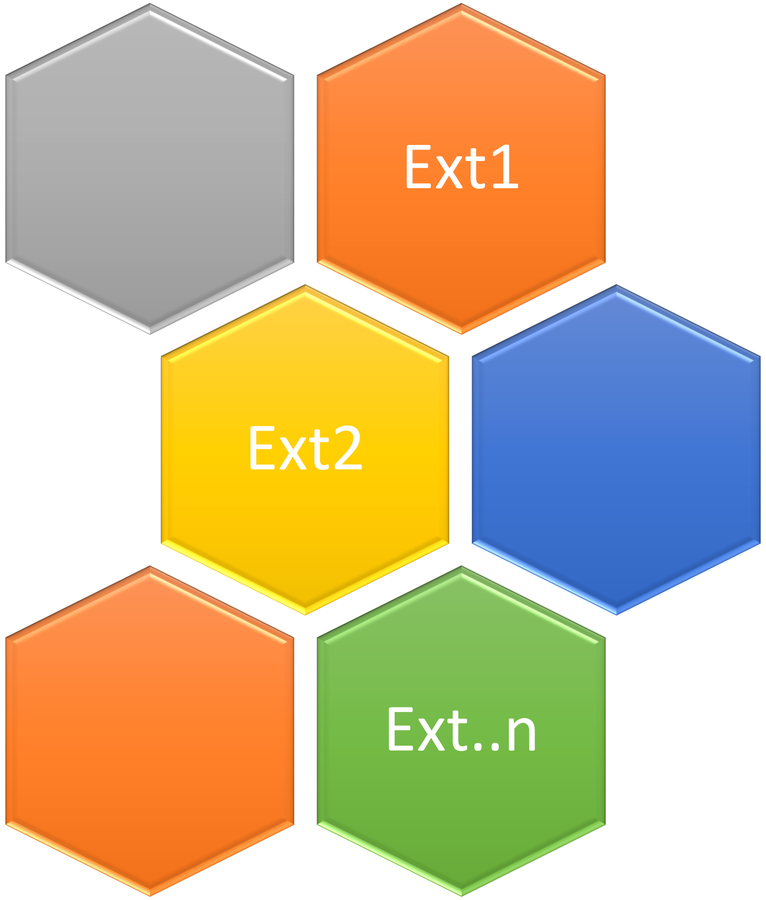
```
codeunit 50110 SalesOrderPerformanceTest
{
    Subtype = Test;
```

- Example….

Performance Regression Test of a Scenario

- Testing "Creating Sales Orders"
- SqlRowCounter, SqlExecuted obtained using SessionInformation object from Server
- This is just demonstrating Sales Order creation.
- Then new functionality is introduced
- Over time it can pose a risk

1 Statement 3ms
1000 statements = 3 seconds



Preview: New open sourced Performance test tool

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- Provides a UI.
- Compare to baseline during development.
- Easily discover regressions.
- All part of the standard Docker images.
- ETA H1 2020 on GitHub etc.

BENCHMARK TOOL | WORK DATE: 1/28/2021 ✓ SAVED

Baseline Version: 16.0

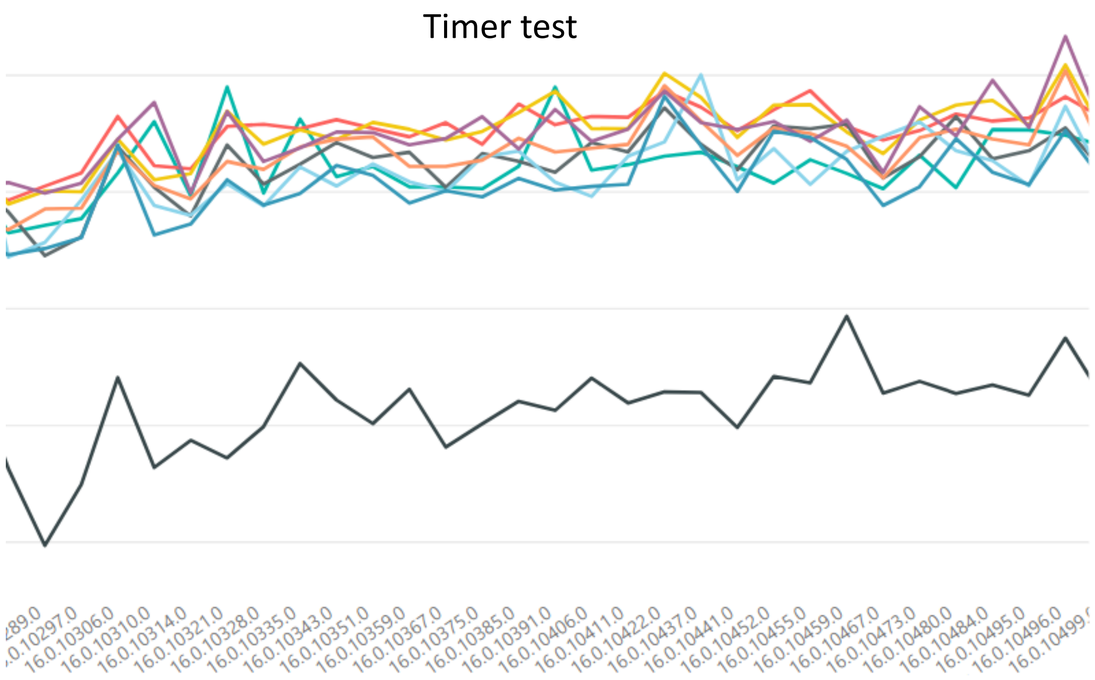
Manage | Delete Lines | Get Benchmarks | Run | Run Selected | Save Last Run | Save Last Run As

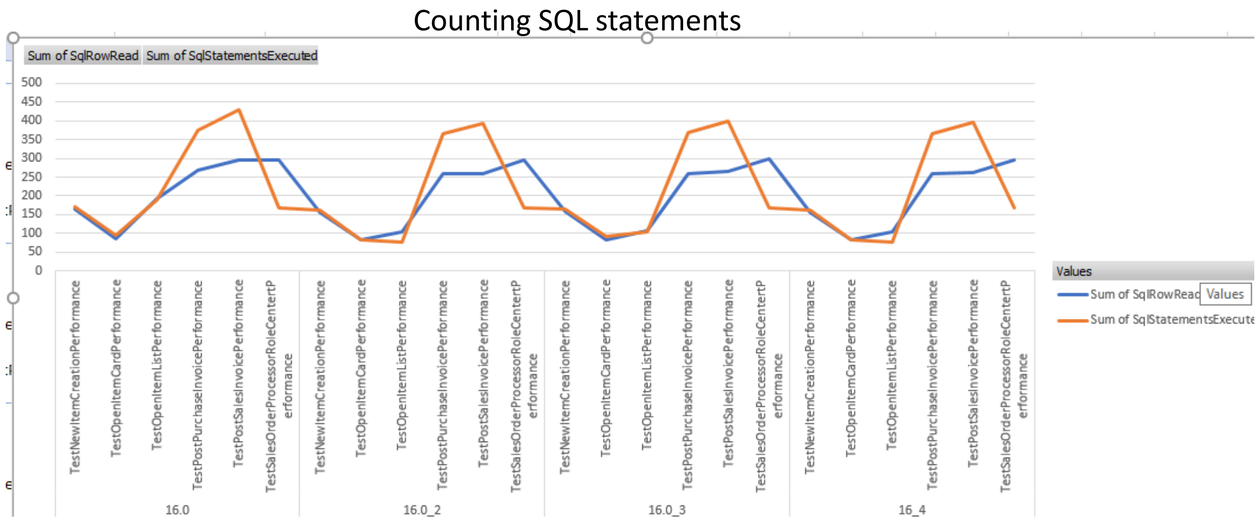
Line Type	Codeunit ID	Name	Run	Execution	Sql Reads	Sql Reads Diff	Sql Statements	Sql Statements Diff	Duration
Codeunit	**130470**	Benchmark Tests	☑	Success	0	0	0	0	22 seconds 640 millisec...
Function	130470	TestSalesOrderProcessorRoleCentertPerformance	☑	Success	297	1	169	1	3 seconds 703 milliseco...
Function	130470	TestOpenItemListPerformance	☑	Success	106	-85	105	-85	2 seconds 890 milliseco...
Function	130470	TestOpenItemCardPerformance	☑	Success	83	-3	93	-3	1 second 660 milliseco...
Function	130470	TestNewItemCreationPerformance	☑	Success	159	-5	166	-5	1 second 900 milliseco...
Function	130470	TestPostSalesInvoicePerformance	☑	Success	264	-31	398	-31	8 seconds 993 milliseco...
Function	130470	TestPostPurchaseInvoicePerformance	☑	Success	260	-7	368	-7	3 seconds 406 milliseco...

Sql Rows Read Total	1169	Successful Tests	6
Sql Rows Read Diff Total	-130	Failed Tests	0
Sql Statements Executed Total	1299	Skipped Tests	0
Sql Statements Executed Diff Total	-130	Tests not Executed	0

Export to Excel

- Provide better reporting
- More stabile than timer test
- Keep track over time
- Share with PowerBi, other tools
- Setup Flows





Resources for AL Testing

- **Testing the Advanced Sample Extension**
- https://freddysblog.com/2019/08/20/business-central-on-docker-for-non-experts/

New Features In 15.0

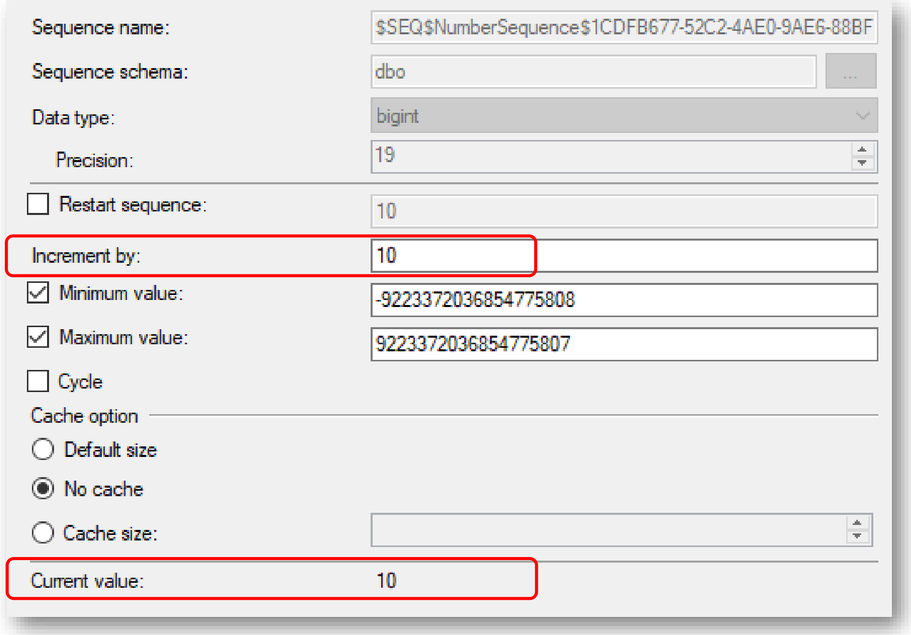
- Number Sequence object
- Page Background Tasks
- SessionInformation
- Immutable Keys

New number sequence object type in AL

- Fast, non-blocking number sequences that be used from AL
- Based on SQL Server ‘Sequence’ object
- Non-transactional

```
NumberSequence.Insert("Sequence Name", "Starting Sequence No.", "Increment-by No.");
```

```
if ModifySeries then
    NewNo := NumberSequence.Next("Sequence Name")
else
    NewNo := NumberSequence.Current("Sequence Name") + "Increment-by No."; // Peek
```



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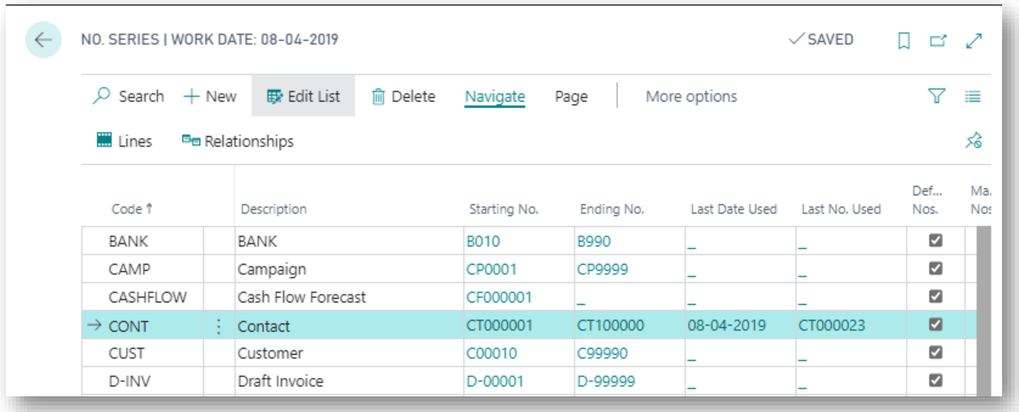
Non-blocking Number Series

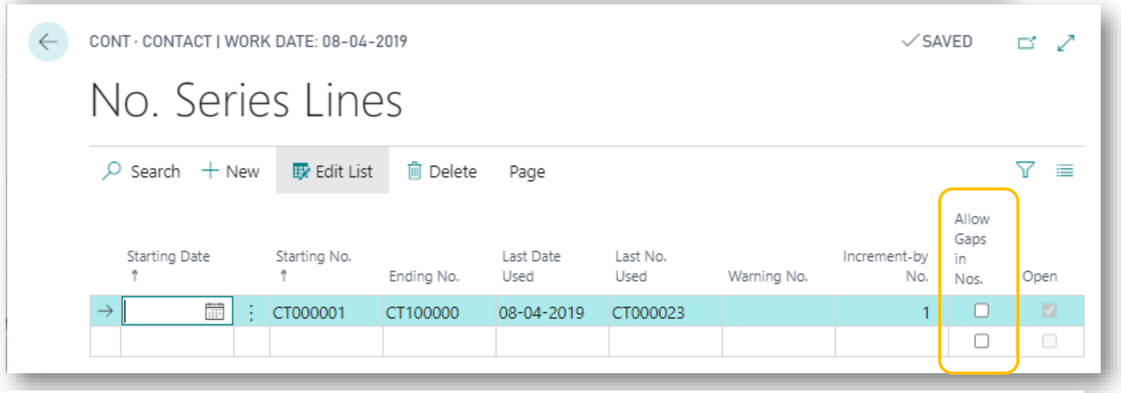
Builds on the new NumberSequence object

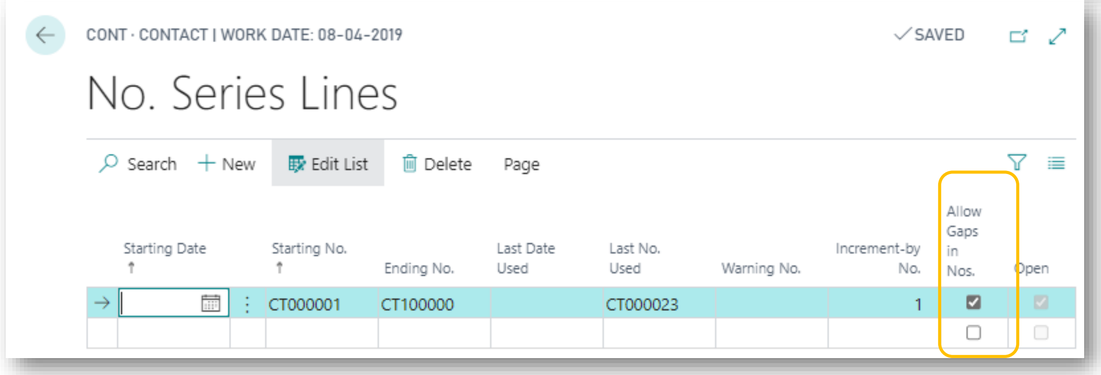
Switch to the new Non-blocking Number Series for all series where possible gaps in the sequence is acceptable.

Gaps will happen if a number is taken and the transaction rolled back.

This will give better performance due to less locking when creating entities.







Do not use for financial documents as gaps may occur

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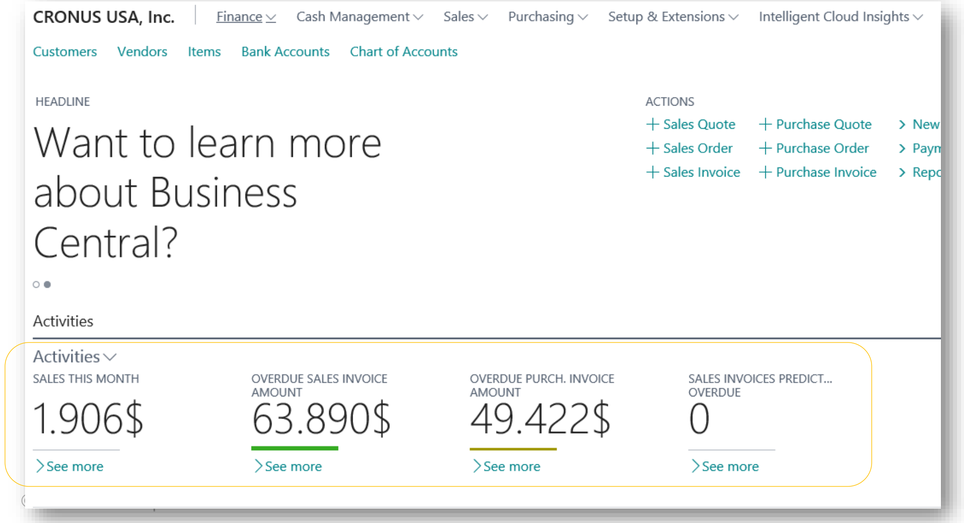
Page Background Tasks

AL developers can use asynchronous concepts

Consider using a page background task for long running (read-only) calculations on your pages.

This makes pages responsive even if some calculations have not completed yet.



What does it look like?

```
procedure CalculateCueFieldValues()

begin
    if (TaskIdCalculateCue <> 0) then
        CurrPage.CancelBackgroundTask(TaskIdCalculateCue);
    CurrPage.EnqueueBackgroundTask(TaskIdCalculateCue, Codeunit::"O365 Activities Dictionary");
end;

trigger OnPageBackgroundTaskError(TaskId: Integer; ErrorCode: Text; ErrorText: Text; ErrorCallStack: Text; var IsHandled: Boolean)
begin
    SendTraceTag('00009V0', PBTTelemetryCategoryLbl, Verbosity::Warning, StrSubstNo(PBTTelemetryMsgTxt, ErrorCode, ErrorText, Error

    if (TaskId <> TaskIdCalculateCue) then
        exit;

    if ActivitiesMgt.IsCueDataStale then
        if not TASKSCHEDULER.CanCreateTask then
            CODEUNIT.Run(CODEUNIT::"Activities Mgt.")
        else
            TASKSCHEDULER.CreateTask(CODEUNIT::"Activities Mgt.", 0, true, CompanyName, CurrentDateTime);

    IsHandled := TRUE;
end;

trigger OnPageBackgroundTaskCompleted(TaskId: Integer; Results: Dictionary of [Text, Text])
var
    O365ActivitiesDictionary: Codeunit "O365 Activities Dictionary";
begin
    if (TaskId = TaskIdCalculateCue) THEN BEGIN
        LockTable(true);
        Get();
        O365ActivitiesDictionary.FillActivitiesCue(Results, Rec);
        "Last Date/Time Modified" := CurrentDateTime;
        Modify(true);
    END
end;
```

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New SessionInformation AL object type

AL developers can query

- Number of SQL statements executed on the session since session start.
- Number of SQL rows read on the session since session start.

Make your AL performance test code much simpler.

These insights can also be monitored from AL debugger.

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Immutable keys

New stable ID on all tables both internally and externally, for example to use in integration scenarios

All records now have an (unique) immutable key (GUID).

Uptake: Staged deprecation of Integration Records

- dbo.Company
  - Columns
    - timestamp (timestamp, not null)
    - Name (PK, nvarchar(30), not null)
    - Evaluation Company (tinyint, not null)
    - Display Name (nvarchar(250), not null)
    - Id (uniqueidentifier, not null)
    - Business Profile Id (nvarchar(250), not null)
    - $systemId (uniqueidentifier, not null)

```
MyGuid := Company.SystemId;
```

```
part("Attached Documents v2"; "Document Attachment Factbox")
{
    ApplicationArea = All;
    Caption = 'Some New Attachments';
    SubPageLink = SystemId = FIELD(SystemId);
}
```

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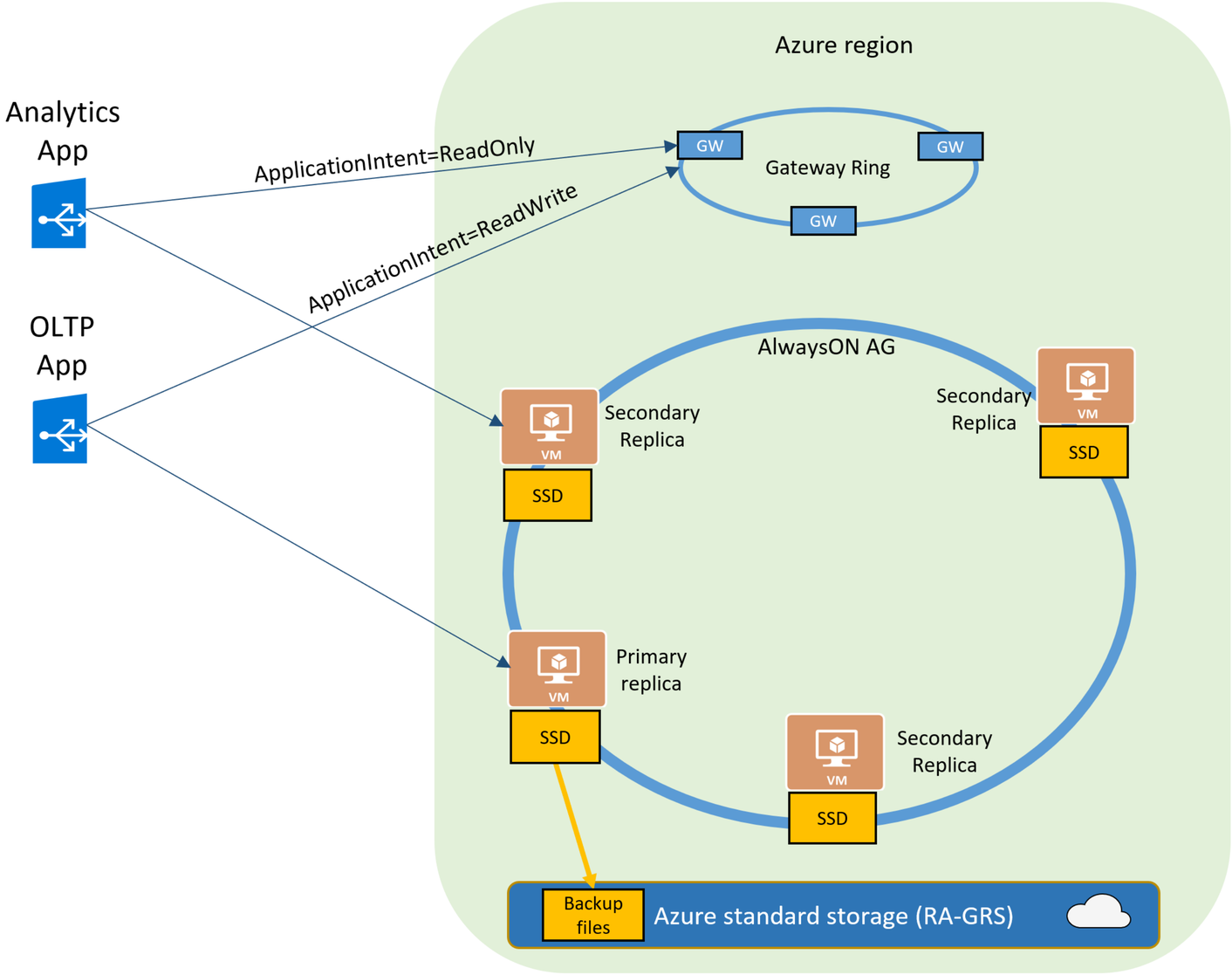
Coming soon: Read scale-out support



Coming soon: Read scale-out support

- Will enable the BC server to route requests to secondary replica
- Frees up resources on the primary sql server
- Can be used for API pages, Reports and Queries

Coming soon: DataAccessIntent

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AccountEntity.Page.al

AccountEntity.Page.al > Page 5480 "Account Entity"

```
1   page 5480 "Account Entity"
2   {
3       Caption = 'accounts', Locked = true;
4       ChangeTrackingAllowed = true;
5       DelayedInsert = true;
6       DeleteAllowed = false;
7       Editable = false;
8       EntityName = 'account';
9       EntitySetName = 'accounts';
10      InsertAllowed = false;
11      ModifyAllowed = false;
12      ODataKeyFields = Id;
13      PageType = API;
14      SourceTable = "G/L Account";
15      DataAccessIntent =
16
17      layout
18      {
19          area(content)
20          {
21              repeater(Co
22              {
23                  ShowCap
24                  field(i
25                  {
26                      App
27                      Cap
28                      Editable = false;
29                  }
30                  field(number; "No.")
31                  {
32                      ApplicationArea = All;
33                      Caption = 'Number', Locked = true;
```

- ReadOnly
- ReadWrite
- taction
- tassert
- tcaptionml
- tcaseelse
- tcaseof
- tcodeunit
- tcolumn
- tcontroladdin
- tdataitem
- tdotnet

Intent to access records, but not to modify them. Read-only pages are run against a replica of the database leading to improved performance, but preventing modifications to the database records.

Coding for performance in Azure

- Minimize the number of SQL statements
- Schedule as background tasks
- Scale out

#SQL calls - Reports

```
report 4 "Detail Trial Balance"
{
dataset
  {dataitem("G/L Account"; "G/L Account")
    {DataItemTableView = WHERE("Account Type" = CONST(Posting));
      PrintOnlyIfDetail = true;
      RequestFilterFields = "No.", "Search Name", "Income/Balance", "Debit/Credit", "Date Filter";

      dataitem(PageCounter; "Integer")
      {
          DataItemTableView = SORTING(Number) WHERE(Number = CONST(1));

        dataitem("G/L Entry"; "G/L Entry")
        {
          DataItemLink = "G/L Account No." = FIELD("No."), "Posting Date" = FIELD("Date Filter"), "Global Dimension 1 Code" = FIELD("Global Dimension 1 Filter"), ...
          DataItemLinkReference = "G/L Account";
          DataItemTableView = SORTING("G/L Account No.", "Posting Date");

      trigger OnAfterGetRecord() // G/L Account
      var
        GLEntry: Record "G/L Entry";
        Date: Record Date;
      begin
        StartBalance := 0;
        if GLDateFilter <> '' then begin
          Date.SetRange("Period Type", Date."Period Type"::Date);
          Date.SetFilter("Period Start", GLDateFilter);
          if Date.FindFirst then begin
            SetRange("Date Filter", 0D, ClosingDate(Date."Period Start" - 1));
            CalcFields("Net Change");
            StartBalance := "Net Change";
            SetFilter("Date Filter", GLDateFilter);
          end;
        end;

        if PrintOnlyOnePerPage then begin
          GLEntry.Reset;
          GLEntry.SetRange("G/L Account No.", "No.");
          if CurrReport.PrintOnlyIfDetail and GLEntry.FindFirst then
            PageGroupNo := PageGroupNo + 1;
        end;
      end;
```

For each G/L Account we issue 3 queries

Can we improve?

- Rewrite the report to use a query
  - Change dataitem(s) to be 'Integer' loops to consume the query
  - Adapt the RDLC (or Word layouts) to the new structure
- Or…
- Declare a global GLEntry record that finds **all** the entries
  - Change the existing "G/L Entry" dataitem into a temp table
  - Fill in the temp "G/L Entry" table on OnAfterGetRecord of "G/L Account"
- Declare a global GLAccount record with the StartBalance date filter
  - SetAutoCalcFields("Net Change")

Modified Report

```
report 51004 "Detail Trial Balance v2"
{
  dataset
  {
    dataitem("G/L Account"; "G/L Account")
    {
      DataItemTableView = WHERE("Account Type" = CONST(Posting));
      PrintOnlyIfDetail = true;
      RequestFilterFields = "No.", "Search Name", "Income/Balance", "Debit/Credit", "Date Filter";
      dataitem(PageCounter; "Integer")
      {
        DataItemTableView = SORTING(Number) WHERE(Number = CONST(1));
        dataitem("G/L Entry"; "G/L Entry")
        {
          DataItemLink = "G/L Account No." = FIELD("No."), "Posting Date" = FIELD("Date Filter"), "Global Dimension 1 Code" = FIELD("Global Dimension 1 Filter"),…
          DataItemLinkReference = "G/L Account";
          DataItemTableView = SORTING("G/L Account No.", "Posting Date");
          UseTemporary = true;
```

Modified Report

```
trigger OnPreDataItem()   // G/L Account
        var
           Date: Record Date;
        begin
           PageGroupNo := 1;
           if GLDateFilter <> '' then begin
              Date.SetRange("Period Type", Date."Period Type"::Date);
              Date.SetFilter("Period Start", GLDateFilter);
              if Date.FindFirst then begin
                 CalculateBeginningBalance := true;
                 GlobalGLAccount.CopyFilters("G/L Account");
                 GlobalGLAccount.SetRange("Date Filter", 0D, ClosingDate(Date."Period Start" - 1));
                 GlobalGLAccount.setautoCalcFields("Net Change");
                 if GlobalGLAccount.findset then;
              end;
           end;
        end;
```

Modified Report

```
trigger OnAfterGetRecord() // G/L Account
    var
      AnyEntryForThisAccount: Boolean;
      MoreGLAccounts: Boolean;
    begin
      StartBalance := 0;
      if CalculateBeginningBalance then begin
        MoreGLAccounts := true;
        while (GlobalGLAccount."No." < "no.") and MoreGLAccounts do
          MoreGLAccounts := GlobalGLAccount.next <> 0;
        if GlobalGLAccount."No." = "no." then
          StartBalance := GlobalGLAccount."Net Change";
      end;
      if not GlobalGLEntryRead then begin
        GlobalGLEntry.CopyFilters("G/L Entry");
        if GetFilter("No.") <> '' then
          CopyFilter("No.", GlobalGLEntry."G/L Account No.");
        if GetFilter("Date Filter") <> '' then
          CopyFilter("Date Filter", GlobalGLEntry."Posting Date");
        if GetFilter("Business Unit Filter") <> '' then
          CopyFilter("Business Unit Filter", GlobalGLEntry."Business Unit Code");
        if GetFilter("Global Dimension 1 Filter") <> '' then
          CopyFilter("Global Dimension 1 Filter", GlobalGLEntry."Global Dimension 1 Code");
        if GetFilter("Global Dimension 2 Filter") <> '' then
          CopyFilter("Global Dimension 2 Filter", GlobalGLEntry."Global Dimension 2 Code");
        GlobalGLEntry.SetCurrentKey("G/L Account No.", "Posting Date");
        MoreGlobalGLEntries := GlobalGLEntry.findset;
      end else
        "G/L Entry".DeleteAll();
      AnyEntryForThisAccount := false;
      if MoreGlobalGLEntries and (GlobalGLEntry."G/L Account No." = "No.") then
        repeat
          "G/L Entry" := GlobalGLEntry;
          "G/L Entry".Insert();
          AnyEntryForThisAccount := true;
          MoreGlobalGLEntries := GlobalGLEntry.next <> 0;
        until not MoreGlobalGLEntries or (GlobalGLEntry."G/L Account No." <> "No.");
      GlobalGLEntryRead := true;

      if PrintOnlyOnePerPage then
        if CurrReport.PrintOnlyIfDetail and AnyEntryForThisAccount then
          PageGroupNo := PageGroupNo + 1;
    end;
```

Modified Report

```
trigger OnAfterGetRecord() // G/L Account
    var
      AnyEntryForThisAccount: Boolean;
      MoreGLAccounts: Boolean;
    begin
      StartBalance := 0;
      if CalculateBeginningBalance then begin
        MoreGLAccounts := true;
        while (GlobalGLAccount."No." < “No.") and MoreGLAccounts do
          MoreGLAccounts := GlobalGLAccount.next <> 0;
        if GlobalGLAccount."No." = “No." then
          StartBalance := GlobalGLAccount."Net Change";
      end;
      if not GlobalGLEntryRead then begin
        GlobalGLEntry.CopyFilters("G/L Entry");
        if GetFilter("No.") <> '' then
          CopyFilter("No.", GlobalGLEntry."G/L Account No.");
        if GetFilter("Date Filter") <> '' then
          CopyFilter("Date Filter", GlobalGLEntry."Posting Date");
        if GetFilter("Business Unit Filter") <> '' then
          CopyFilter("Business Unit Filter", GlobalGLEntry."Business Unit Code");
        if GetFilter("Global Dimension 1 Filter") <> '' then
          CopyFilter("Global Dimension 1 Filter", GlobalGLEntry."Global Dimension 1 Code");
        if GetFilter("Global Dimension 2 Filter") <> '' then
          CopyFilter("Global Dimension 2 Filter", GlobalGLEntry."Global Dimension 2 Code");
        GlobalGLEntry.SetCurrentKey("G/L Account No.", "Posting Date");
        MoreGlobalGLEntries := GlobalGLEntry.findset;
      end else
        "G/L Entry".DeleteAll();
      AnyEntryForThisAccount := false;
      if MoreGlobalGLEntries and (GlobalGLEntry."G/L Account No." = "No.") then
        repeat
          "G/L Entry" := GlobalGLEntry;
          "G/L Entry".Insert();
          AnyEntryForThisAccount := true;
          MoreGlobalGLEntries := GlobalGLEntry.next <> 0;
        until not MoreGlobalGLEntries or (GlobalGLEntry."G/L Account No." <> "No.");
      GlobalGLEntryRead := true;

      if PrintOnlyOnePerPage then
        if CurrReport.PrintOnlyIfDetail and AnyEntryForThisAccount then
          PageGroupNo := PageGroupNo + 1;
    end;
```

```
StartBalance := 0;
if CalculateBeginningBalance then begin
    MoreGLAccounts := true;
    while (GlobalGLAccount."No." < “No.") and MoreGLAccounts do
        MoreGLAccounts := GlobalGLAccount.next <> 0;
        if GlobalGLAccount."No." = “No." then
            StartBalance := GlobalGLAccount."Net Change";
end;
```

```
AnyEntryForThisAccount := false;
if MoreGlobalGLEntries and (GlobalGLEntry."G/L Account No." = "No.") then
  repeat
    "G/L Entry" := GlobalGLEntry;
    "G/L Entry".Insert();
    AnyEntryForThisAccount := true;
    MoreGlobalGLEntries := GlobalGLEntry.next <> 0;
  until not MoreGlobalGLEntries or (GlobalGLEntry."G/L Account No." <> "No.");
GlobalGLEntryRead := true;

if PrintOnlyOnePerPage then
  if CurrReport.PrintOnlyIfDetail and AnyEntryForThisAccount then
    PageGroupNo := PageGroupNo + 1;
```

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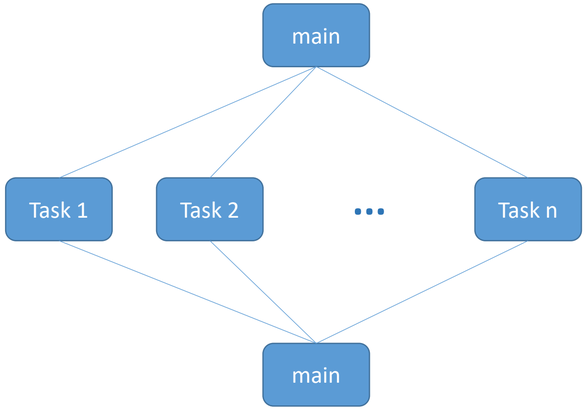
Did it matter?

- “Detail Trial Balance” on standard CRONUS demo data:
- Standard report : 225-597 SQL queries (depends on no. of accounts)
- Modified report: 18 SQL queries

Scale Out

- Split your job into smaller taks
- Wait for all sub-tasks to finish before continuing



Configuration Package Import (codeunit 8614 "Config. XML Exchange“)

```
TableNodes := DocumentElement.ChildNodes;
if not HideDialog then
    ConfigProgressBar.Init(TableNodes.Count, 1, ImportPackageTxt);
for NodeCount := 0 to (TableNodes.Count - 1) do begin
    TableNode := TableNodes.Item(NodeCount);
    if Evaluate(TableID, Format(TableNode.FirstChild.InnerText)) then begin
        NoOfChildNodes := TableNode.ChildNodes.Count;
        if (NoOfChildNodes < ConfigPackage."Min. Count For Async Import") or ExcelMode then
            ImportTableFromXMLNode(TableNode, PackageCode)
        else begin
            // Send to background
            Clear(TempBlob);
            TempBlob.CreateOutStream(OutStream, TEXTENCODING::UTF8);
            OutStream.WriteText('<doc>' + TableNode.OuterXml + '</doc>');
            ParallelSessionManagement.NewSessionRunCodeunitWithBlob(
              CODEUNIT::"Config. Import Table in Backgr", PackageCode, TempBlob);
        end;
```

```
if not HideDialog then
    ConfigProgressBar.Close;
if not ExcelMode then
    ParallelSessionManagement.WaitForAllToFinish(0);
```

Did it matter?

- Import of Configuration Package on standard CRONUS demo data:
- 13.0 (NAV2018): ~**20 min** (slow machine).
- 14.0 (BC): ~**10 min** (same slow machine).

Q&A

Any Questions?

Thank You!

Templates

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Slide with title & content

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1 col — 2 rows content

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Mea ne magna inciderint, putant neglegentur nam et.

2 cols — comparison

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