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NAV/BC for high demanding environments

Zeljko Hajdinjak

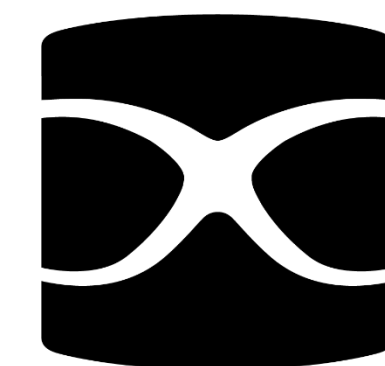
When you are passionate about
Microsoft Dynamics NAV/365 Business Central

About



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Mister Spex GmbH
Germany

From IT & User Perspective



MISTER SPEX

User story

Your company
implemented
NAV/BC

New
features

Scaling &
trust in the
system

ERP
strategy

Not just
ERP

1. A lot of data
2. Many features

1. System is growing
2. Team is growing
3. More internal systems
4. ERP just one of many

1. How much can the system handle?
2. What is happening in the world?
3. Are we safe?
4. Can the system handle our demands?

1. Build own features
2. Use patterns of other technologies
3. Focus on enterprise

1. Outside of ERP world
2. When instead of why & how
3. What to do in the next 1-3 years
4. Where are the real limits

High demanding environments (related to NAV/BC)

Technical KPIs

KPI	Advanced	Demanding	High demanding
Number of orders /day	<= 5.000	<= 10.000	> 10.000
<i>Number of customers</i>			> 1.000.000
<i>Number of items</i>			> 500.000
Number of users (concurrent)	<= 50	<= 200	> 200
Number of interfaces	<= 5	<= 10	> 10
Parallel jobs (automation level)	<= 20	<= 50	> 50
Needed availability (online)	(Mo-Fr)	(Mo-Su)	Near 24/7
Possible outage duration	Days (weekend)	Hours	Minutes
Scalability demands	Yearly	Quarterly/Monthly	Daily/Weekly
Standard vs. customizations	Near to standard	Mix of both	Made for you
Tech. dependency	Low - high	Low - high	Very high
Databases/Storage	< 200GB	<= 500 GB	TB, Big Data

User requirements & IT complexity

		Complexity ↑							
		System is solving problems							
	High demanding	Made for you	System alerts about its problems	Helping Leading Informing	<= 1sec	>= 50% weekly/daily oscillations	Public APIs	Microservices, non relational DBs	100% 24/7
	Demanding	Highly customized system	System is executing main processes	Intuitive	<= 2sec	<= 50% monthly oscillations	Many internals & externals	Cloud, split monolithic system	100% during working hours
	Advanced	Customizations	Automation	Less clicking	<= 3sec	<= 25 % yearly	More internals & some externals	Other technologies, BI, web	Longer downtime possible
	Basic/Average	ERP standard features	Standard processes	Standard user interface (UI)	OK	System works	Some interfaces	ERP Technology & architecture	Tracking business activities
		Features	Processes	UI	Performance	Scalability	Connectivity	Tech & architecture	Business dependency

About what is not this session

High demanding environments probably are familiar with:

Docker .NET C/AL→AL Online
Cloud Power BI Azure functions Public
Power Platform git TFS JS Agile
Azure DEV-OPS Builds Pipelines
Angular React Global failover Non relational DBs
Azure Event Grid Enterprise Service Bus High available APIs
Microservices

About what it is this session

How to scale NAV/BC (basics)

01

UI (frontend)

02

Performance
(backend)

03

Telemetry

04

Scalability, Tech &
Architecture

05

Business
dependency

06

Organization

User interface (frontend)

UI – Focus

UI

- How does the system look like
- How does it support my business, job, daily routines....
- How fast is it (2 seconds rule)



Filtering

Fast filter

CRONUS AG | Sales ✓ Purchasing ✓ Inventory ✓ Posted Documents ✓ Setup & Extensions ✓

Customers: All ▾ Search + New Delete Process ▾ Report ▾ New Document ▾ Customer ▾ Navigate ▾ Open in Excel More options

Views

All

Filter list by:

+ Filter...

Filter totals by:

Date Filter: ..01/28/21

Edit

No. ↑	Name	Responsibility Center	Location Code	Phone No.	Contact
01121212	Spotsm		GELB		Mr. Mike Nash
01445544	Progres		GELB		Mr. Scott Mitchell
01454545	New Co		GELB		Ms. Tammy L. McDonald
01905893	Candox		GELB		Mr. Rob Young
01905899	Elkhorn		GELB		Mr. Ryan Danner
01905902	London		GELB		Mr. John Kane
10000	Möbel-	DÜSSELDORF	BLAU		Herr Michael Emanuel
20000	Blütenhaus GmbH				Herr Paul West
20309920	Metatorad Malaysia Sdn Bhd		GELB		Mrs. Azleen Samat

Ascending

Descending

Filter...

Filter to This Value

Clear Filter

What's this?

General/Column filters

Customers: All▼

airport

+ New

Delete

Process▼

Report▼

New Document▼

Customer▼

Navigate▼

Open in Excel

Actions

Views	No. ↑	Name	Responsibility Center	Location Code	Phone No.	Contact	Balance (LCY)
All	01905899	Elkhorn Airport		GELB		Mr. Ryan Danner	0.0

Filter list by...

Filter totals by:

Date Filter: ..01/28/21

Edit

Query contains
all records in
specific table

```
declare @p1 int
set @p1=154
exec sp_prepxec @p1 output,N'@o bigint,@1 nvarchar(40),@2 nvarchar(200),@3 nvarchar(20),@4 nvarchar(20),@5 nvarchar(60),@6 nvarchar(200),@7 binary(8),@8 nvarchar(20),@9 nvarchar(250),@10 decimal(38,20),@11 int,@12 int,@13 tinyint,@14 datetime,@15 datetime,@16 uniqueidentifier,@17 varchar(32),@18 uniqueidentifier,@19 bigint,@20 bigint,@21 datetime,@22 bigint,@23
datetime,@24 bigint,@25 int,@26 int,@27 datetime,@28 nvarchar(20) N'SELECT TOP (@o) ISNULL("Customer"."timestamp",@7) AS "timestamp",ISNULL("Customer"."No_",@8) AS "No_",ISNULL("Customer"."Name_",@9) AS "Name",ISNULL("Customer"."Search Name",@8) AS "Search Name",ISNULL("Customer"."Line 2_",@9) AS "Name 2",ISNULL("Customer"."Address",@9) AS
"Address",ISNULL("Customer"."Address 2_",@9) AS "Address 2",ISNULL("Customer"."City",@9) AS "City",ISNULL("Customer"."Contact",@9) AS "Contact",ISNULL("Customer"."Phone No_",@9) AS "Phone No_",ISNULL("Customer"."Telex No_",@9) AS "Telex No_",ISNULL("Customer"."Document Sending Profile",@8) AS "Document Sending Profile",ISNULL("Customer"."Ship-to Code",@8) AS "Ship-to
Code",ISNULL("Customer"."Our Account No_",@9) AS "Our Account No_",ISNULL("Customer"."Territory Code",@8) AS "Territory Code",ISNULL("Customer"."Global Dimension 1 Code",@8) AS "Global Dimension 1 Code",ISNULL("Customer"."Global Dimension 2 Code",@8) AS "Global Dimension 2 Code",ISNULL("Customer"."Chain Name",@8) AS "Chain Name",ISNULL("Customer"."Budgeted
Amount",@10) AS "Budgeted Amount",ISNULL("Customer"."Credit Limit (LCY)",@10) AS "Credit Limit (LCY)",ISNULL("Customer"."Customer Posting Group",@8) AS "Customer Posting Group",ISNULL("Customer"."Currency Code",@8) AS "Currency Code",ISNULL("Customer"."Customer Price Group",@8) AS "Customer Price Group",ISNULL("Customer"."Language Code",@8) AS "Language
Code",ISNULL("Customer"."Statistics Group",@11) AS "Statistics Group",ISNULL("Customer"."Payment Terms Code",@8) AS "Payment Terms Code",ISNULL("Customer"."Fin_ Charge Terms Code",@8) AS "Fin_ Charge Terms Code",ISNULL("Customer"."Salesperson Code",@8) AS "Salesperson Code",ISNULL("Customer"."Shipment Method
Code",@8) AS "Shipment Method Code",ISNULL("Customer"."Shipping Agent Code",@8) AS "Shipping Agent Code",ISNULL("Customer"."Place of Export",@8) AS "Place of Export",ISNULL("Customer"."Invoice Disc_ Code",@8) AS "Invoice Disc_ Code",ISNULL("Customer"."Customer Disc_
Group",@8) AS "Customer Disc_ Group",ISNULL("Customer"."Country_Region Code",@8) AS "Country_Region Code",ISNULL("Customer"."Collection Method",@8) AS "Collection Method",ISNULL("Customer"."Amount",@10) AS "Amount",ISNULL("Customer"."Blocked",@12) AS
"Blocked",ISNULL("Customer"."Invoice Copies",@11) AS "Invoice Copies",ISNULL("Customer"."Last Statement No_",@11) AS "Last Statement No_",ISNULL("Customer"."Print Statements",@13) AS "Print Statements",ISNULL("Customer"."Bill-to Customer No_",@8) AS "Bill-to Customer
No_",ISNULL("Customer"."Priority",@11) AS "Priority",ISNULL("Customer"."Payment Method Code",@8) AS "Payment Method Code",ISNULL("Customer"."Last Modified Date Time",@14) AS "Last Modified Date Time",ISNULL("Customer"."Last Date Modified",@15) AS "Last Date
Modified",ISNULL("Customer"."Application Method Code",@8) AS "Application Method Code",ISNULL("Customer"."Prices Including VAT",@8) AS "Prices Including VAT",ISNULL("Customer"."Location Code",@8) AS "Location Code",ISNULL("Customer"."Customer
No_",ISNULL("Customer"."Telex Answer Back",@9) AS "Telex Answer Back",ISNULL("Customer"."Registration No_",@10) AS "VAT Registration No_",ISNULL("Customer"."Combine Shipments",@8) AS "Combine Shipments",ISNULL("Customer"."Bus_ Posting Group",@8) AS "Bus_
Posting Group",DATALENGTH("Customer"."Phone") AS "Phone",ISNULL("Customer"."GLN",@8) AS "GLN",ISNULL("Customer"."Post Code",@8) AS "Post Code",ISNULL("Customer"."County",@8) AS "County",ISNULL("Customer"."E-Mail",@8) AS "E-Mail",ISNULL("Customer"."Home
Page",@9) AS "Home Page",ISNULL("Customer"."Reminder Term Code",@8) AS "Reminder Term Code",ISNULL("Customer"."No_ Set",@8) AS "No_ Set",ISNULL("Customer"."Area Code",@8) AS "Area Code",ISNULL("Customer"."Tax Area Code",ISNULL("Customer"."Tax
Table",@13) AS "Tax Table",ISNULL("Customer"."Bus_ Posting Group",@8) AS "VAT Bus_ Posting Group",ISNULL("Customer"."Reserve",@12) AS
"Reserve",ISNULL("Customer"."Block Payment Tolerance",@13) AS "Block Payment Tolerance",ISNULL("Customer"."IC Partner Code",@8) AS "IC Partner Code",ISNULL("Customer"."Prepayment",@10) AS "Prepayment",ISNULL("Customer"."Partner Type",@10) AS "Partner Type",ISNULL("Customer"."Privacy
Blocked",ISNULL("Customer"."Disable Search by Name",@13) AS "Disable Search by Name",ISNULL("Customer"."Preferred Bank Account Code",@8) AS "Preferred Bank Account Code",ISNULL("Customer"."Cash Flow Payment Terms Code",@8) AS "Cash Flow Payment Terms Code",ISNULL("Customer"."Primary Contact No_",@8) AS "Primary Contact No_",ISNULL("Customer"."Contact Type",@12) AS
"Contact Type",ISNULL("Customer"."Responsibility Center",@8) AS "Responsibility Center",ISNULL("Customer"."Shipping Time",@12) AS "Shipping Time",ISNULL("Customer"."Shipping Agent Service Code",@8) AS "Shipping Agent Service Code",ISNULL("Customer"."Service Zone Code",@8) AS "Service Zone
Code",ISNULL("Customer"."Allow Line Disc_",@13) AS "Allow Line Disc_",ISNULL("Customer"."Base Calendar Code",@8) AS "Base Calendar Code",ISNULL("Customer"."Copy Set",@12) AS "Copy Set",ISNULL("Customer"."Qte Term",@12) AS "Qte Term",ISNULL("Customer"."Validate E
at Re No_",@18) AS "Validate E at Re No_",ISNULL("Customer"."Date EU Vat Reg_ No_",@18) AS "Date EU Vat Reg_ No_",ISNULL("Customer"."Id",@18) AS "Id",ISNULL("Customer"."Currency
Id",@18) AS "Currency Id",ISNULL("Customer"."Pay Terms Id",@18) AS "Pay Terms Id",ISNULL("Customer"."Shipment Method",@8) AS "Shipment Method",ISNULL("Customer"."Payment Method Id",@8) AS "Payment Method Id",ISNULL("Customer"."Tax Area",@10) AS "Tax Area",ISNULL("Customer"."Contact ID",@18) AS "Contact ID",ISNULL("Customer"."Contact Graph
Id",@9) AS "Contact Graph Id",ISNULL("Customer"."$systemid",@18) AS "$systemid",ISNULL("SUB$Balance (LCY)".Balance (LCY)$Detailed Cust_ Ledg_ Entry$SUM$Amount (LCY)",@10) AS
"Balance (LCY)",ISNULL("SUB$Balance Due (LCY)".Balance Due (LCY)$Detailed Cust_ Ledg_ Entry$SUM$Amount (LCY)",@10) AS "Balance Due (LCY)",ISNULL("SUB$Sales (LCY)".Sales (LCY)$Cust_ Ledger Entry$SUM$Sales (LCY)",@10) AS "Sales (LCY)",ISNULL("SUB$Payments
(LCY)".Payments (LCY)$Detailed Cust_ Ledg_ Entry$SUM$Amount (LCY)",@10) AS "Payments (LCY)" FROM "Demo Database BC (15-0)".dbo."CRONUS AG$Customer$437dbfoe-84ff-417a-965d-ed2bb9650972" AS "Customer" WITH(READUNCOMMITTED) OUTER APPLY (SELECT TOP (@19)
ISNULL(SUM("Balance (LCY)$Detailed Cust_ Ledg_ Entry".SUM$Amount (LCY)",@10) AS "Balance (LCY)$Detailed Cust_ Ledg_ Entry$SUM$Amount (LCY)" FROM "Demo Database BC (15-0)".dbo."CRONUS AG$Detailed Cust_ Ledg_ Entry$437dbfoe-84ff-417a-965d-ed2bb9650972$VSIFT$Key14" AS
"Balance (LCY)$Detailed Cust_ Ledg_ Entry" WITH(READUNCOMMITTED,NOEXPAND) WHERE ("Balance (LCY)$Detailed Cust_ Ledg_ Entry".Customer No_"="Customer"."No_") AS "SUB$Balance (LCY)" OUTER APPLY (SELECT TOP (@20) ISNULL(SUM("Balance Due (LCY)$Detailed Cust_ Ledg_
Entry".SUM$Amount (LCY)",@10) AS "Balance Due (LCY)$Detailed Cust_ Ledg_ Entry$SUM$Amount (LCY)" FROM "Demo Database BC (15-0)".dbo."CRONUS AG$Detailed Cust_ Ledg_ Entry$437dbfoe-84ff-417a-965d-ed2bb9650972$VSIFT$Key14" AS "Balance Due (LCY)$Detailed Cust_ Ledg_
Entry" WITH(READUNCOMMITTED,NOEXPAND) WHERE ("Balance Due (LCY)$Detailed Cust_ Ledg_ Entry".Customer No_"="Customer"."No_" AND ISNULL("Balance Due (LCY)$Detailed Cust_ Ledg_ Entry".Initial Entry Due Date",@15)<=@21) AS "SUB$Balance Due (LCY)" OUTER APPLY (SELECT
TOP (@22) ISNULL(SUM("Sales (LCY)$Cust_ Ledger Entry".SUM$Sales (LCY)",@10) AS "Sales (LCY)$Cust_ Ledger Entry$SUM$Sales (LCY)" FROM "Demo Database BC (15-0)".dbo."CRONUS AG$Cust_ Ledger Entry$437dbfoe-84ff-417a-965d-ed2bb9650972$VSIFT$Key2" AS "Sales (LCY)$Cust_
Ledger Entry" WITH(READUNCOMMITTED,NOEXPAND) WHERE ("Sales (LCY)$Cust_ Ledger Entry".Customer No_"="Customer"."No_" AND ISNULL("Sales (LCY)$Cust_ Ledger Entry".Posting Date",@15)<=@23) AS "SUB$Sales (LCY)" OUTER APPLY (SELECT TOP (@24) ISNULL(SUM("Payments (LCY)$Detailed Cust_ Ledg_ Entry".SUM$Amount (LCY)",@10) AS "Payments (LCY)$Detailed Cust_
Ledg_ Entry$SUM$Amount (LCY)" FROM "Demo Database BC (15-0)".dbo."CRONUS AG$Detailed Cust_ Ledg_ Entry$437dbfoe-84ff-417a-965d-ed2bb9650972$VSIFT$Key11" AS "Payments (LCY)$Detailed Cust_ Ledg_ Entry" WITH(READUNCOMMITTED,NOEXPAND) WHERE (ISNULL("Payments (LCY)$Detailed Cust_ Ledg_ Entry".Initial Document Type",@12)=@25 AND ISNULL("Payments
(LCY)$Detailed Cust_ Ledg_ Entry".Entry Type",@12)=@26 AND "Payments (LCY)$Detailed Cust_ Ledg_ Entry".Customer No_"="Customer"."No_" AND ISNULL("Payments (LCY)$Detailed Cust_ Ledg_ Entry".Posting Date",@15)<=@27) AS "SUB$Payments (LCY)" WHERE ("Customer"."No_" COLLATE Latin1_General_100_CI_AI LIKE @1 OR "Customer"."Name" COLLATE Latin1_General_100_CI_AI
LIKE @2 OR "Customer"."Responsibility Center" COLLATE Latin1_General_100_CI_AI LIKE @3 OR "Customer"."Location Code" COLLATE Latin1_General_100_CI_AI LIKE @4 OR "Customer"."Phone No_" COLLATE Latin1_General_100_CI_AI LIKE @5 OR "Customer"."Contact" COLLATE Latin1_General_100_CI_AI LIKE @6) AND (ISNULL("Customer"."No_",@8)<@28) ORDER BY "No_" DESC
OPTION(OPTIMIZE FOR UNKNOWN,FAST 50),@o=50,@1=N'%AIRPORT%',@2=N'%airport%',@3=N'%AIRPORT%',@4=N'%AIRPORT%',@5=N'%airport%',@6=N'%airport%',@7=0x0000000000000000,@8=N",@9=N",@10=0,@11=0,@12=0,@13=0,@14=1753-01-01 00:00:00',@15=1753-01-01 00:00:00',@16=00000000-0000-0000-0000-000000000000',@17=',@18=00000000-0000-0000-0000-0000
000000000000',@19=1,@20=1,@21=2021-01-28 00:00:00',@22=1,@23=2021-01-28 00:00:00',@24=1,@25=1,@26=1,@27=2021-01-28 00:00:00',@28=N'01905899'
select @p1
```

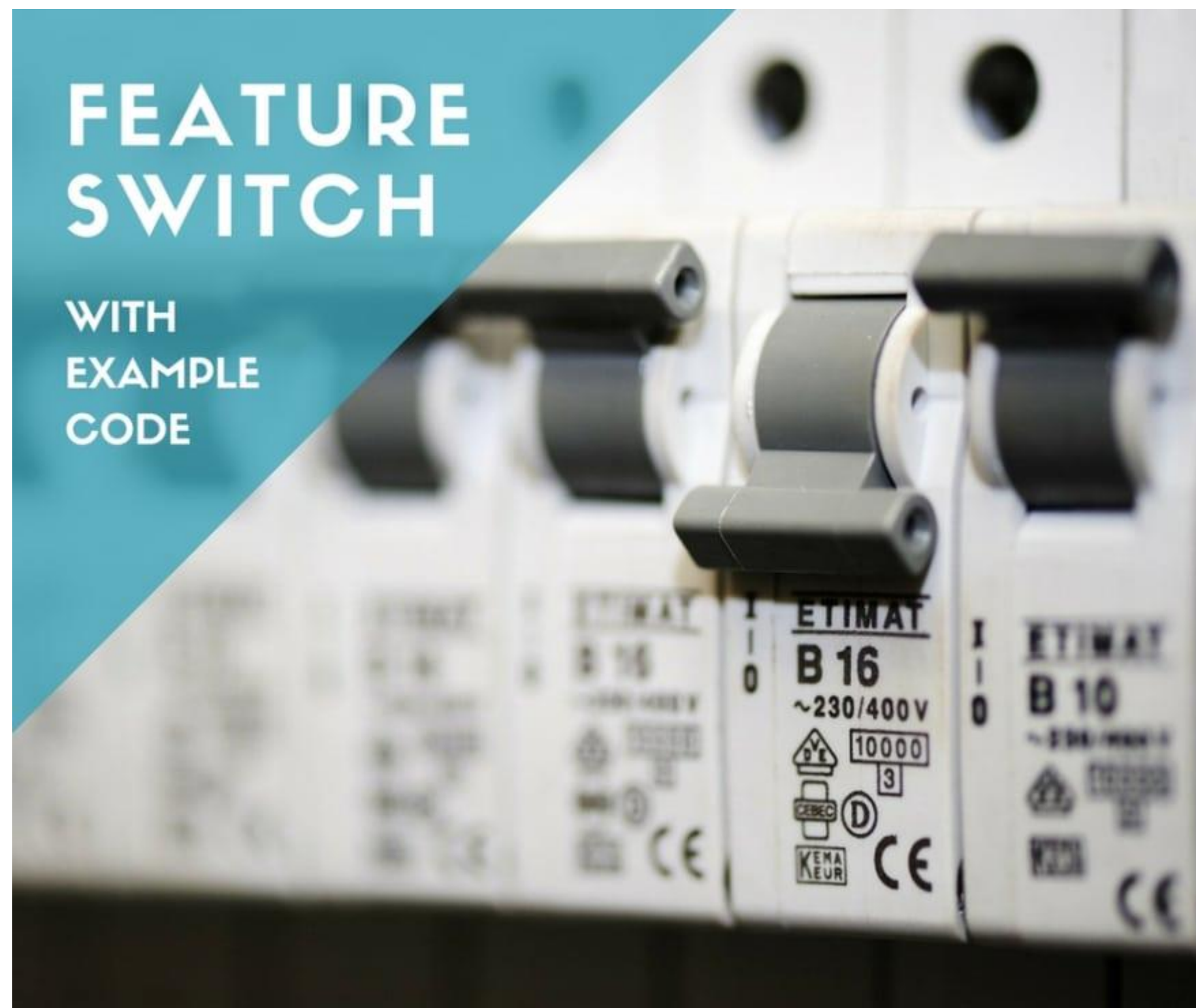
ApplicationName	TextData	CPU	Reads	Writes	Duration
Microsoft Dy...	declare @p1 int set @p1=159 exec s...	0	22	0	0

```
WHERE (
    "Customer"."No_" COLLATE latin1_general_100_ci_ai LIKE @1
OR
    "Customer"."Name" COLLATE latin1_general_100_ci_ai LIKE @2
OR
    "Customer"."Responsibility Center" COLLATE latin1_general_100_ci_ai LIKE @3
OR
    "Customer"."Location Code" COLLATE latin1_general_100_ci_ai LIKE @4
OR
    "Customer"."Phone No_" COLLATE latin1_general_100_ci_ai LIKE @5
OR
    "Customer"."Contact" COLLATE latin1_general_100_ci_ai LIKE @6
)
AND
(
    isnull("Customer"."No_",@8)<@28
)
ORDER BY "No_"
```

```
@0=50,
@1=N'%AIRPORT%',
@2=N'%airport%',
@3=N'%AIRPORT%',
@4=N'%AIRPORT%',
@5=N'%airport%',
@6=N'%airport%'
```

- You have > 1.000.000 records
- You have > 100.000.000 records

FEATURE SWITCH NEEDED



- Feature switch for system actions
- Global level (not just per page)
- For GUI elements as well

Customers: *Custom filtered*

Search

+ New



Process

Report

New Document

Customer

Navigate



Open in Excel

Actions

Views

**All*

Filter list by:

× Location Code

GELB



+ Filter...

Filter totals by:

Date Filter: ..01/28/21

No. ↑	Name	Responsibility Center	Location Code ▼	Phone No.	Contact	Balance (LCY)
01121212	Spotsmeyer's Furnishings		GELB		Mr. Mike Nash	0
01445544	Progressive Home Furnishings		GELB		Mr. Scott Mitchell	2,322
01454545	New Concepts Furniture		GELB		Ms. Tammy L. McDonald	344,207
01905893	Candoxy Canada Inc.		GELB		Mr. Rob Young	0
01905899	Elkhorn Airport		GELB		Mr. Ryan Danner	0
01905902	London Candoxy Storage Cam...		GELB		Mr. John Kane	0
20309920	Metatorad Malaysia Sdn Bhd		GELB		Mrs. Azleen Samat	0
20339921	TraxTonic Sdn Bhd		GELB		Mrs. Rubina Usman	0

Customers: *Custom filtered*

Search

+ New



Process

Report

New Document

Customer

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Open in Excel

Actions

Views

**All*

Filter list by:

× Location Code

GELB



× Name

B*

+ Filter...

Filter totals by:

Date Filter: ..01/28/21

Edit

Reset filters

No. ↑	Name ▼	Responsibility Center	Location Code ▼	Phone No.	Contact	Balance (LCY)
35122112	Bilabankinn		GELB		Kristjan Thor Arnason	0.0

AT LEAST 2 SQL CALLS

Filtering (alternative)

HOME ACTIONS

Edit - Table Filter - Customer [+ new](#)

	Field Number		Field Caption	Field Filter
	1	...	No.	
	2	...	Name	
	5	...	Address	

Close

- Predefined filters per object/table/user
- Just one SQL query to get result
- Dynamically change sorting of the page
 - It will help SQL to use proper key

Searching

I as customer service employee

- Mostly search for customers, orders or items

Provide generic search to find a customer, order or item (or mixed)

The image displays three screenshots of SAP search dialog boxes, arranged in a 2x2 grid with the bottom-right cell empty. Each dialog box has a light gray header bar with the text 'HOME' on the left. Below the header, the text 'Search Input' is followed by a small magnifying glass icon. A blue-outlined text input field is positioned below this. At the bottom of each dialog, there are two buttons: a blue 'OK' button and a white 'Cancel' button with a gray border.

- Top-left dialog:** The input field is empty. Below it, the text 'Find Customer by No., Name or E-Mail.' is displayed.
- Top-right dialog:** The input field contains a single vertical bar '|'. Below it, the text 'Find Sales Document by Number.' is displayed.
- Bottom-left dialog:** The input field is empty. Below it, the text 'Find Item by No., EAN, PNO or Description.' is displayed.

Searching

Magic



- Filter record with **appropriate index**
- Replicate needed data to another place
 - Do search there
 - Index with included columns
- **Do external search**
 - Fill data in external service
 - Redirect searching/filtering there

Fast browser

I as a customer service employee

- While talking with a customer on the phone need fast system reaction
- (≤ 2 sec)

Choose the optimal browser

- Standard NAV/BC – similar performance
- Adding more controls -> 2-8 seconds difference
- Browser updates can cause diff. speed



Opera



Google Chrome



Safari



Mozilla Firefox



Internet Explorer



Microsoft Edge

Dashboards

I as a customer service employee

- Can't use 100 different pages and filters
 - Need dashboard with all relevant information
 - Every order, customer or item should provide information needed to solve the issue

Provide dashboards

- Main role center/dashboard should have all main links
- Provide data on demand
 - Not on
 - Opening the page
 - Running the report
 - Core ERP functionality

A lot of data

Dynamics 365 Business Central

CRONUS AG

Sales

Purchasing

Inventory

Posted Documents

Setup & Extensions



Items

Customers

Item Journals

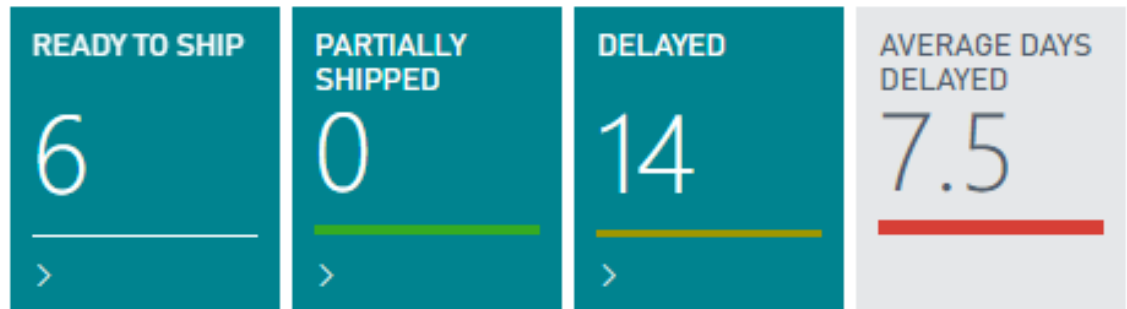
Sales Journals

Cash Receipt Journals

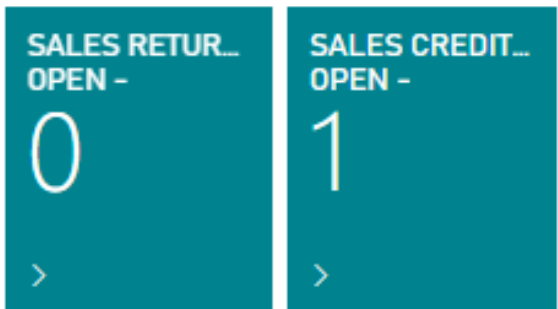
Transfer Orders



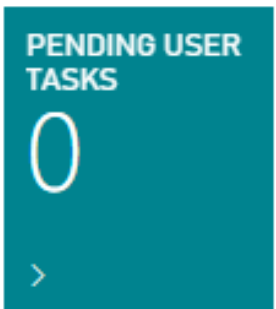
SALES ORDERS RELEASED NOT SHIPPED



RETURNS



MY USER TASKS

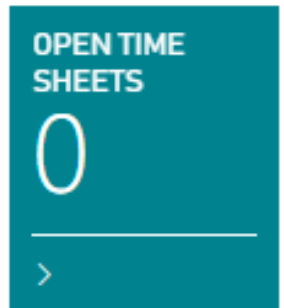


Insights

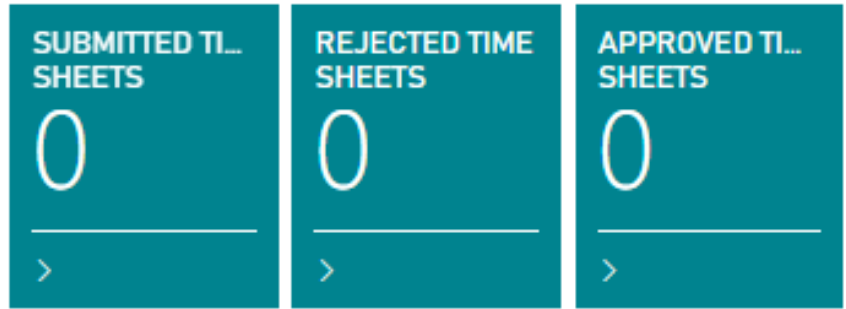
My Customers

Customer No. ↑	Name	Phone No.	Balance (LCY)
01445544	Progressive Home Furnish...		2,322.63
01454545	New Concepts Furniture		344,207.60
10000	Möbel-Meller KG		259,426.65
20000	Blütenhaus GmbH		148,372.39
30000	Gilde Jupiter Versicherung...		541,098.42

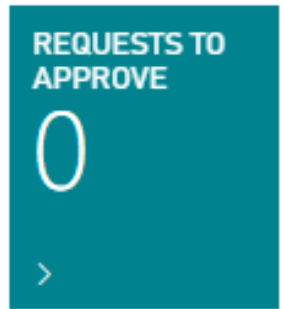
Self-Service TIME SHEETS



PENDING TIME SHEETS

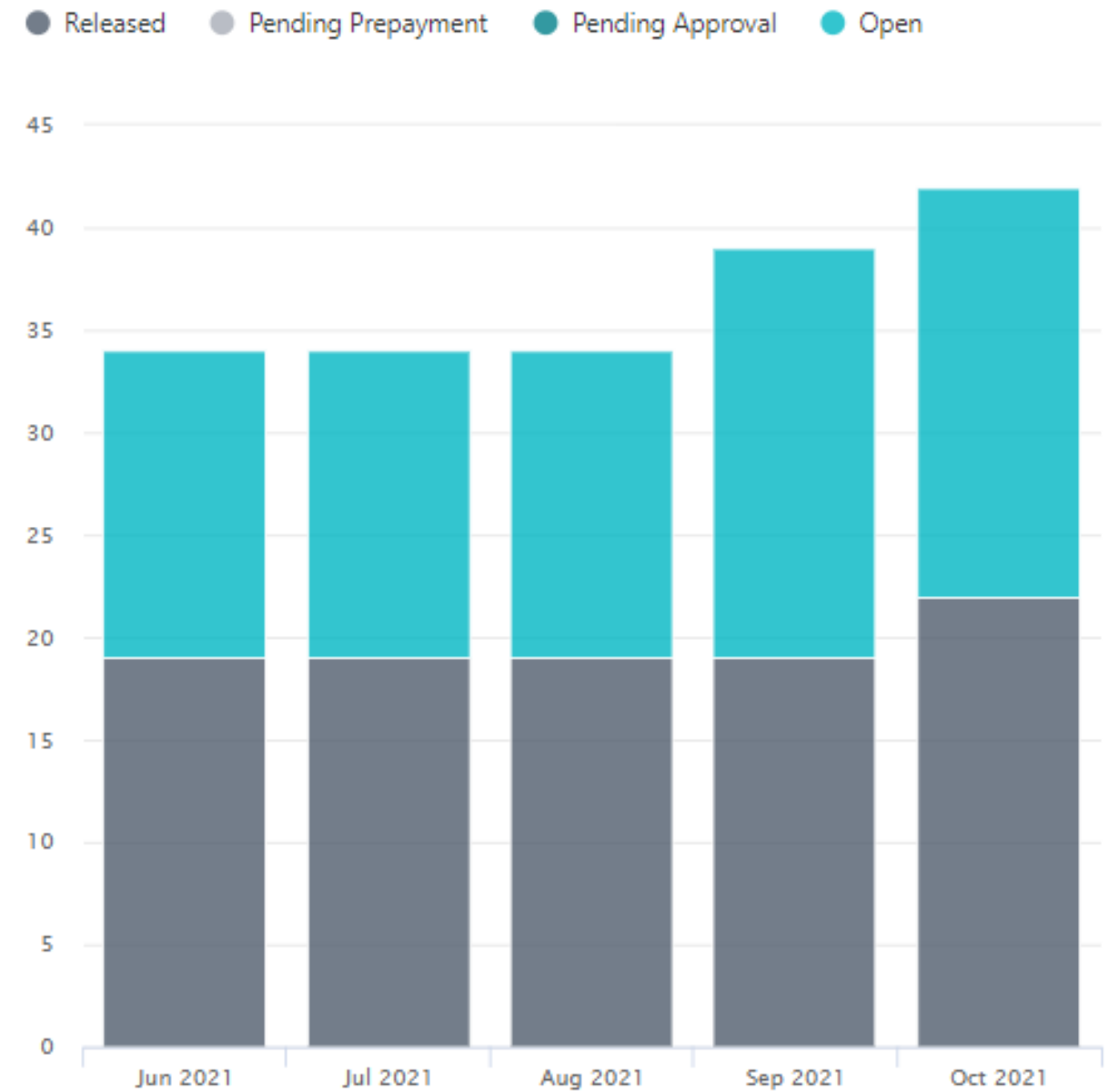


APPROVALS



Trailing Sales Orders

All Orders|Month|No. of Orders|. (Updated at 6:22:57 PM.)



A lot of data

SALES ORDER | WORK DATE: 1/28/2021



✓ SAVED

104015 · VisioSound

Process Release Posting Prepare Order Request Approval Print/Send Navigate More options

General

Show more

Customer Name	VisioSound	Order Date	1/20/2021	External Docume...	
Contact		Due Date	2/20/2021		
Posting Date	1/20/2021	Requested Deliver...			

Lines Manage Line Order Fewer options

Type	No.	Description	Location Code	Quantity	Qty. to Assemble to Order	Reserved Quantity	Unit of Measure Code	Unit Pr
→ Item	LS-120	Lautsprecher, schwarz, 120 W	WEISS	4			STÜCK	

Subtotal Excl. VAT...	352.00	Invoice Discount %	0	Total VAT (EUR)	66.88
Inv. Discount Am...	0.00	Total Excl. VAT (EU...	352.00	Total Incl. VAT (EUR)	418.88

Invoice Details >

1M(8T)

Shipping and Billing >

1/20/2021

Foreign Trade >

Prepayment >

0 2/20/2021

Details Attachments (0)

Sell-to Customer Sales History

0	0	3	0
Ongoing Sales Quotes	Ongoing Sales Blanket Orders	Ongoing Sales Orders	Ongoing Sales Invoices
0	0	0	0
Ongoing Sales Return Orders	Ongoing Sales Credit Memos	Posted Sales Shipments	Posted Sales Invoices
0	0		
Posted Sales Return Receipts	Posted Sales Credit Memos		

Customer Details

Customer No. 61000
Name VisioSound
Phone No.
Email
Fax No.
Credit Limit (LCY) 0.00
Available Credit (LCY) 0.00
Payment Terms Code 1M(8T)
Contact

Sales Line Details

Item No. LS-120
Required Quantity 4
ATTACHMENTS
Documents 0
AVAILABILITY

REAL TIME
CALCULATION



Automation

I as a return department employee

- Need to worry about my daily business, not the system

New return order

- Fill-in customer
- Fill-in items
- Or copy document

Automation

Sales Return Order

Process Release Posting Request Approval Print/Send Return Order Navigate More options

General

Show more

Customer Name	*		Posting Date		Campaign No.	
SELL-TO			Order Date		Responsibility Center	
Country/Region			External Document		Assigned User ID	
Contact			No. of Archived Ver...	0	Status	Open

Lines		Manage	More options							
Type	No.	Description	Return Reason Code	Location Code	Quantity	Unit of Measure Code	Unit Price Excl. VAT	Tax Group Code	Line Dis	
→	⋮									

Subtotal Excl. VAT (EUR)	0.00	Invoice Discount %	0	Total VAT (EUR)	0.00
Inv. Discount Amou...	0.00	Total Excl. VAT (EUR)	0.00	Total Incl. VAT (EUR)	0.00

Invoice Details >

Shipping and Billing >

Foreign Trade >

Functions Warehouse

- Calculate Invoice Discount
- Copy Document...
- Move Negative Lines...
- Post and Print...
- Archive Document
- Send IC Return Order Cnfm.
- Post...
- Preview Posting
- Attachments

IT TAKES TIME

Automation

...make completely new types of pages?

Minimize frontend effort (->backend)

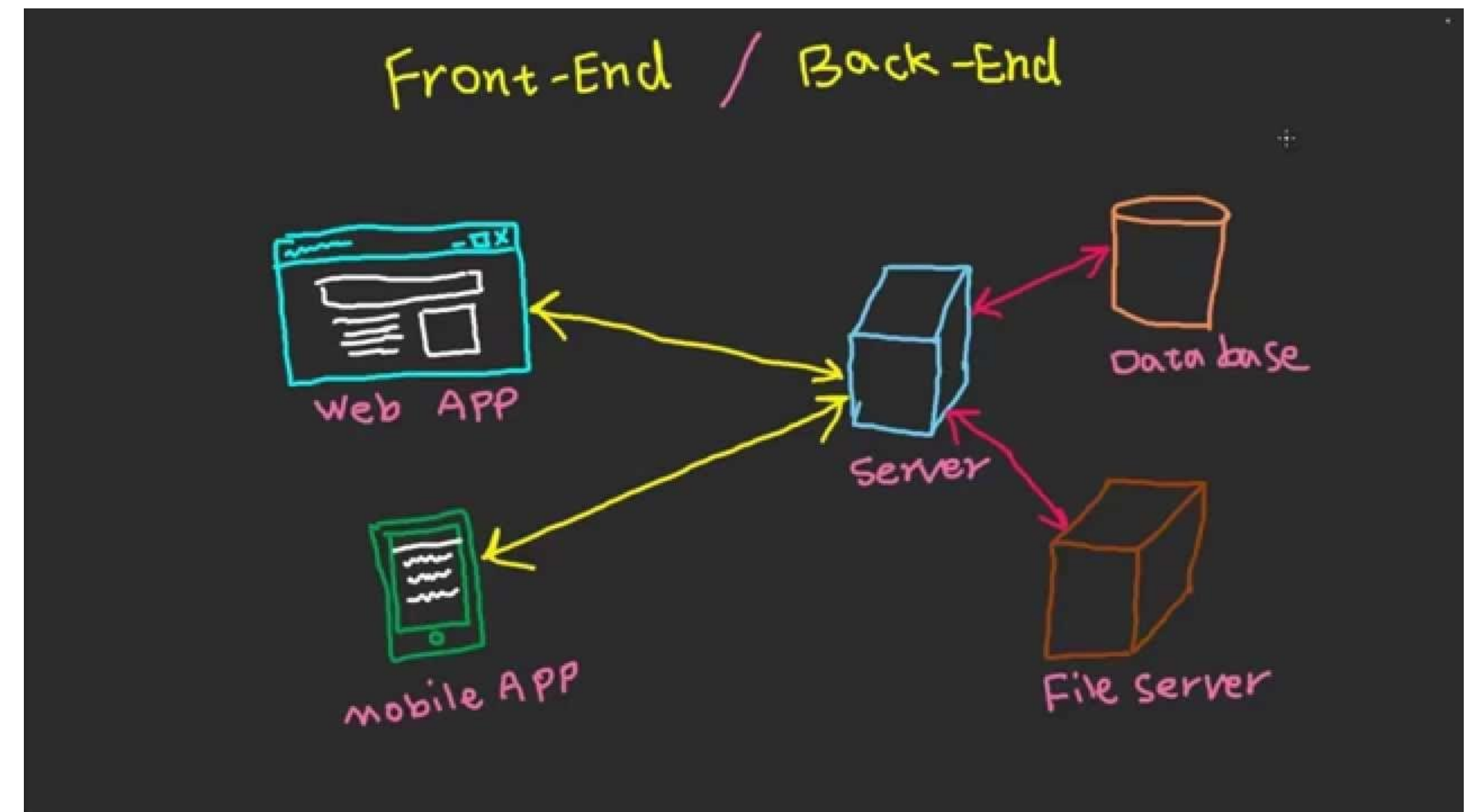
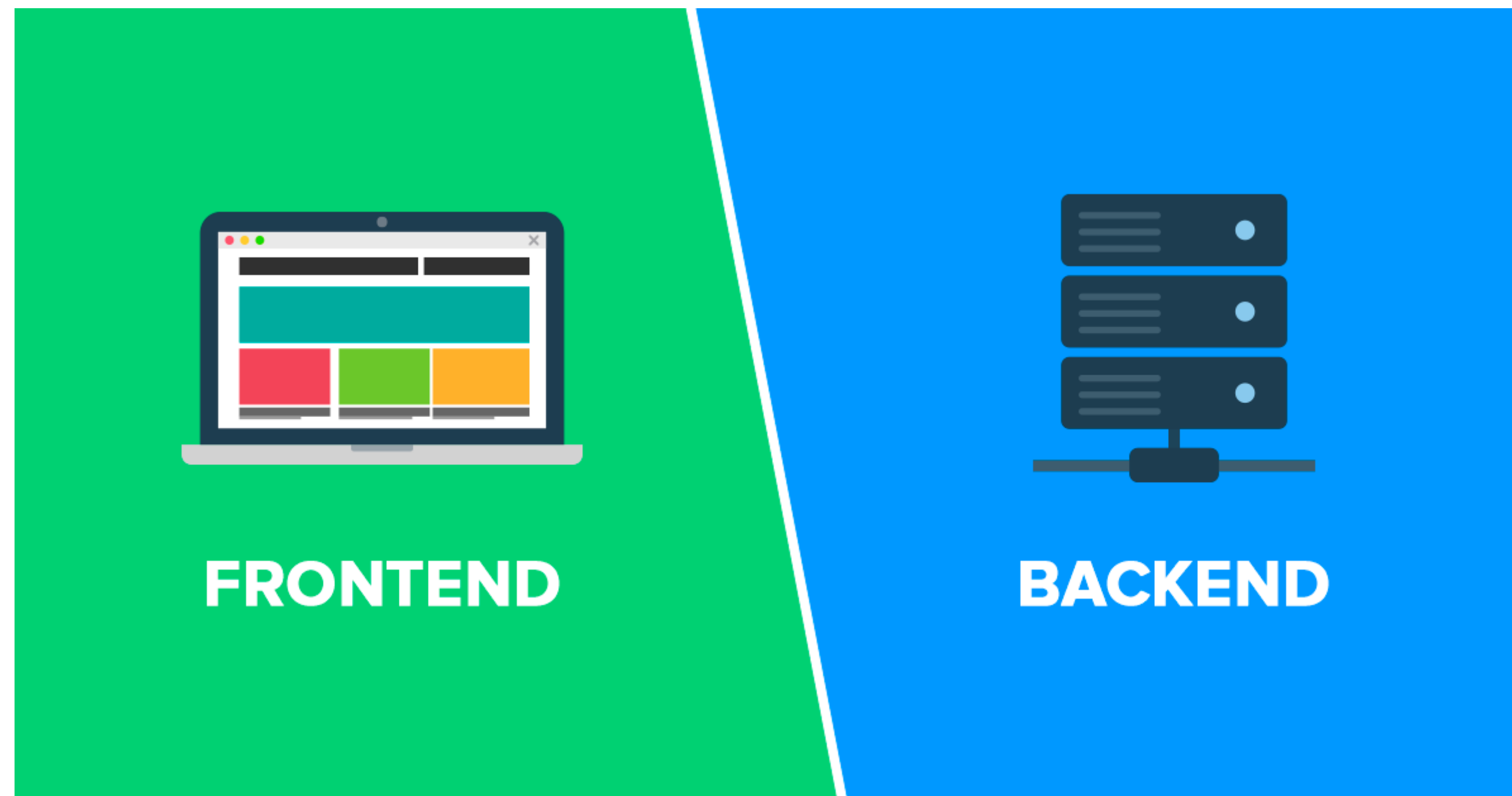
- Documents creation
- Printing (showing pop-up for a printer)
- Releasing, approving, posting
- Calling APIs
- Offer reaction of the system
<2 sec

Order, EAN, return reasons
Back, forward, create, approve
Yes, No

Performance (backend)

Backend is the king

- Heavy actions belong to the backend
- Take locks/long trans. out of the user perspective



4 rules about Backend (+ hints)

Posting buffer

Reporting buffer

Stock buffer

Payment buffer

Pattern 1 – posting buffer

Posting should be background process (**of everything**)

- Control source of documents (sales, purchase, manufacturing...)
- Define priorities
- Define posting times
- Enable re-trying of posting
- Enable monitoring on it
- Implement parallelisms
- Create feature of it, app....

Rule 1 – posting buffer

Hint

- Nice to have dedicated instances/hardware
- Use fast CPUs
 - Fsv2-series (3.4GHz and a max. single-core turbo frequency of 3.7 GHz).

Expected speed

- Sales order with 4 item lines in high demanding environment (big data and heavy orders)
 - Posting of shipment and invoice should be way faster than 1 second

Rule 2 – reporting buffer

Use reporting buffer for all printouts (shipments, invoices....)

- Posting shouldn't be a reason to have a printout
- Combine source for main printouts in one place
- Fill reporting buffer when you need printout
- Print it from the reporting buffer

Rule 3 – Stock buffer

Posting shouldn't be a reason to get available inventory (simulated as well)

- Standard vs. advanced reservation logic
 - Performance
 - Location/system independent
 - Intercompany feature enabled by default
- Introduce new layer where available stock is traced
- Data source can be ERP & other systems
 - Posting is not any more prerequisite to close/release next document

Rule 4 – Payment buffer

Posting shouldn't be a reason to control open balances (customers, vendors)

- Introduce new layer where it is traced
 - Amounts from the documents which are waiting for the posting process
- Use it as a payment for next document (or even Refund)
 - Posting is not any more prerequisite to start new sales/purchase document

```
[.autoscale: true]
```

Hint 1 – don't slow down main process

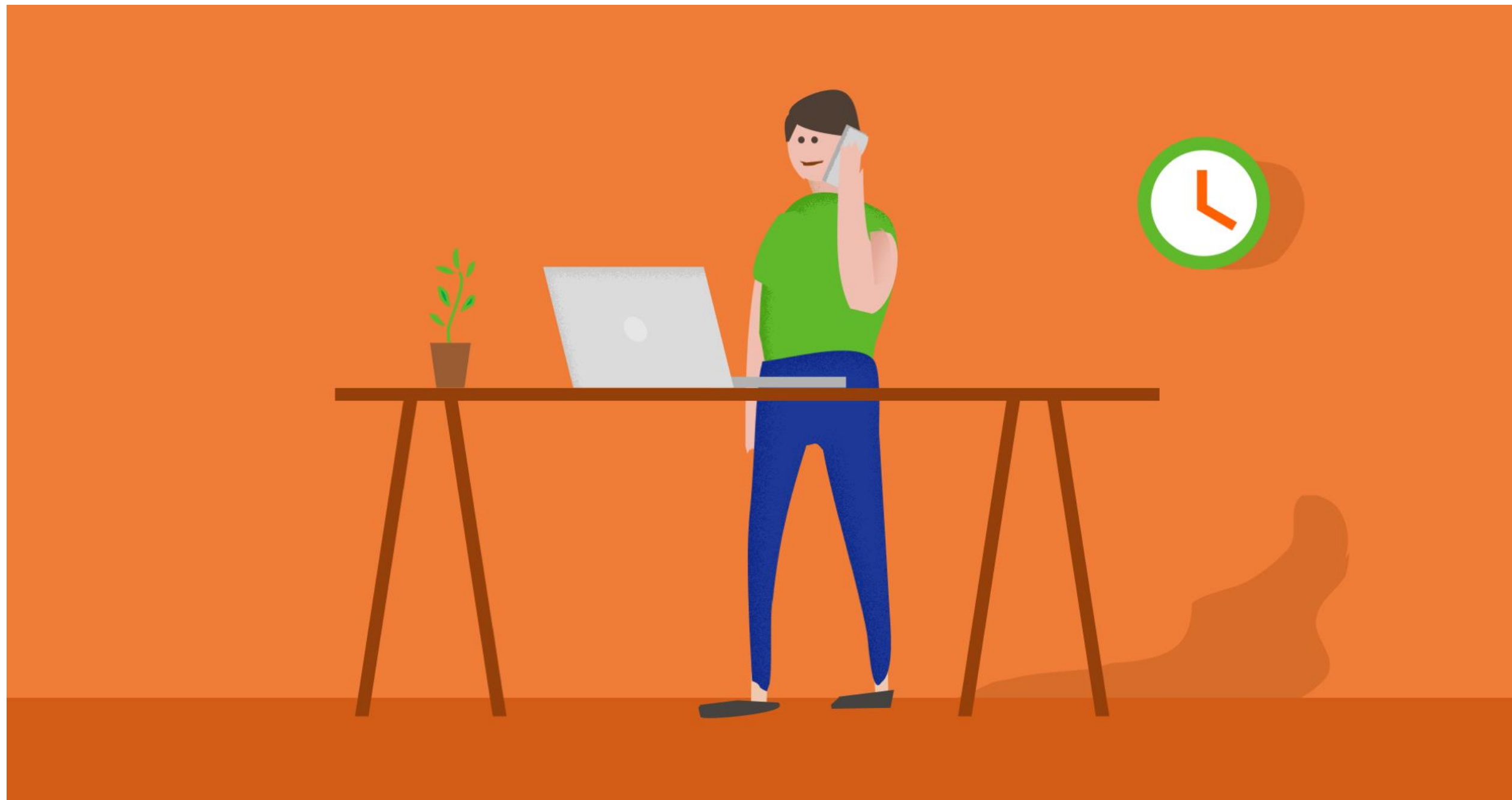
There are processes which are core, certificated, standard



- Any posting process
- Any document creation
- Anything what will limit processing your current volume (at least x2) during normal working hours
- Don't change the core
- There is even too many standard indexes in core
- Find another way to develop your features

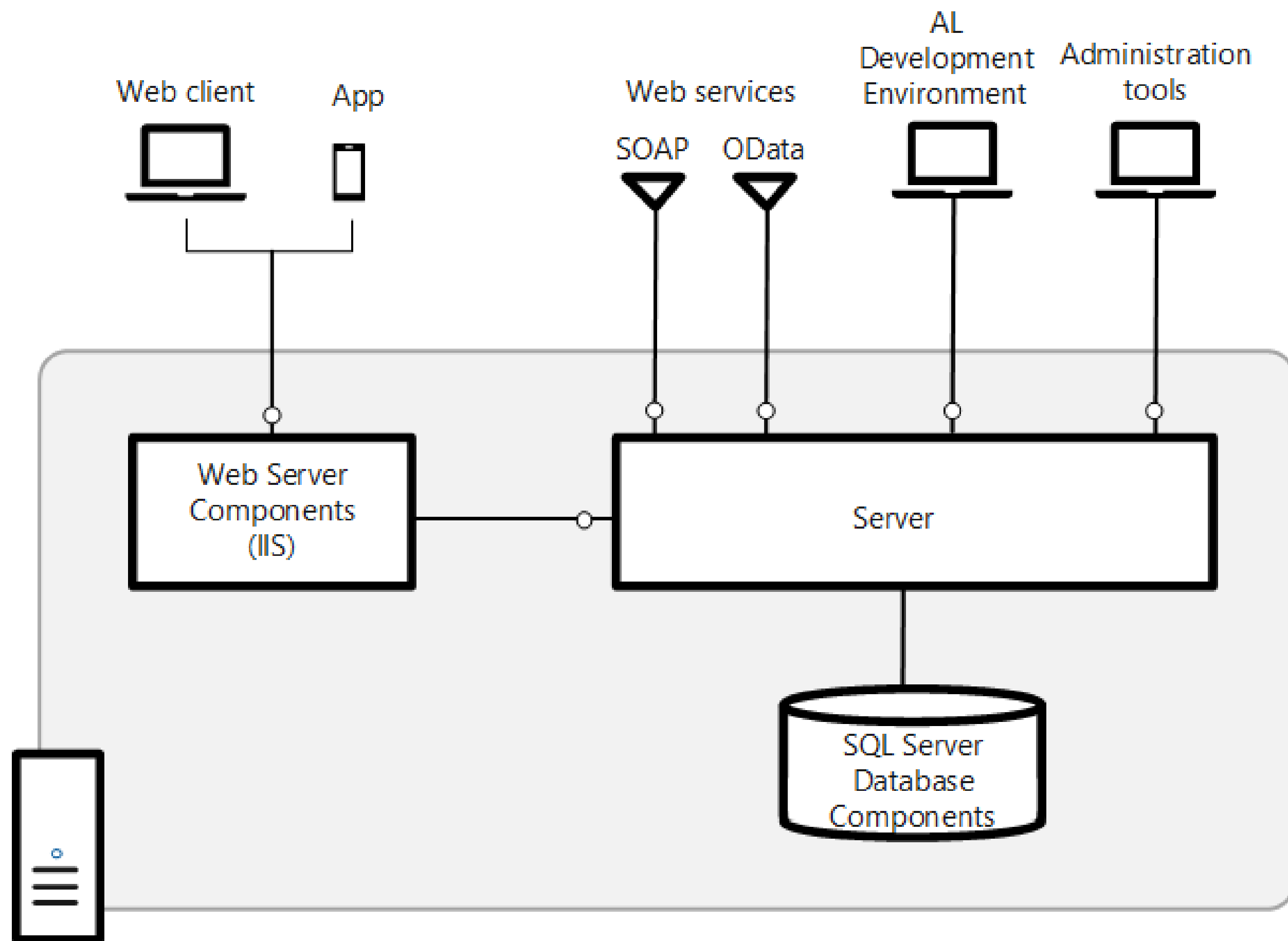
Hint 2 – Leave non working hours free

Offer scalability



- Reduce heavy batches during the night
- Execute them during working hours
- Use non working hours for infrastructure
- Use non working hours for growth

Hint 3 – Use system as a framework



If you can do it better, just do it

- Standard features vs. new feature
- Standard features are general
- You need one part of it, use this advantage
- Use system as a framework
- Build your own world

System monitoring & alerting



- Enterprise platforms are offering amazing performance
- Someone is taking care about performance

Business size

Enterprises by business size. ... In small and medium-sized **enterprises (SMEs)** employ fewer than 250 people. **SMEs** are further subdivided into micro **enterprises** (fewer than 10 employees), small **enterprises** (10 to 49 employees), medium-sized **enterprises** (50 to 249 employees). Large **enterprises** employ 250 or more people.

Entrepreneurship - Enterprises by business size - OECD Data

[https://data.oecd.org › entrepreneur › enterprises-by-business-size](https://data.oecd.org/entrepreneur/enterprises-by-business-size)

System monitoring & SME

SME patterns

- System should offer great performance by design
- Features have in many cases priority vs. performance

Reality

- Without working on performance, it is not getting better
- SME & Enterprise performance requirements have been never closer

Basic monitoring – why he's showing this?



Basic monitoring – what?

- Hardware – standard
- DISK I/O – can be (if they are limited such @Cloud)
- DB
 - Long running transactions
 - Waits
 - Deadlocks

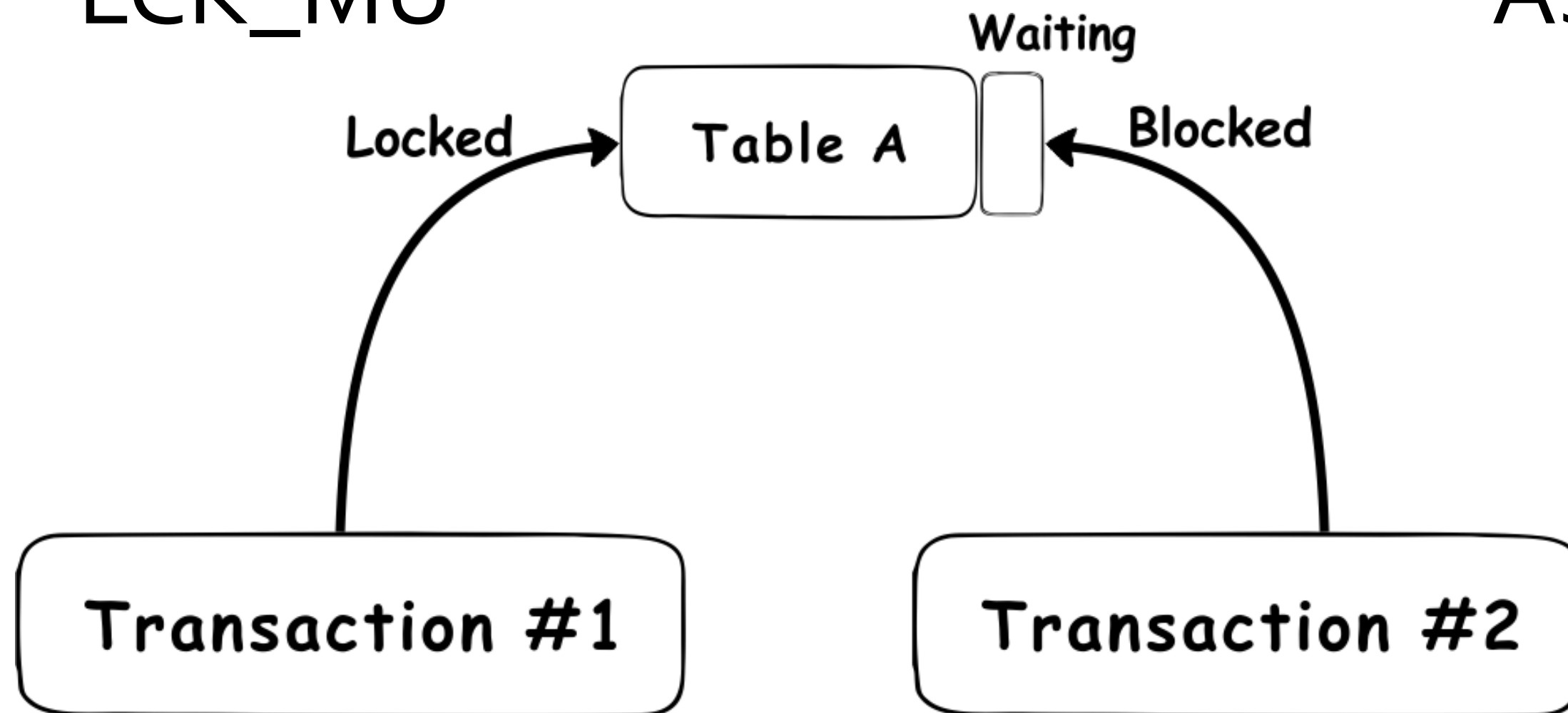
Heavy & long running queries

TOP 50 QUERIES		TOP 10 WAITS		Show as: <input checked="" type="radio"/> Avg. per execution <input type="radio"/> Totals			
Query Text	Execution count	Duration (ms) ▼	CPU time (ms)	Physical reads	Logical reads	Logical writes	Database
> SELECT TOP (@0) "5107"."timestamp","51...	2	13,618	13,231	0	1,826,838	0	
> SELECT "23"."timestamp","23"."No_","23...	2	11,802	42	0	4,022	0	
> SELECT TOP (@0) "18"."timestamp","18"...	1	7,944	7,908	0	529,032	0	
> SELECT TOP (@0) "18"."timestamp","18"...	1	7,507	7,417	1	529,026	0	
> SELECT TOP (@0) "18"."timestamp","18"...	1	6,895	6,578	0	494,752	0	
> SELECT TOP (@0) "5107"."timestamp","51...	2	6,544	6,488	0	1,006,558	0	

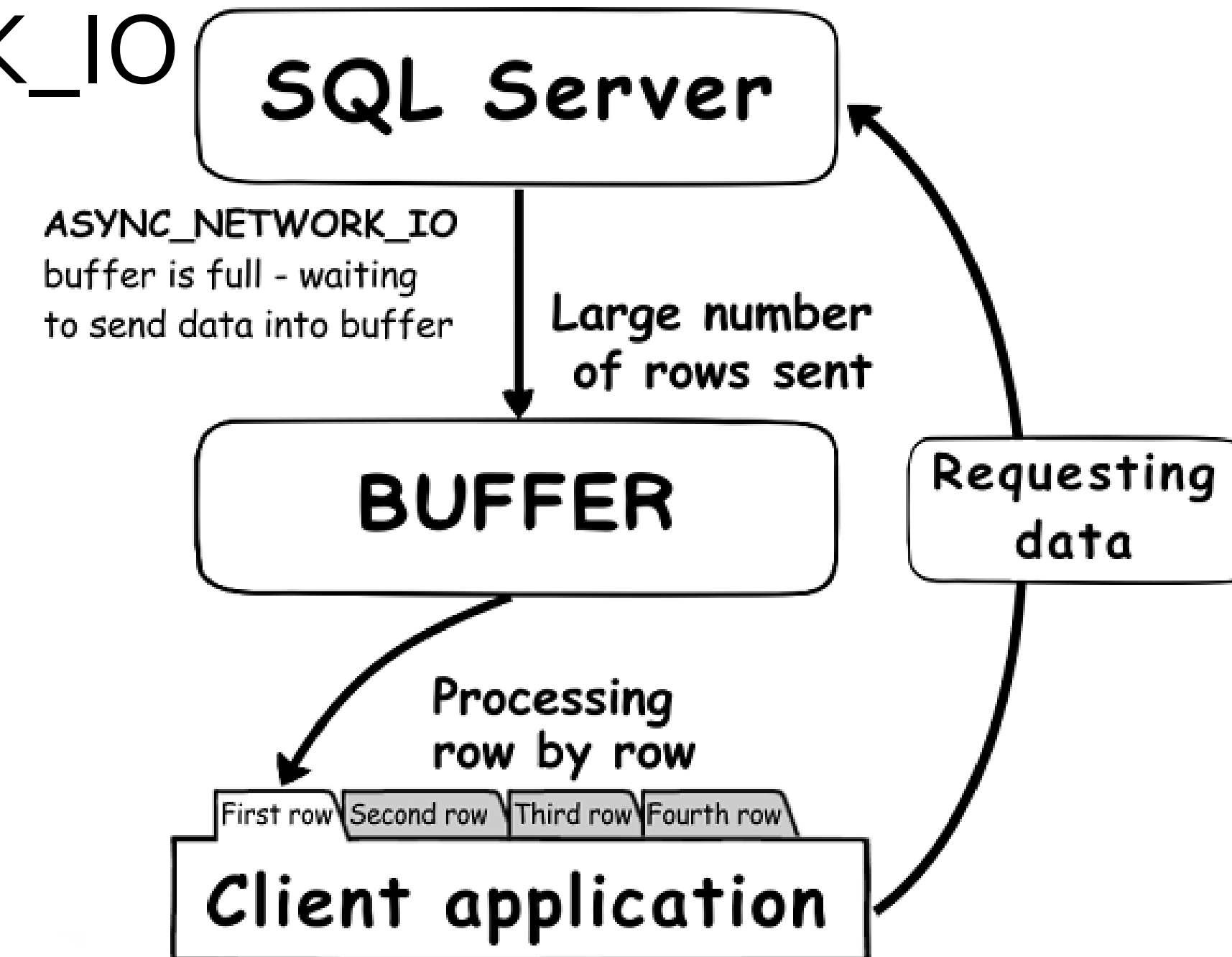
- Check on daily or at least on weekly basis
- Create SLA
- React according to SLA

Waits - critical wait types

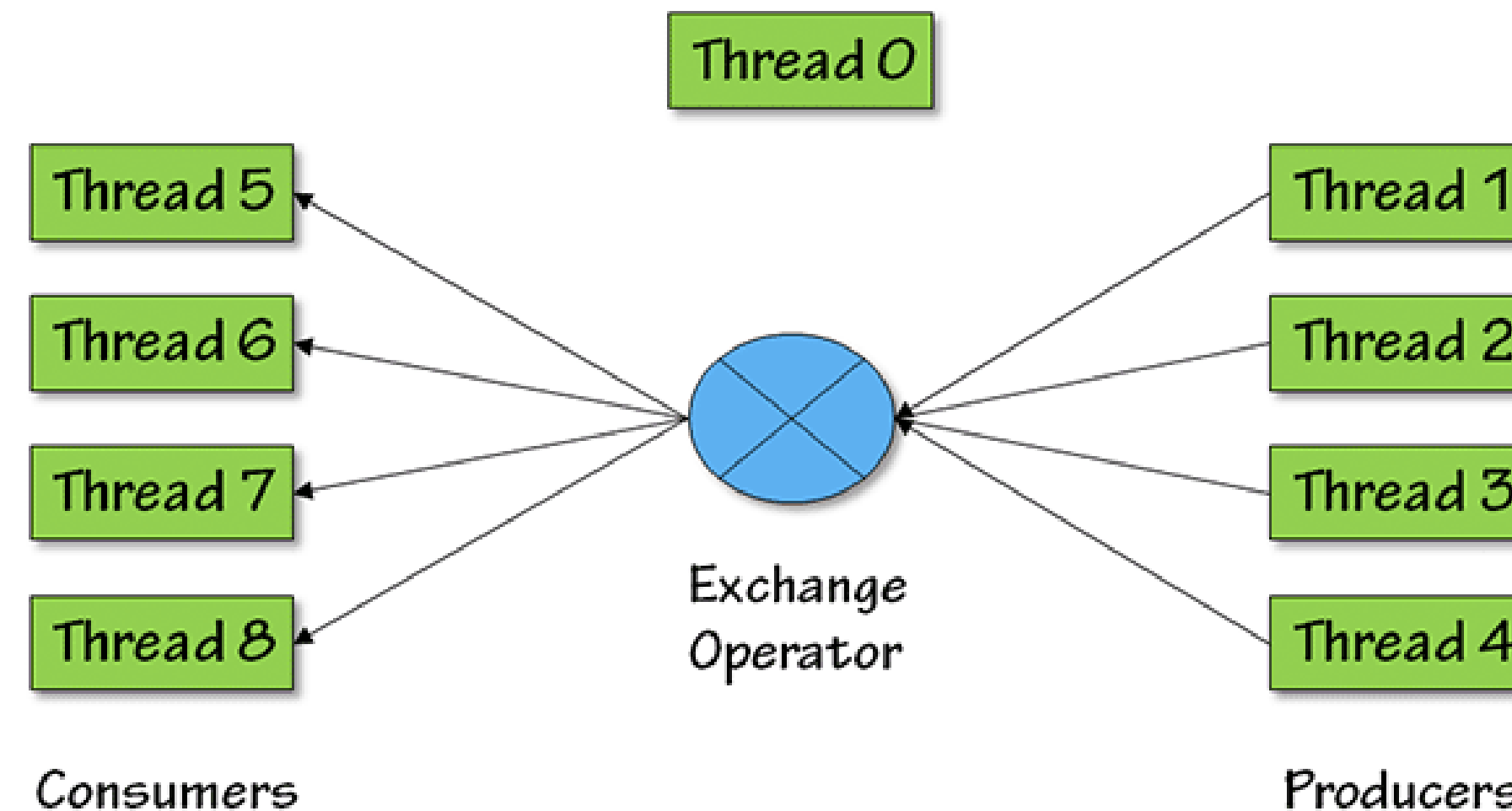
LCK_MU



ASYNC_NETWORK_IO



CXPACKET



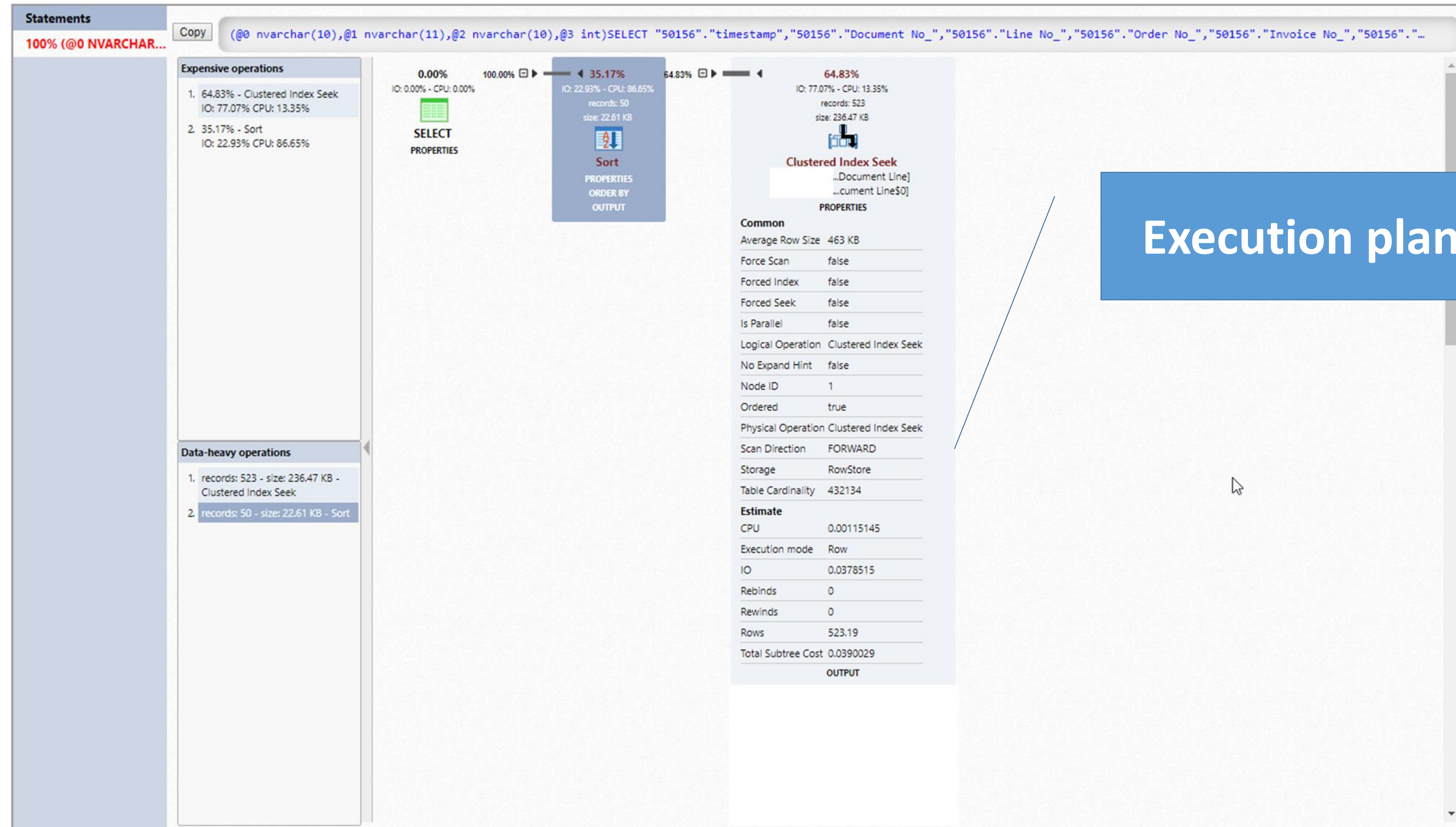
Queries which cause waits

Query Text	Execution count ▼	Duration (ms)	CPU time (ms)	Physical reads	Logical reads	Logical writes
> UPDATE [...].[dbo].[\$ndo\$taskscheduling] SET [state] =...	8,928	0	0	0	18	0
> DELETE ase FROM [dbo].[Active Session] AS ase INNER JOIN INSERTED ...	5,145	2	0	0	19	0
> SELECT "472"."timestamp","472"."ID","472"."User ID",DATALENGTH("47...	3,084	1	0	0	2	0
> SELECT SUM("37"."Outstanding Qty_ (Base)") FROM " ...	1,365	1	1	0	816	0

- Check on daily or at least weekly basis
- Create SLA
- React according to SLA

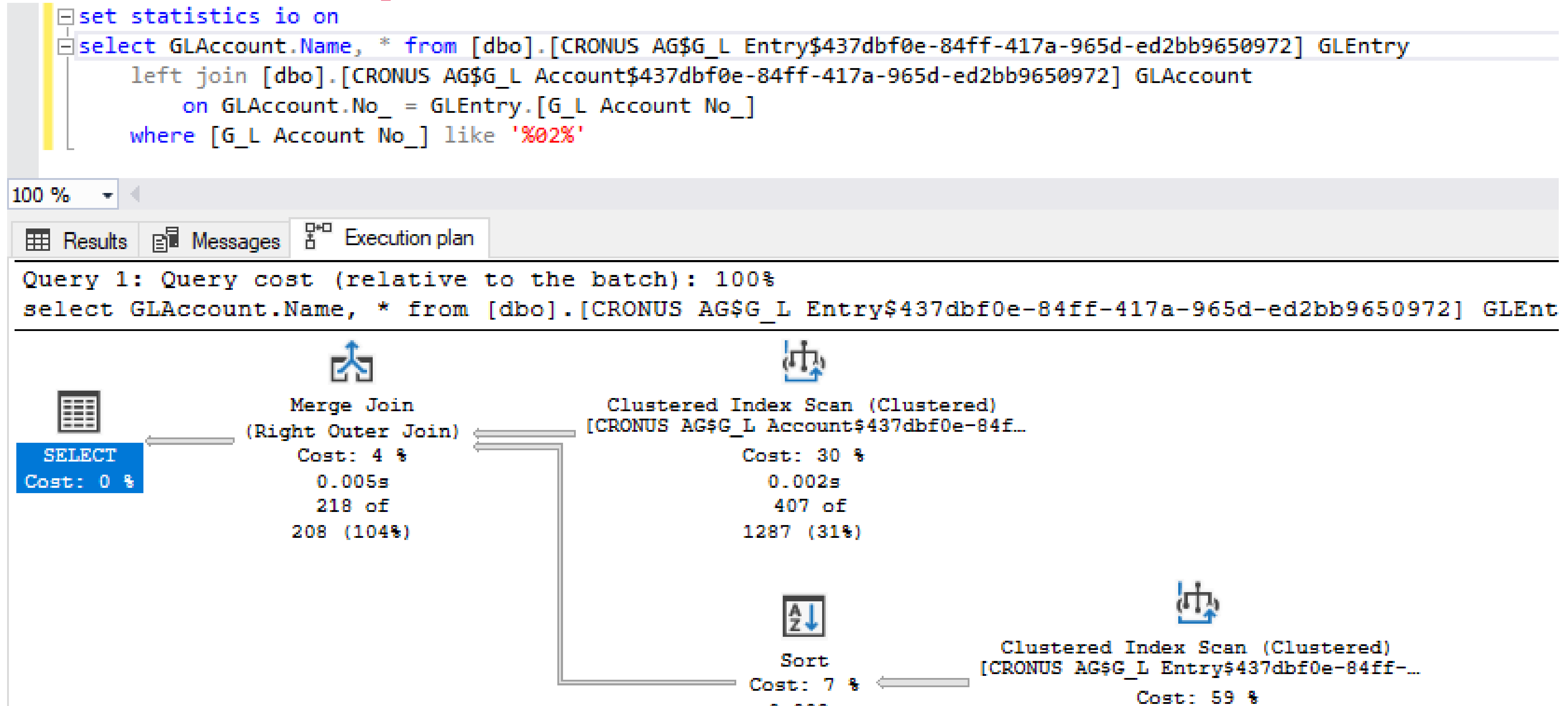
Execution plan

QUERY PLAN (DOWNLOAD)



Execution plan details

Execution plan (SSMS)



Always execute NAV/BC query (Parameter Sniffing)

Deadlock

MEDIUM Deadlock (extended event)

Status: **Event** Time raised: 2 Oct 2019 07:45

Alert Inbox Newer Older Clear Unclear Read Unread Comment Email Configure alert...

Details Output Comments Alert history Occurrences Description

Object:
Sales Line\$VSIFT\$17

SPID: 170
(process20a93995c28)
Host name: AVM-NAV-NAS1
Application: Microsoft Dynamics NAV Server
Login name: NAVISION\nas_msx01

keylock
Object: Sales Line\$VSIFT\$17
Waiter: RangeS-I
Owner: X

keylock
Object: Sales Header - Last Modified
Waiter: S

SPID: 183
(process20868acf088)
Host name: AVM-NAV-NST7
Application: Microsoft Dynamics NAV Server
Login name: NAVISION\service.nst

SPID: 170 (process20a93995c28)
Host name: AVM-NAV-NAS1
Database: 7

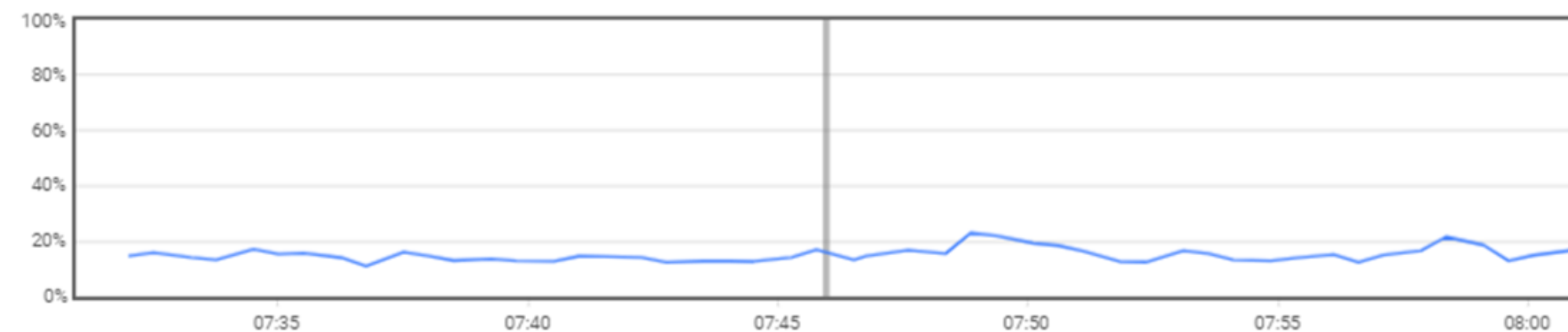
Login name:
service.nst

Hostname:
AVM-NAV-NAS1

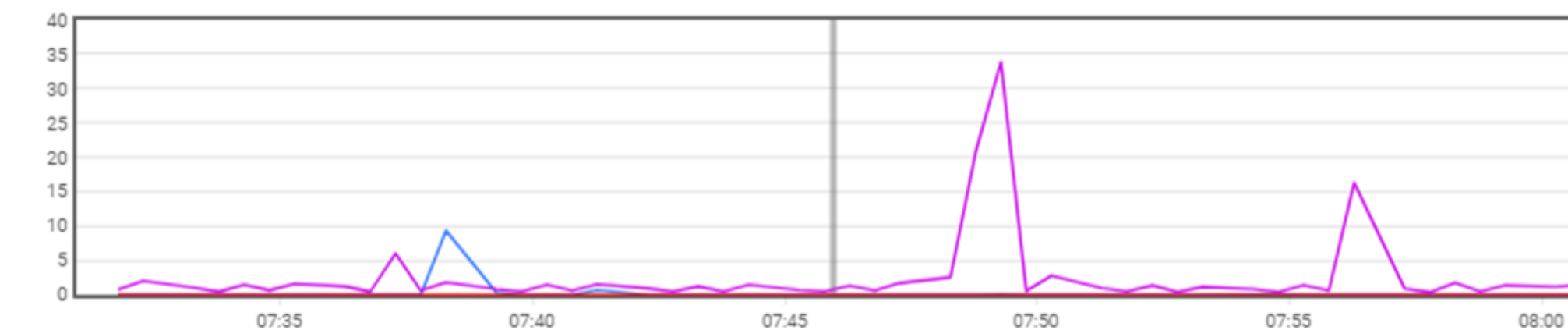
PERFORMANCE DATA

Host machine SQL Server System processes SQL processes / Profiler trace Top queries

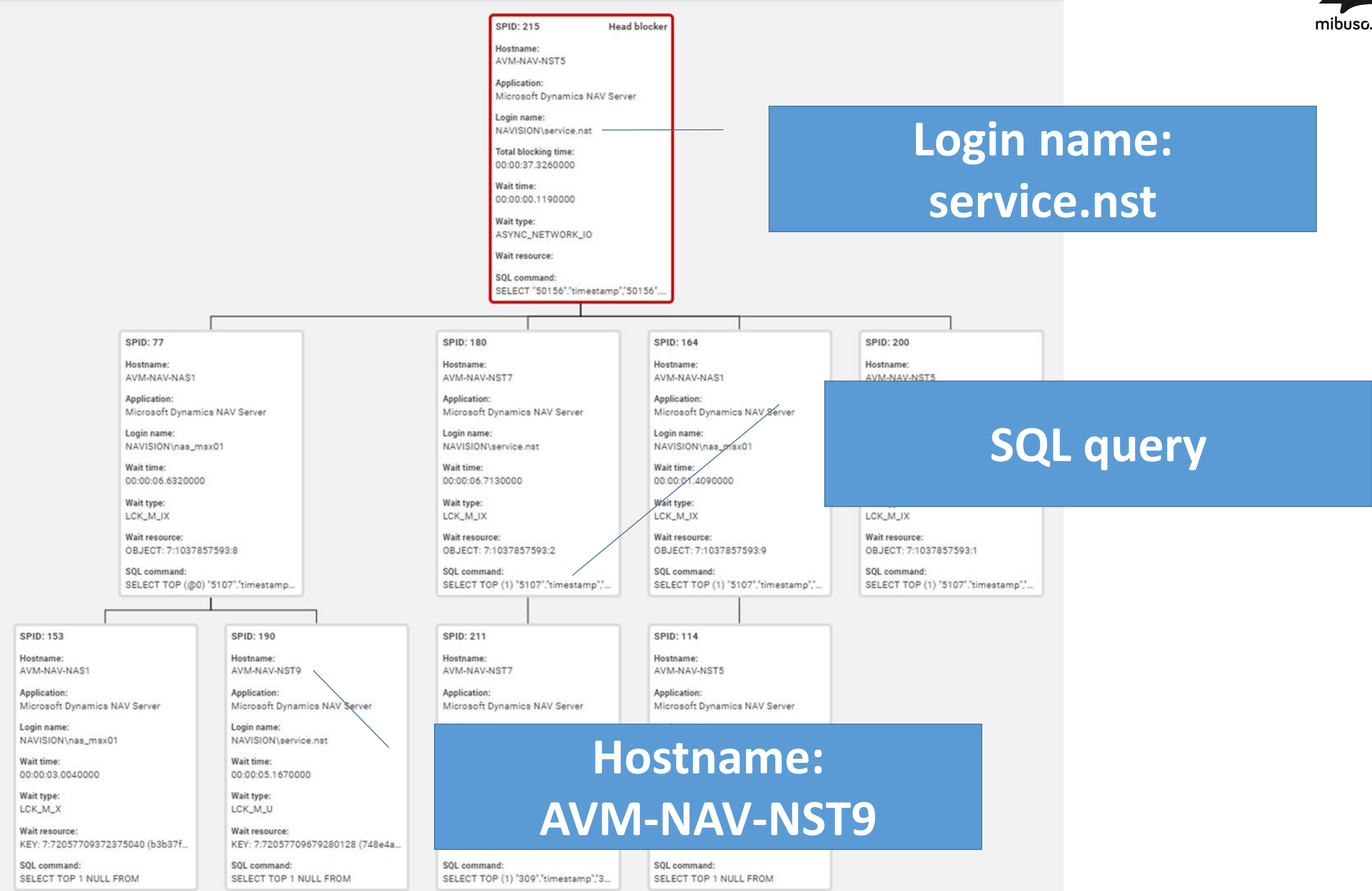
MACHINE: PROCESSOR TIME (%)



AVG. DISK QUEUE LENGTH



Deadlock source and affected processes



NAV/BC Service possibility

BC150 - (Running)

General			
Build Restriction:	WarnClient	Lockout Failed Sign-In Attempts Window:	0
Century Cutoff for 2-Digit Years:	-1	Max Concurrent Calls:	1000
Certificate Thumbprint:		Max Data Rows Allowed to Send to Excel:	MaxValue
Compile and Load Business Application:	<input checked="" type="checkbox"/>	Max Items in Object Graph:	512
Credential Type:	Windows	Maximum Stream Read Size:	1000000
Data Cache Size:	10	Multitenant:	<input type="checkbox"/>
Default Client:	Windows	Network Protocol:	Default
Default Language:	en-US	Non-Interactive Sessions Log Retain Time Interval:	5.00:00:00
Diagnostics Trace Level:	Normal	Server Instance Name:	BC150
Diagnostics Trace Level for external proxies:	Error	Services Default Company:	
Disable Token-Signing Certificate Validation:	<input type="checkbox"/>	Services Default Time Zone:	UTC
Disable Writes Inside Try Functions:	<input checked="" type="checkbox"/>	Services Language:	en-US
Enable Certificate Validation:	<input checked="" type="checkbox"/>	Services Option Text Source:	OptionCaption
Enable Event Logging to Windows Application Log:	<input checked="" type="checkbox"/>	Session Event Table Retain Time Interval:	90.00:00:00
Enable File Access by C/AL Functions:	<input checked="" type="checkbox"/>	Supported Languages:	
Enable Full C/AL Function Tracing:	<input type="checkbox"/>	Token Signing Validation Mode:	IssuerNameValidation
Enable Incremental Company Deletion:	<input type="checkbox"/>	UI Elements Removal:	LicenseFileAndUserPermissions
Enable Session Creation While Sync And Data Upgrade Pending:	<input checked="" type="checkbox"/>	Use NTLM Authentication:	<input type="checkbox"/>
Encryption Provider:	LocalKeyFile	XML Metadata Cache Size:	500
Lockout Failed Sign-In Attempts Count:	0		

Who's causing the problems?

Where is USER ID?

- No User ID on DB level is a deadlock
 - NAV/BC session ID \neq SQL process ID
- For smaller installations it can be fine
- For high demanding it is an open question
- What about SaaS?

Basic monitoring – what NOT?

NAV/BC Server Performance Counters

- Active sessions
- Average server operation time
- Open connections
- Calculated fields cache total requests



Telemetry (of processes)

Tracking execution

For what

- To be sure that system works as expected (or NOT)

Monitoring + alerting (24/7)

- Task Scheduler jobs
 - Automation = high number of jobs
- Status of different processes
 - Not expected status
- Buffers
 - Errors, warning
- Interfaces
 - Status, connection status
 - Errors

Search...

Host Summary

0

Hosts Down

79 Up

Service Summary

27

Services Critical

1320

Ok

24

Warning

27

Critical

4

Unknown

< 1 2 3 >

Search... service_state = 1 & service_handled = 0

10 Sort by Service Severity

WARNING since 16:01	Load on LOAD AVERAGE WARNING : 12.67,12.55,11.47	!
WARNING since 15:15	Processes on nexus.navision PROCS WARNING : count 225	!
WARNING since 12:37	ESB Queue WARNING - messages: 40	!
WARNING since 12:34	/boot 93.48 MB used (39.73%, Max=235.32 MB) /run/shm 0.00 MB used (0.00%, Max=3989.21 MB) / 640519.38 MB used (85.00%, Max=753553.89 MB) /dev 0.00 MB used (0.00%, Max=3978.68 MB)	!
WARNING since 12:34	esb. SSL WARNING - Certificate expires in 10 day(s) (2019-11-28 10:03 +0100/CET).	!
WARNING since 12:31	Processes on PROCS WARNING : count 226	!
WARNING since 12:29	Processes on PROCS WARNING : count 159	!
WARNING since 12:28	Memory on MEMORY WARNING : Mem used: 85.31%, Swap used: 5.23%	!
WARNING since 12:28	0 Security Updates Available. 226 Non-Security Updates Available	!
WARNING since 12:26	WARNING : up 74 days, 07:01:21	!

24/7 alerting for super critical checks

Tracking speed

For what

- Process duration

Monitor speed + SLA

- Speed of different processes
 - Document creation
 - Releasing
 - Posting
 - Waits
 - ...
- Interfaces
 - Request
 - Response

.Ops dashboard

Dashboard for Team NAV 3

[Update in background](#)[Fullscreen](#)

150.75



a few seconds ago



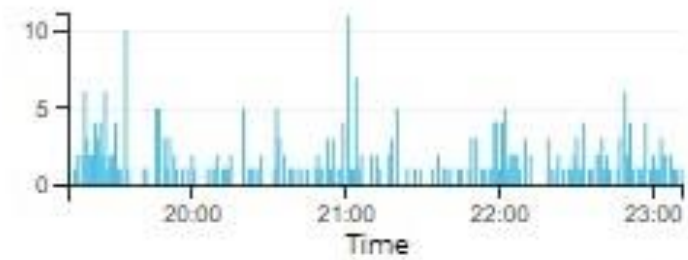
a few seconds ago



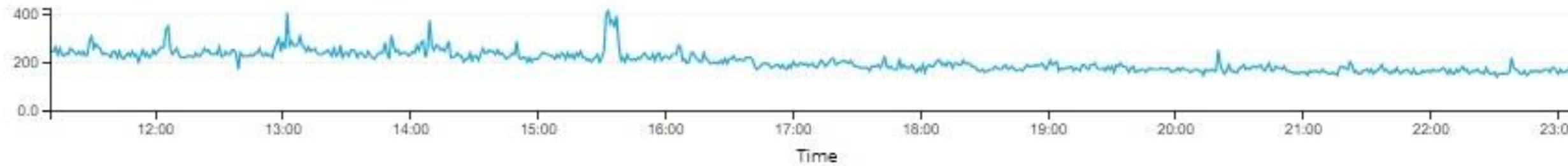
771



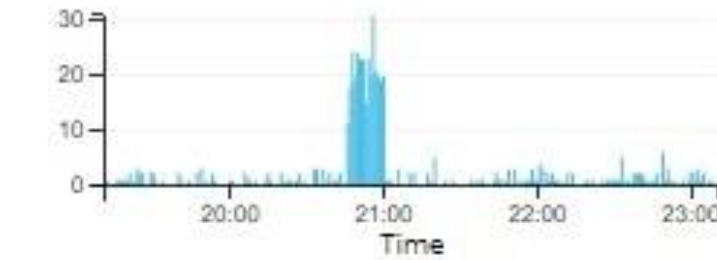
a few seconds ago



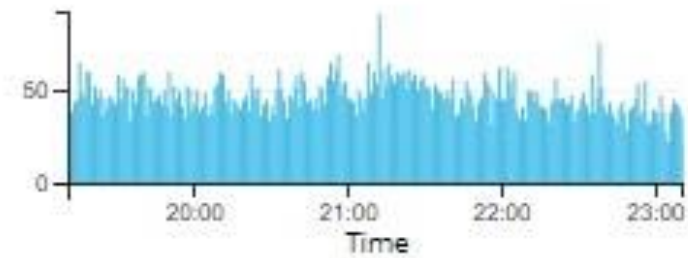
a few seconds ago



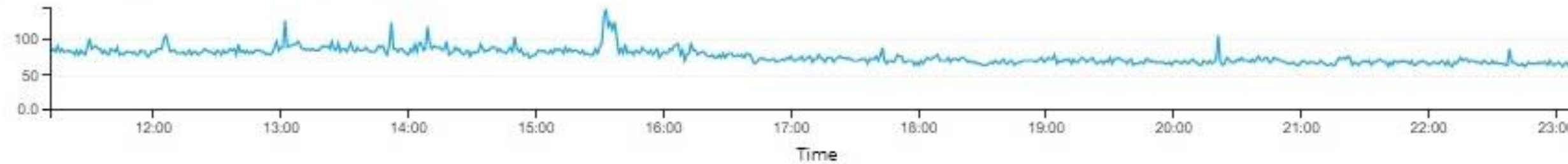
a minute ago



a minute ago



a minute ago



a few seconds ago



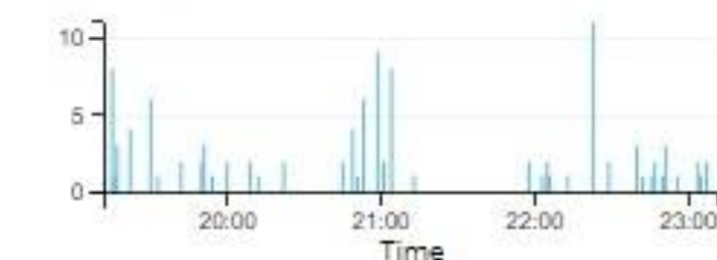
34



a few seconds ago



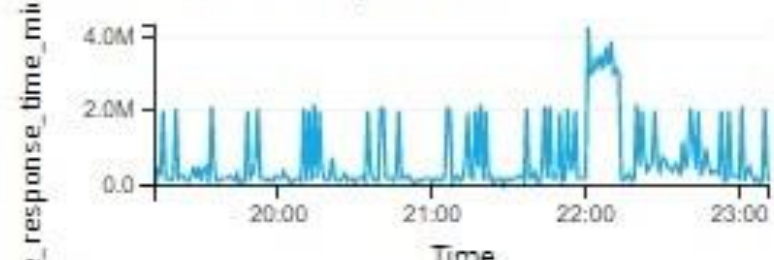
a minute ago



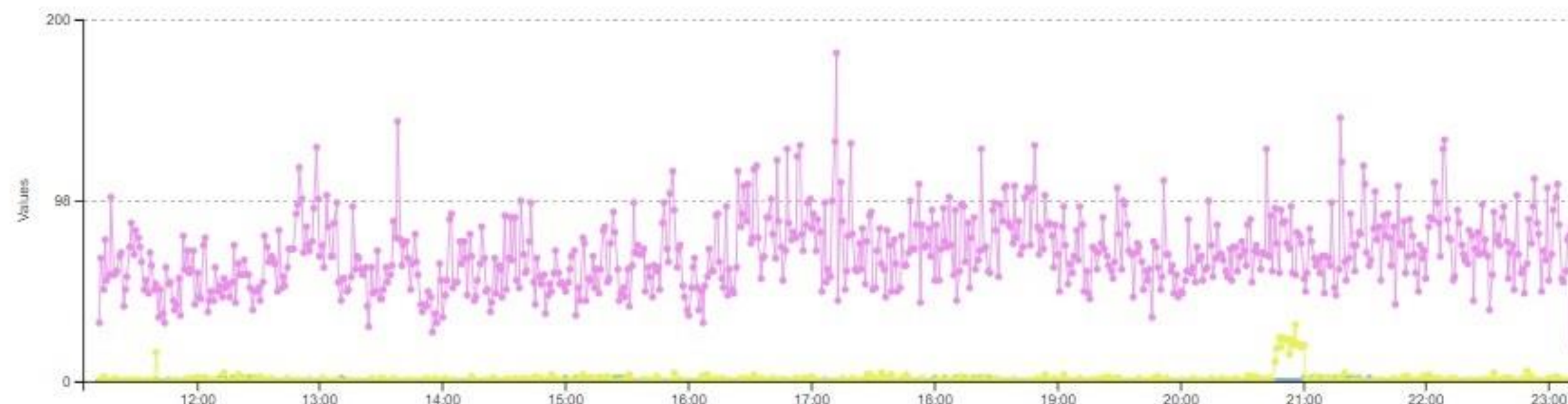
a few seconds ago



ERP to ISH max rsp. time



a few seconds ago



a few seconds ago



0

a few seconds ago



Tracking trends

For what

- Process duration degradation
 - After deployments
 - During time

Why is the performance degrading

- New features
- Data volume is growing
- System was updated
 - ERP
 - Environment
- Hardware outdated
 - Not the first option

Telemetry - how

Many, many ways

- NAV/BC native
- Small, fast SQL procedures to get current status
- Write data as an independent transaction in NAV
- Fire fast small calls to external systems/data sources
 - No feedback needed
 - Use external tools for presentation layer

Who is responsible for telemetry



Scalability, Connectivity, Tech & Architecture

Infrastructure

Hosting options

- On-prem
- External hosting, private cloud, hybrid
- Public cloud
- Microsoft SaaS

Requirements

- Dynamic environment
- Scalable up & down
- Public (vs. LAN/VPN/Leased line)
- Tech. source
- Playground

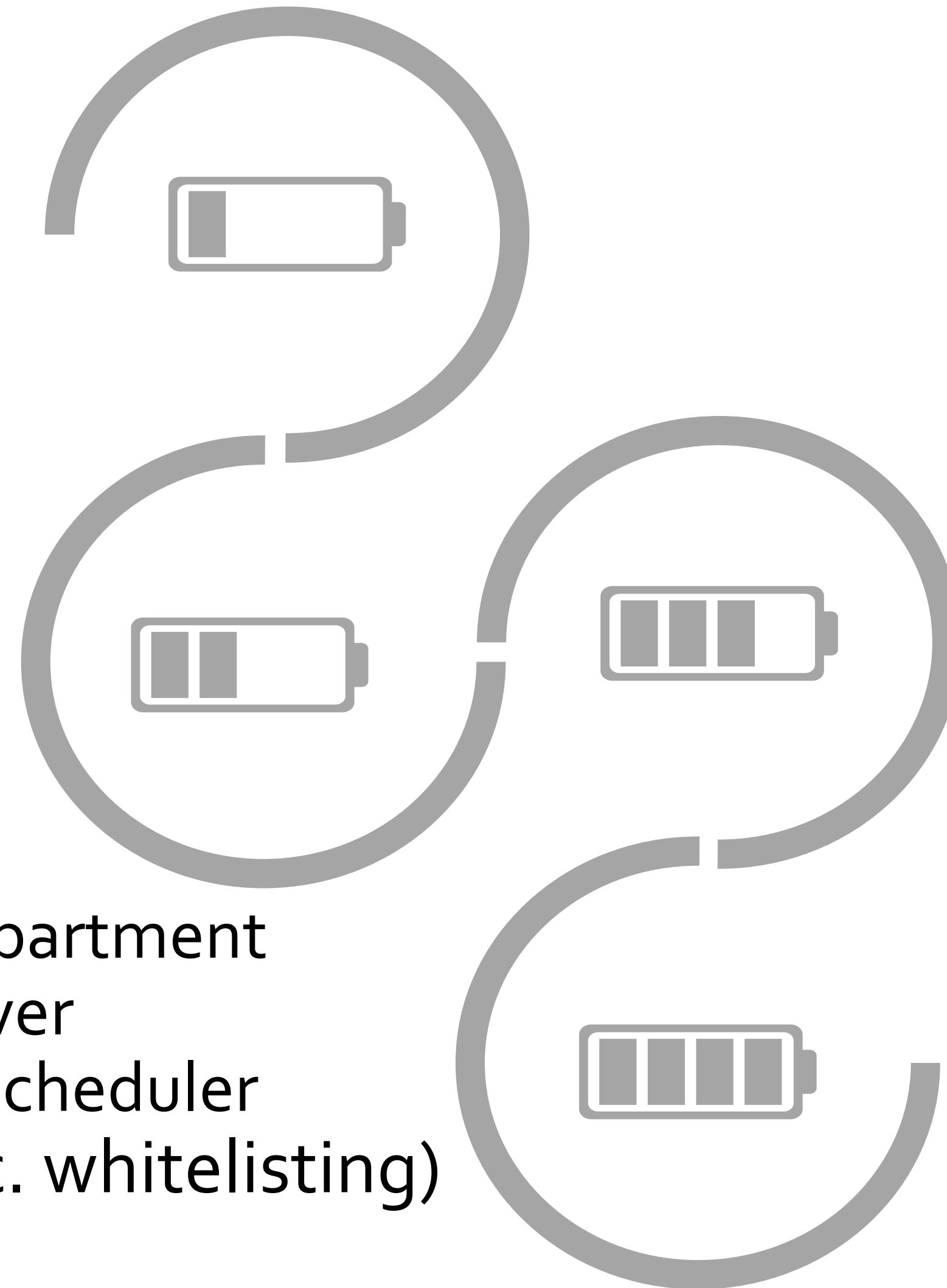
Public cloud and system growth

Basic infrastructure

- DBs
- Services
- DC

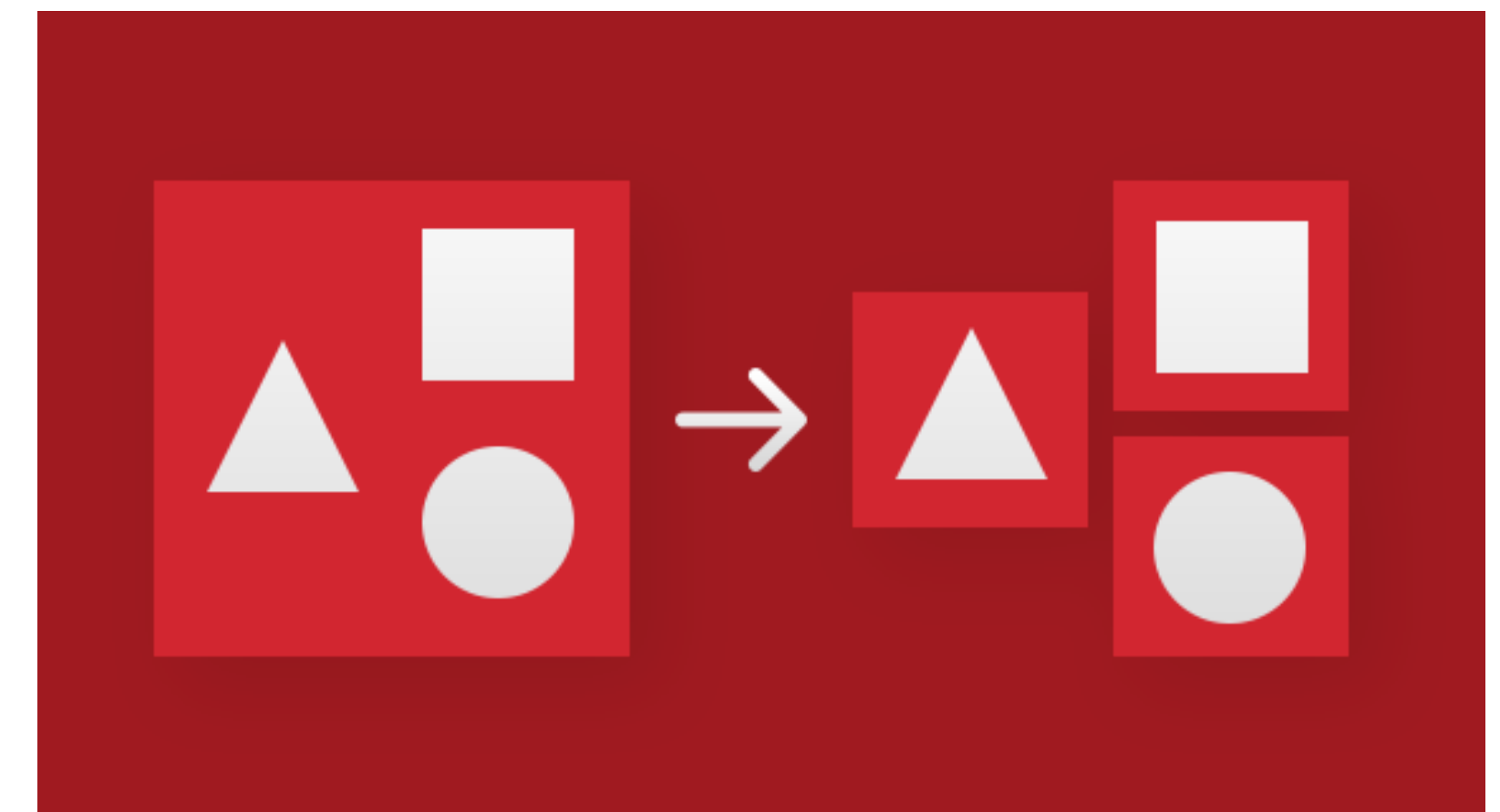
Tuned infrastructure

- Load balancers
- Services
 - At least 2 per department
 - 1 Service = 1 Server
 - Really fast Task scheduler
- Public access (inc. whitelisting)
- DNS, certificates
- High available ERP



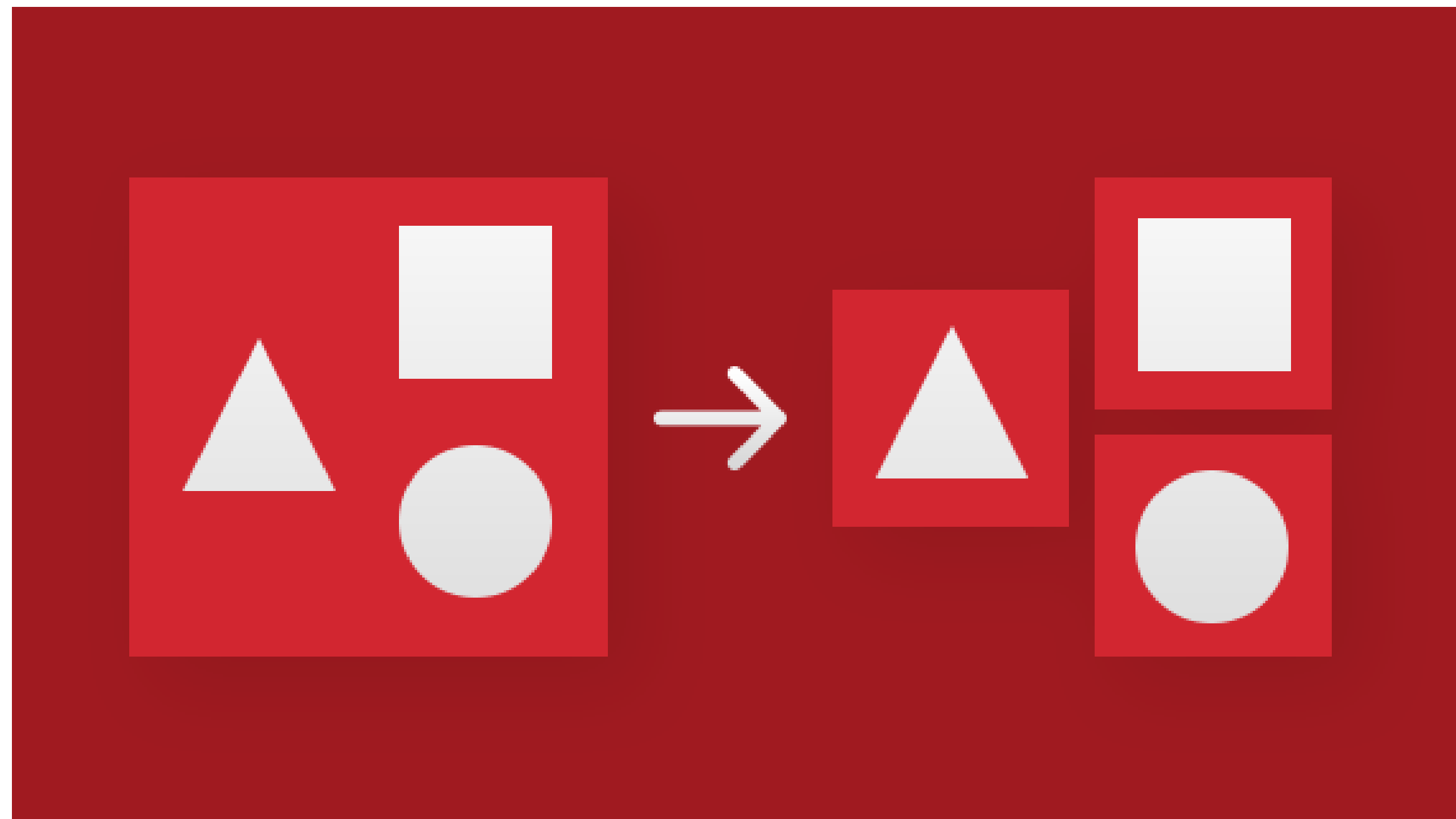
Cloud services

- Azure functions
- DEV-OPS
- Power BI
- Power Apps



Public cloud and system growth

Break a Monolith



APIs/Microservices

- High available services
- 24/7, global failover
- >100 calls per second
- App services, Insights
- Non-relational DBs
- Event Grid, Service Bus

Public cloud – to consider

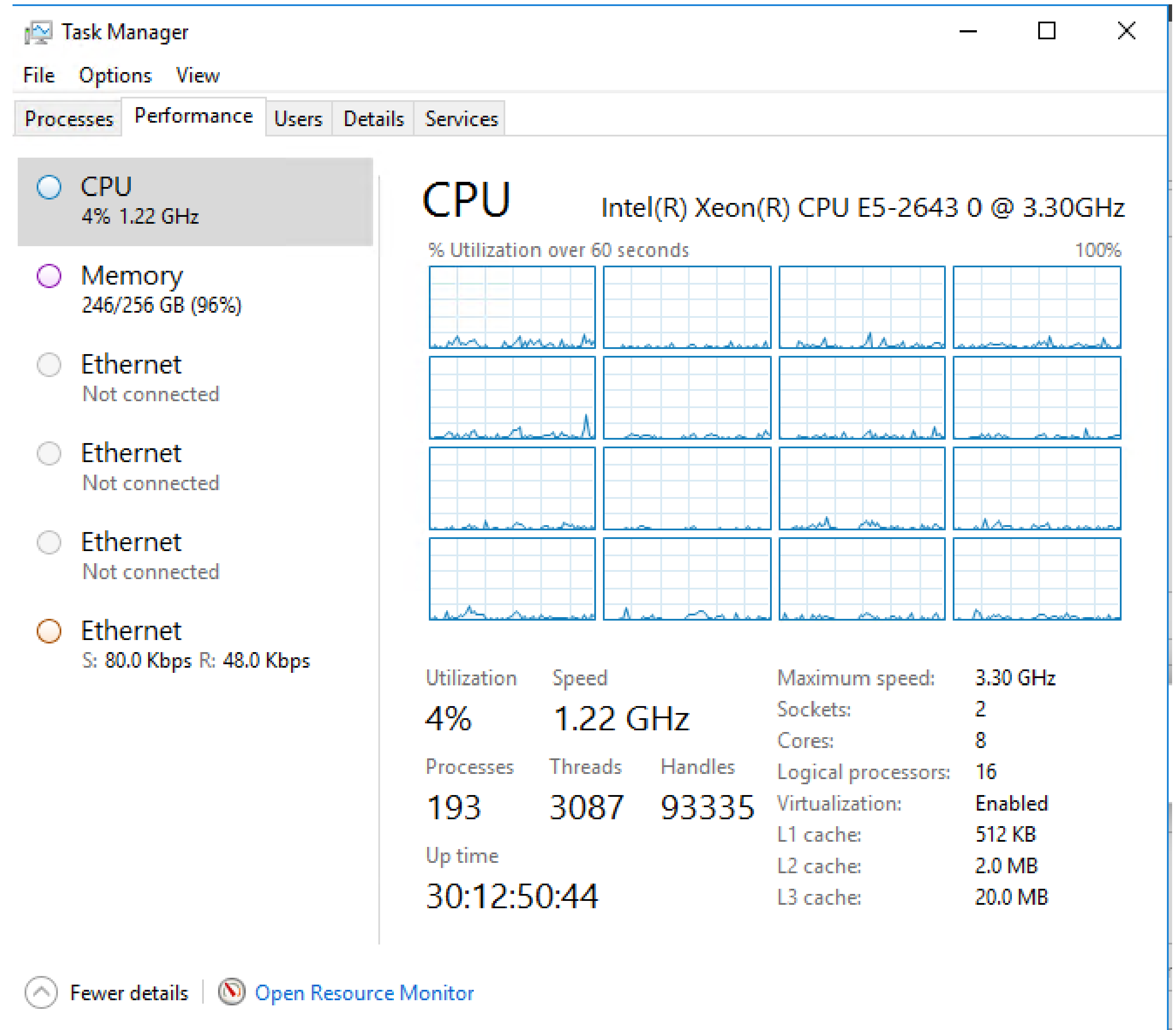
Performance

- On-prem vs. cloud performance
 - Could be that on-prem offers more (IOPS)
 - Performance driven development

On-prem vs. public cloud

On-prem

- RAM – hundreds of GB
- CPU – 16 - 32 cores
- Disk – SSD
 - IOPS limited by hardware
- SQL
 - Standard or Enterprise



On-prem vs. public cloud

On-prem

- RAM – hundreds of GB
- CPU – 16 - 32 cores
- Disk – SSD
 - IOPS limited by hardware
- SQL
 - Standard or Enterprise

Public cloud – different ROI

- RAM – around hundred
- CPU – 16
- Disk – SSD
 - IOPS limited VM and disk type
- SQL
 - Standard (Enterprise?)

On-prem vs. public cloud - benchmark

Public cloud - benchmark

- RAM – 432
- CPU – 64
- Disk – SSD
 - IOPS 80.000
 - 16 TB (P30)
- SQL
 - Enterprise

Results

- RAM – system needs days to fill it
- CPU – not visible need for 64 cores
- Disk – SSD
 - Peek was 35.000 IOPS
 - Big free space 😊
- SQL
 - Online re-indexing possible
 - Everything else can be done with Standard

VM Size	Offering	Family		vCPUs	RAM (GiB)	Data disks	Max IOPS
E64s_v3	Standard	Memory optimized		64	432	32	80000

Performance driven development

What to consider (basic)

Database

- Number of reads/writes
- Execution plan
- Don't overload NAV core
- Avoid long transactions

Automate deployment

- Including data manipulations
- Including permissions and dependencies
- Feature switch



DEVELOP A
PERFORMANCEDRIVEN
CULTURE

Business dependency

Limited downtime



Downtime is limited
A day

Upgrade & TO DOs

Technology					QA			
Azure			Development		Smoke test		Key users	
Data migration	Visaul Studio Code	WIN 10		Apps	Regression test		All users	
	Code merge	.NET	Install...	DEV/ TEST Systems	PM		Go-live	Training
					Proj... lead	Stak... mgt.	Company A	DEV/QA/ PM
Extensions	Infrastruct...	Cleani...	Clients	Deplo...	Communicat...		Company B	Users

Limited downtime & upgrade

Time consuming

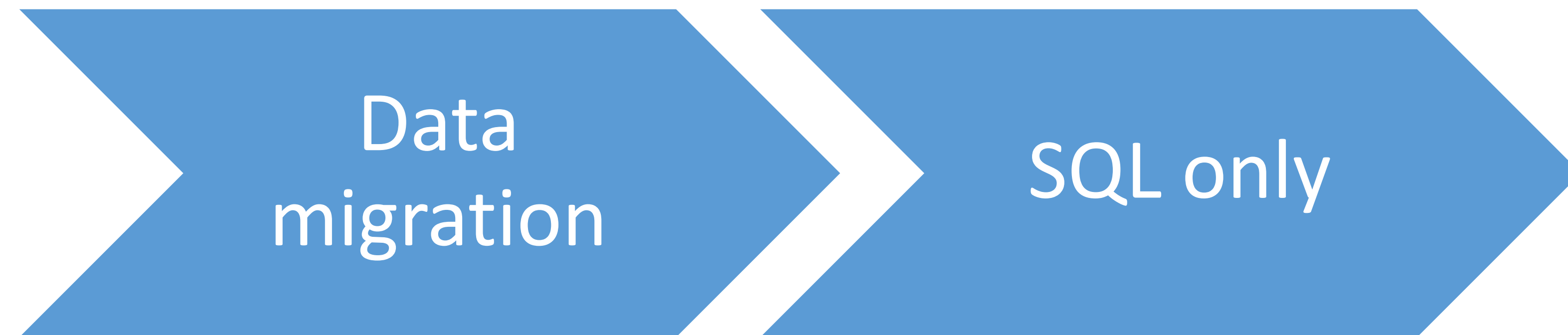
- Data migration between versions
- Converting DB to the newest version (maybe via more of them)
- Big data

Approach

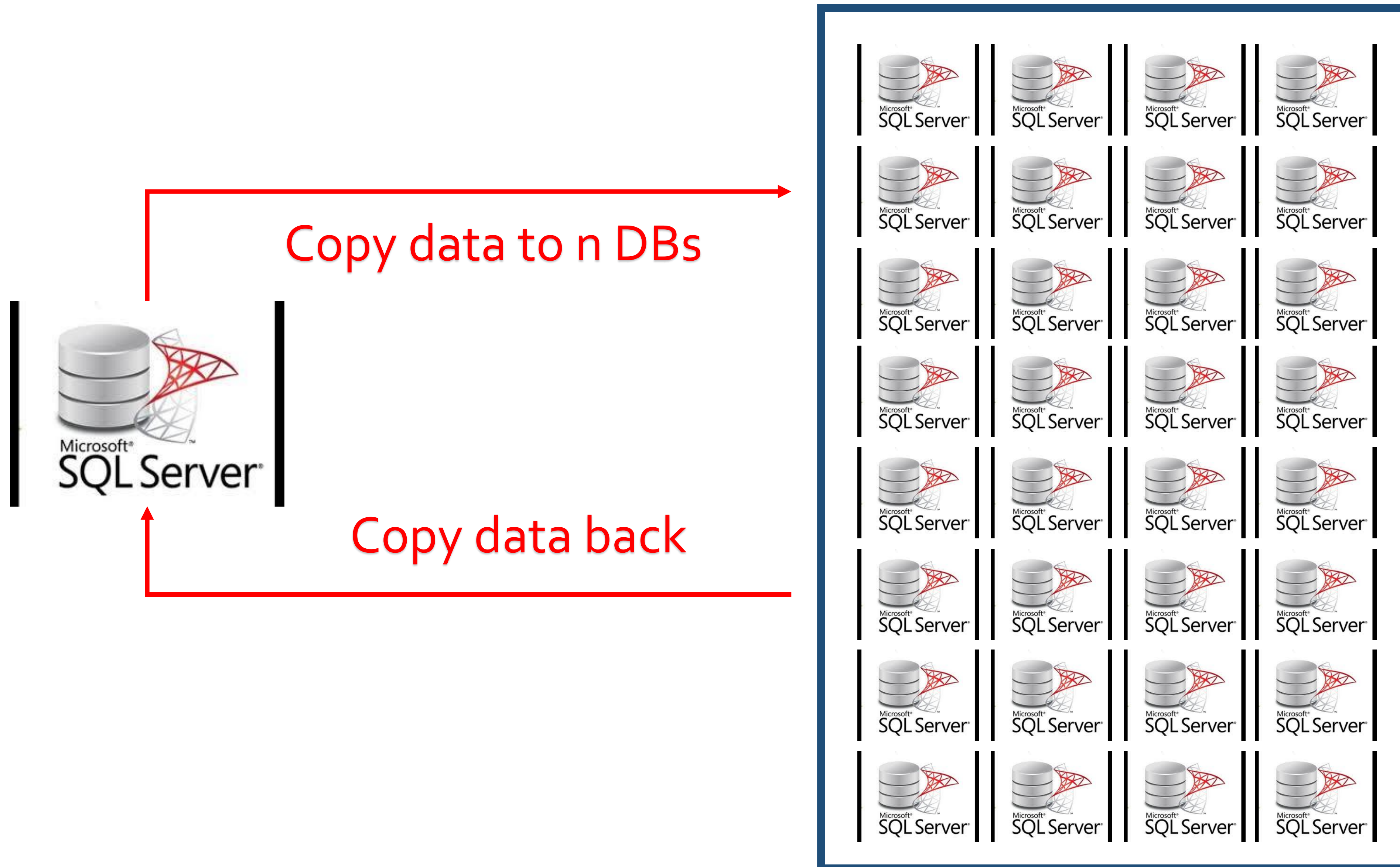
- Standard upgrade path



Go-live strategy



Go-live strategy (DB conversion)



Do conversion
in parallel

Go-live strategy (DB conversion)

Use the strongest hardware
which you can get

CPU Intel(R) Xeon(R) CPU E5-2673 v4 @ 2.30GHz

Logical processors

100%	100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%	100%	100%	100%
100%								

Utilization	Speed	Maximum speed:	2.29 GHz
100%	2.29 GHz	Sockets:	2
Processes	Threads	Handles	Virtual processors: 64
79	2450	45774	Virtual machine: Yes
			L1 cache: N/A

Up time

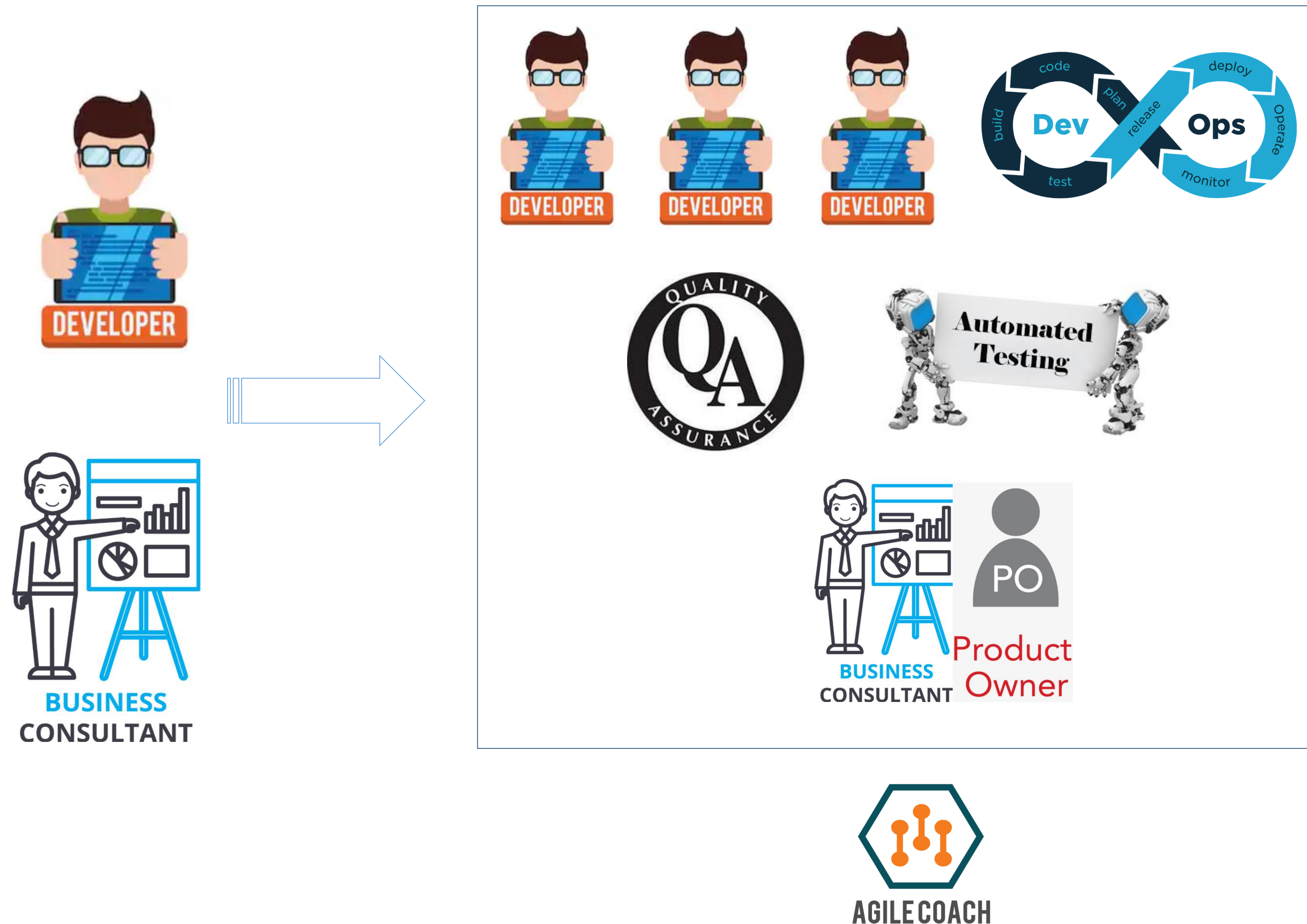
5:05:55:50

VM Size ↑↓	Offering ↑↓	Family	↑↓	vCPUs ↑↓	RAM (GiB) ↑↓	Data disks ↑↓	Max IOPS ↑↓
E64s_v3	Standard	Memory optimized		64	432	32	80000

Organizational changes & Teams

There are things to be done
A lot of them

Roles transition



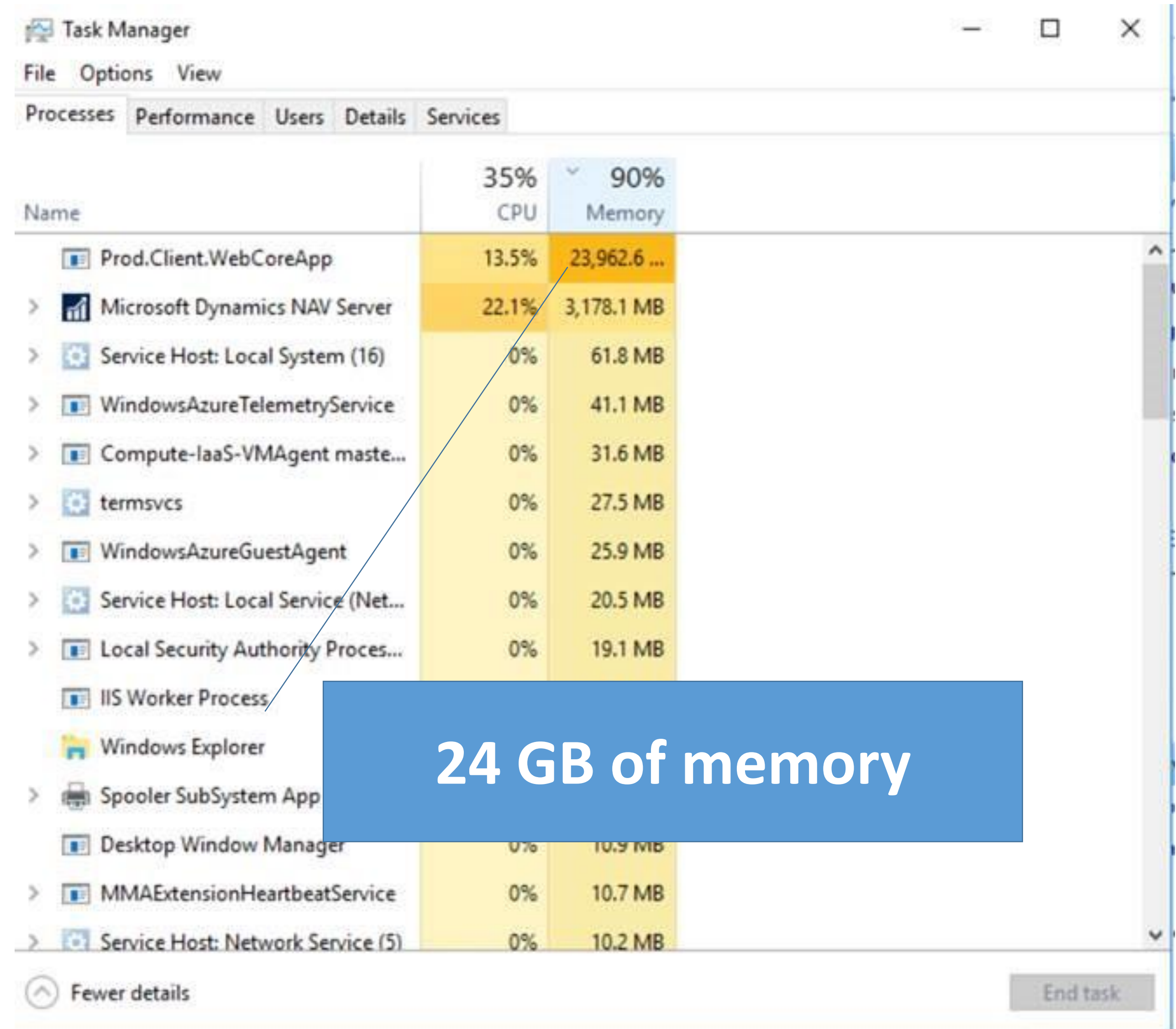
- Keep teams small
- Specialization
- Teams interaction

Challenges & Open questions

Challenge I – WebCoreApp memory usage

IIS/web client uses whole server memory and noticeably slows down the server

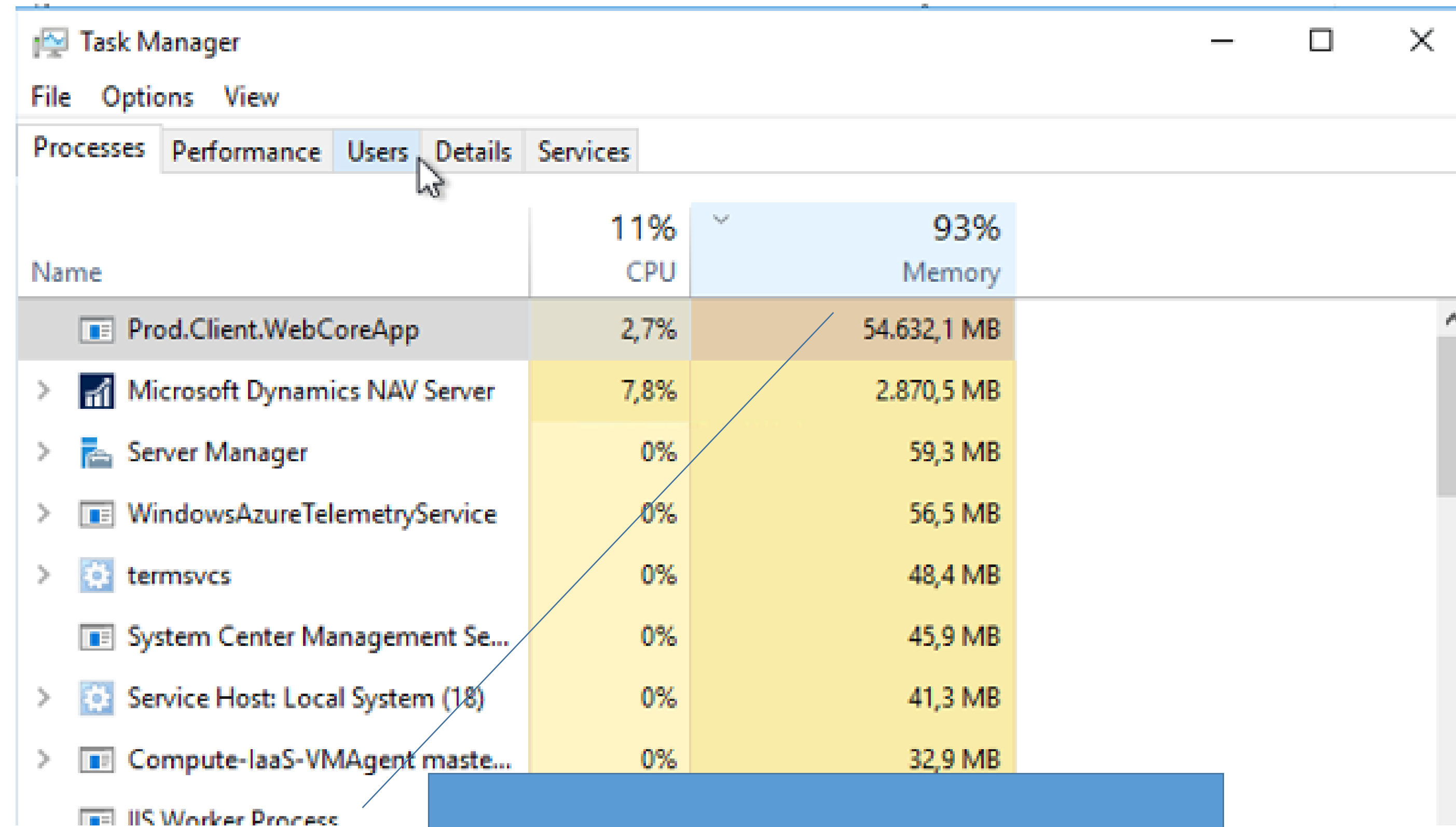
- One service per server
- Up until 30 users
- VM (E4s_v3)
 - 4 cores (Xeon 2.3 GHz)
 - 32 GB RAM



Challenge I – WebCoreApp memory usage

Upsize the VM

- One service per server
- Up until 30 users
- VM (E8-4s_v3)
 - 4 cores (Xeon 2.3 GHz)
 - 64 GB RAM



The screenshot shows the Windows Task Manager Performance tab. The 'Memory' section is expanded, showing a usage of 93%. Below this, a list of processes is shown with their respective CPU and Memory usage. The process 'Prod.Client.WebCoreApp' is highlighted, showing it is using 2.7% CPU and 54,632.1 MB of memory. A blue callout box points to this value.

Name	CPU	Memory
Prod.Client.WebCoreApp	2,7%	54.632,1 MB
Microsoft Dynamics NAV Server	7,8%	2.870,5 MB
Server Manager	0%	59,3 MB
WindowsAzureTelemetryService	0%	56,5 MB
termsvcs	0%	48,4 MB
System Center Management Se...	0%	45,9 MB
Service Host: Local System (18)	0%	41,3 MB
Compute-IaaS-VMAgent maste...	0%	32,9 MB
IIS Worker Process		

54 GB of memory

Challenge II – SQL tracing & User ID

Non existence of the User ID on the SQL level makes fine tuning harder, much harder

Challenge III – feature switches needed

Case

- Purchase invoice with 10.000 item lines
- Invoice discount active
- Add one additional line (G/L account)
 - Time needed to enter quantity?



Final words

BC & HIGH DEMANDING ENVIRONMENTS



Dynamics Business Central is a great product
Not perfect, but still great

- It can do more than you think
- Tech. is more & more there
- Backend is the king. Long live Frontend

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Open questions



- High performance orientation needed
- Future
 - SaaS vs. on-prem version?

Q&A

Any Questions?

*Thank
You!*