

What's new in Server and Database



Agenda

New server features in

- Data stack
- Web service stack
- AL runtime
- Reporting
- Security

Data stack

Faster upgrades with DataTransfer

New AL type **DataTransfer**

Allows for

- bulk transfer of fields between two given tables
- copies all rows (matching a filter) from one table to another

How-to use DataTransfer

Setup from and to tables

- `SetTables(<fromTable>, <totable>);`

Select fields / values to copy

- `AddFieldValue(<fromFieldNo>, <toFieldNo>);`
- `AddConstantValue(<value>, <toFieldNo>);`

Define relationship between tables

- `AddJoinCondition(<fromFieldNo>, <toFieldNo>);`

Filter on source

- `AddSourceFilter(<fromFieldNo>, <filterString>);`

Invoke operation

- `CopyFields();`
- `CopyRows();`

DataTransfer: move a field

Before

```
local procedure MoveField()
var
    from: Record FromTable;
    to: Record ToTable;
begin
    if from.Find() then
        repeat
            to.Get(from.RecordId);
            to.IntField := from.IntField;
            to.SmallCodeField := from.SmallCodeField;
            to.Modify();
        until (from.Next() = 0)
    end;
end;
```

With DataTransfer

```
local procedure MoveField()
var
    dt : DataTransfer;
    from: Record FromTable;
    to : Record ToTable;
begin
    dt.SetTables(Database::FromTable, Database::ToTable);

    dt.AddFieldValue(from.FieldNo("SmallCodeField"), to.FieldNo("SmallCodeField"));
    dt.AddFieldValue(from.FieldNo("IntField"), to.FieldNo("IntField"));

    dt.AddJoinCondition(from.FieldNo("id"), to.FieldNo("id"));

    dt.CopyFields();
end;
```

DataTransfer: copy a row

Before

```
local procedure CopyRows()  
var  
    from: Record FromTable;  
    to: Record ToTable;  
begin  
    if from.Find() then  
        repeat  
            to.SmallCodeField := from.SmallCodeField;  
            to.IntField := from.IntField;  
            to.id := from.id;  
            to.Insert();  
        until (from.Next() = 0)  
    end;  
end;
```

With DataTransfer

```
local procedure CopyRows()  
var  
    dt : DataTransfer;  
    to : Record ToTable;  
begin  
    dt.SetTables(Database::FromTable, Database::ToTable);  
  
    dt.AddFieldValue(2, to.FieldNo("SmallCodeField"));  
    dt.AddFieldValue(3, to.FieldNo("IntField"));  
    dt.AddFieldValue(1, to.FieldNo("id"));  
  
    dt.CopyRows();  
end;
```

DataTransfer use cases

Common upgrade scenarios:

Move a field from one table to another (obsolete a field).

Move data from one table to another (deprecate a table).

DataTransfer limitations

Only allowed in upgrade code

(Events are not raised)

Disabled for the following table types

Non-SQL tables

System and virtual tables

Audited tables (destination)

Obsoleted (destination)

Disabled for the following field types

System and Timestamp fields (destination)

Media and MediaSet

Calculated fields

New system field System Rowversion

Rowversion field that are on all tables now exposed as system field [SystemRowversion](#).

Field name (SQL): [timestamp](#)

Field name (AL): [SystemRowVersion](#)

Read-only.

New functions

Row version support

```
// Lowest row version part of some active transaction  
// (anything lower has been committed)  
MinimumActiveRowVersion()
```

```
// Last used RowVersion from the database.  
LastUsedRowVersion
```

Rowversion use cases

Create fully covering indexes.

Read changes since last recorded rowversion for faster data integration.

Show SQL Locks in debugger

The screenshot displays the Visual Studio Code interface during a debugging session. The top menu bar includes File, Edit, Selection, View, Go, Run, Terminal, and Help. The title bar shows 'Manager.page.al - playground'. The 'RUN AND DEBUG' section is active, with a dropdown menu set to 'Your own server'. The left sidebar contains several icons, including a bug icon with a '1' notification, indicating a breakpoint or error.

The 'VARIABLES' pane on the left shows the following structure:

- VARIABLES
 - Globals
 - Locals
 - Database Statistics
 - <Database Statistics>
 - Current SQL Latency (ms): 0.2605
 - Number of SQL Executes: 638
 - Number of SQL Row Reads: 362
 - Locks**
 - Tenant Media: Access: Exclusive (4 KEY, 1 PAGE, 1 RID)
 - Tenant Media Thumbnails: Access: Exclusive (3 KEY, 1 PAGE, 1 RID)
 - Currency: Access: Exclusive (4 KEY)
 - Customer: Access: Exclusive (19 KEY)
 - Item Cross Reference: Access: Exclusive (7 KEY)
 - <Last Executed SQL Statements>

The main editor area shows the code for 'Manager.page.al'. The current execution point is at line 19, which is the `trigger.OnAction()` method. The code includes several variable declarations and a `begin` block with `rec2.LockTable()` and `rec3.LockTable()` calls, indicating that locks are being acquired during the execution of the trigger.

```
19 ..... trigger.OnAction()
18 ..... var
17 ..... i: Integer;
16 ..... cu: Codeunit.DoesNothing;
15 ..... rec: Record.Currency;
14 ..... rec1: Record.Customer;
13 ..... rec2: Record.Cake;
12 ..... rec3: Record.Attachment;
11 ..... rec4: Record.Item;
10 ..... begin
9 ..... rec2.LockTable();
8 ..... rec3.LockTable();
7 .....
6 ..... if (not rec.IsEmpty) then
5 ..... | rec.DeleteAll();
4 .....
3 ..... if (not rec1.IsEmpty) then
```

**Non-blocking
number series
(in demo data)**

Adjusted demo/setup data to allow gaps by default (where allowed).

Changed default settings for non-blocking number series

No. Series | Work Date: 1/25/2024 ✓ Saved

Search + New Edit List Delete Navigate Actions Related Fewer options

Lines Relationships

Code ↑	Description	Starting No.	Ending No.	Last Date Used	Last No. Used	Defa... Nos.	Man... Nos.	Date Order	Allow Gaps in Nos.
IJNL-REC	Recurring Item Journal	T03001	T04000	—	—	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IJNL-REVAL	Revaluation Journal	T04001	T05000	12/31/2023	T04001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I-MOVE+	Registered Invt. Movement	RIM000001	RIM999999	—	RIM000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-MOVEMENT	Inventory Movement	IM000001	IM999999	—	IM000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
INT-MOVE	Internal Movement	RINTM000001	RINTM999999	—	RINTM000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-PICK	Inventory Pick	IPI000001	IPI999999	—	IPI000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-PICK+	Posted Invt. Pick	PPI000001	PPI999999	—	PPI000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-PUT	Inventory Put-away	IPU000001	IPU999999	—	IPU000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-PUT+	Posted Invt. Put-away	PPU000001	PPU999999	—	PPU000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-RCPT	Inventory Receipt	IR000001	IR999999	—	IR000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-RCPT+	Posted Inventory Receipt	IR000001	IR999999	—	IR000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-SHPT	Inventory Shipment	IS000001	IS999999	—	IS000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
I-SHPT+	Posted Inventory Shipment	IS000001	IS999999	—	IS000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ITEM1	Partially Manufactured	70000	70099	—	70060	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ITEM2	Paint	70100	70199	—	70104	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ITEM3	Loose Hardware	70200	70299	—	70201	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ITEM4	Finished	1896-S	2996-S	—	2000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ITEM5	Assembly BOM	1924-W	2096-W	—	1992	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
IJNL-GEN	Job Journal	J00001	J01000	—	J00001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
IJNL-REC	Recurring Job Journal	J01001	J02000	—	J01001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
JOB	JOB	J00010	J99990	—	J00010	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
JOB-WIP	Job-WIP	WIP0000001	WIP9999999	—	WIP0000001	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

New version of SQL Server Express

Installer now deploys SQL Server 2019 Express.

Data stack performance improvements

Partial records now skip obsoleted fields outside upgrade code.

Partial records load fewer fields in calcformulas.

Bulk ModifyAll involving fields from table extensions is faster.

Faster transaction ending in multi-tenancy mode.

Data search is faster.

Web services stack

Other web services stack improvements

Avoiding JIT Load in pages referenced through \$expand

Large reduction in SQL calls

(already shipped with update 2 for Business Central 2022 release wave 1).

New server setting - ODataMaxBodySize

Default is 350MB (also for SaaS)

Automation API now allows larger files.

Better filter handling for Edit-In-Excel.

Added HTTP Retry-After to 429 responses in Odata (when throttled)

AL runtime

Discover orphan media in the database

AL developers can discover orphan media in the database.

New methods

- `Media.FindOrphans`
- `MediaSet.FindOrphans`.

Returns list of Media/MediaSet GUIDs not referenced anywhere.

Coming soon: NST on .NET Standard 2.0/core

We are done moving the server to .NET standard. [Releasing in 2023w1](#).

Start conversion of your (on-premises) .NET add-ins now...

.NET addins running .NET framework will not work in 2023 release wave 1.

Move to services (Azure functions and friends) where possible.

New system application module: Azure Function Integration

Integrate to Azure Functions from AL using the new system module [Azure Function Integration](#).

We used it for two modules that we could not migrate to .NET standard.

Security

Permission system

2022 release wave 1

Composing permission sets

Excluding permissions/permission sets

InherentPermissions

Isolated Events

New in 2022 release wave 2

UI for composing permissions

InherentPermissions available for apps

Exclude permission sets in metadata

InherentEntitlements for objects

Compose permission sets in the UI

PS Name (Type)

Included permissions for the currently selected PS

Permission Set | Work Date: 1/25/2024

TECHDAYS BASIC (Tenant)

View all permissions

General

Permission Set: TECHDAYS BASIC Name: Techdays Basic

Permissions | Manage

Type	Object Type	Object ID	Object Name	Read Permission	Insert Permission	Modify Permission	Delete Permission	Execute Permission	Security Filter
Include	Table Data	472	Job Queue Entry	Yes	Yes	Yes	Yes		
→ Include	Table Data	474	Job Queue Log Entry	Yes	Yes	Yes	Yes	-	

Include/Exclude permissions

Included permissions

Object Type	Object ID	Object Name
Table Data	3	Payment Terms
Table Data	4	Currency
Table Data	5	Finance Charge Terms
Table Data	6	Customer Price Group
Table Data	7	Standard Text

Permission Sets

Type	Permission Set	Scope
Include	D365 READ	System
Include	EMAIL - ADMIN	System
Include	FEATURE MGT. - ADMIN	System
→ Include		System

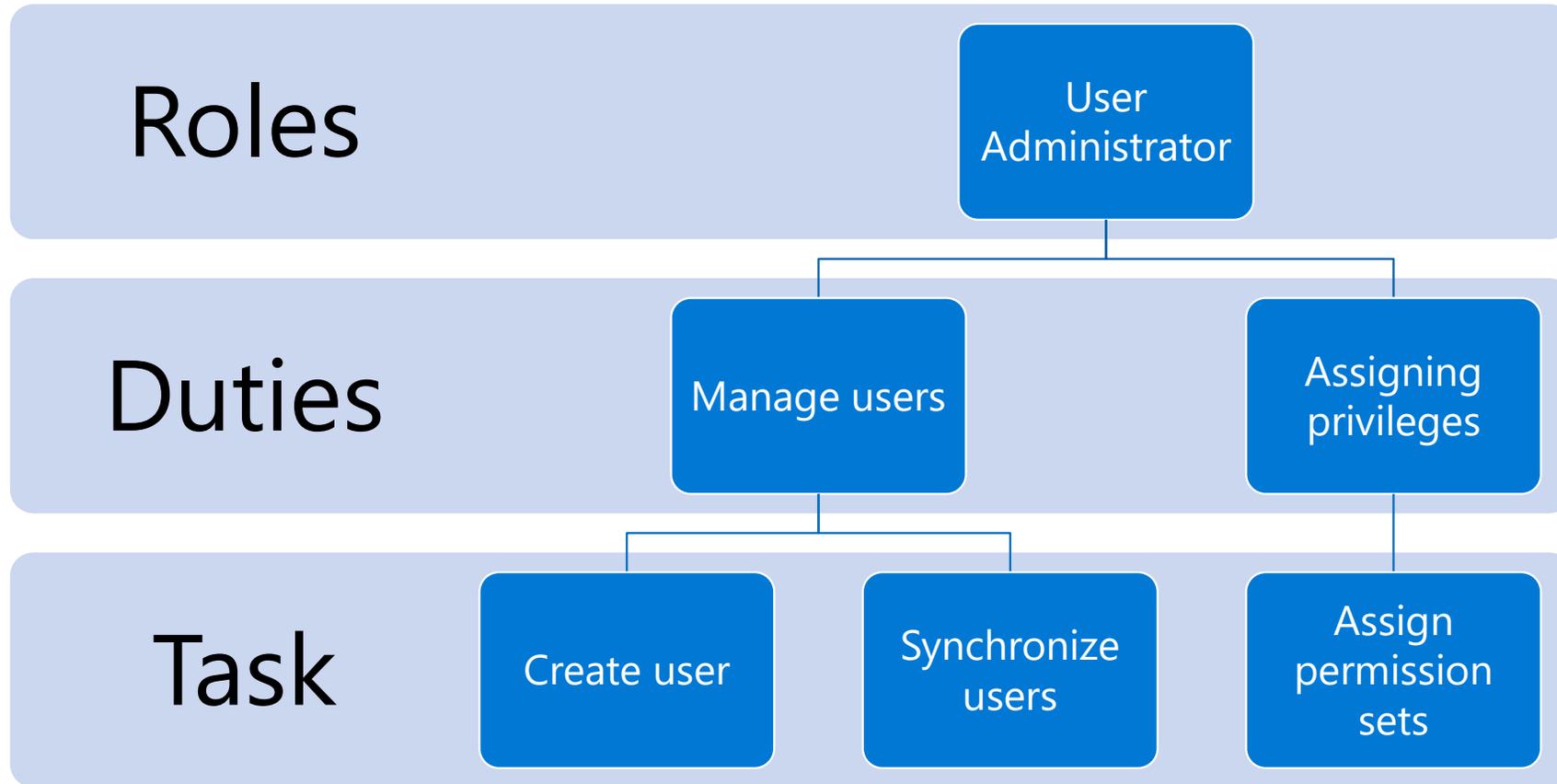
Result

Permission Set	Scope	Inclusion Status
→ > D365 READ	System	Full
> EMAIL - ADMIN	System	Full
> FEATURE MGT. - ADMIN	System	Full

Include permission sets

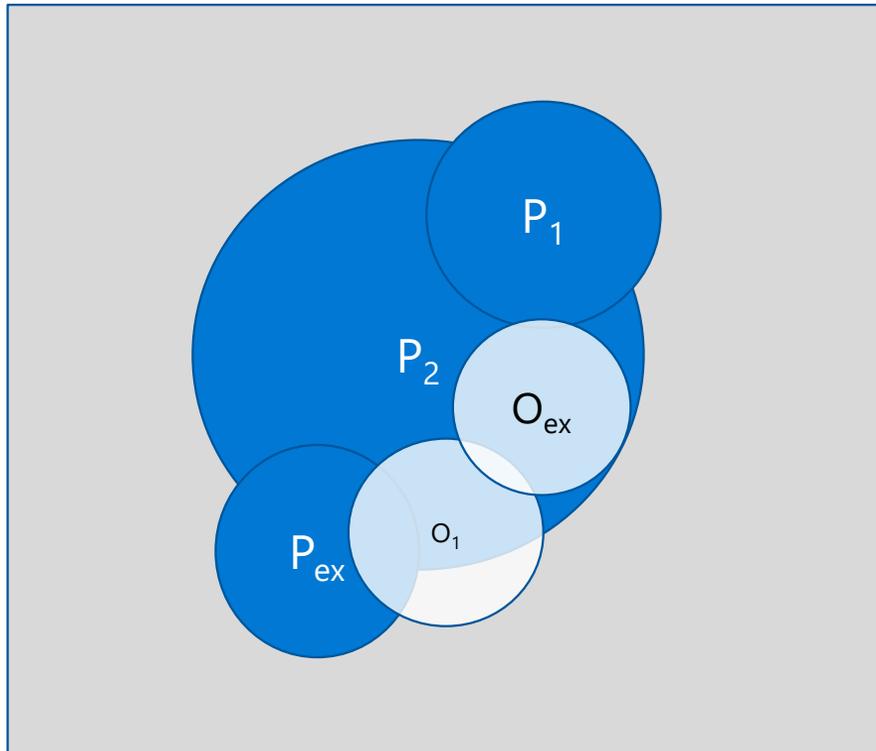
Result of included permission sets and hierarchy

Defining your own permissions hierarchy



How inclusion and exclusion of permission sets work

Warning – Math notation



Permission set P_{top}

Includes permission sets P_1 and P_2

Includes explicit permissions P_{ex}

Excludes permission set O_1

Excludes explicit permissions O_{ex}

$$P_{top} = (P_1 \cup P_2 \cup P_{ex}) / (O_1 \cup O_{ex})$$

\cup is set union

$/$ is set complement

Dark blue area are your permissions.

Exclude permission sets in the UI

Permission Set | Work Date: 1/25/2024



✓ Saved

TECHDAYS BASIC (Tenant)

View all permissions

General

Permission Set: TECHDAYS BASIC Name: Techdays Basic

Permissions Manage

Type	Object Type	Object ID	Object Name	Read Permission	Insert Permission	Modify Permission	Delete Permission	Execute Permission	Security Filter
Include	Table Data	472	Job Queue Entry	Yes	Yes	Yes	Yes		
→ Include	Table Data	474	Job Queue Log Entry	Yes	Yes	Yes	Yes	-	

Included permissions

Object Type	Object ID	Object Name
System	3220	View, Table Filter
System	3230	View, FlowFilter
System	3410	View, Sort
System	3510	View, Design
System	5830	Tools, Security, Password

Permission Sets

Type	Permission Set	Scope
Include	D365 READ	System
Include	EMAIL - ADMIN	System
Include	FEATURE MGT. - ADMIN	System
→ Exclude	EMAIL EDIT	System

Result

Permission Set	Scope	Inclusion Status
D365 READ	System	Partial
BASEAPP OBJECTS - EXEC	System	Full
→ SYSTEM APP - BASIC	System	Partial
SYSTEM APPLICATION - BASIC	System	Partial
EMAIL - ADMIN	System	Partial
EMAIL - EDIT	System	Excluded
EMAIL - READ	System	Excluded
FEATURE MGT. - ADMIN	System	Partial
FEATURE KEY - ADMIN	System	Partial
FEATURE KEY - VIEW	System	Partial
FEATURE KEY - READ	System	Partial
FEATURE KEY - OBJECTS	System	Full
SYSTEM INITIALIZATION - EXEC	System	Excluded
SYSTEM INITIALIZATION - EXEC	System	Excluded

Exclude by updating the type

The PS results update with their inclusion status

Exclude permission sets in metadata

Exclude permission sets in permission set definitions.

New property ExcludedPermissionSets

Excluding permission set in metadata

In extensions you can only exclude permission *sets*.

```
permissionset 132218 "Test Tables - Restricted"  
{  
    Assignable = true;  
  
    IncludedPermissionSets = "System Application Test Tables",  
    | | | | | | | "Local Test Tables";  
  
    ExcludedPermissionSets = "Restricted Local Test Tables"  
  
    Permissions = tabledata "All-Keys Type" = RIMD,  
    | | | | | | | tabledata "Amount Auto Format Test Table" = RIMD,
```

Example: Create an accountant role who can only read from General Ledger Accounts

Exclude read permissions from the "Edit" permission set to get only read permissions.

Exclude all edit permissions provided by the accountant permission set.

```
permissionset 100299 AccountantReadOnly
{
    IncludedPermissionSets = "D365 ACCOUNTANTS";
    ExcludedPermissionSets = GeneralLedgerEditOnly;
}

1 reference
permissionset 100300 GeneralLedgerEditOnly
{
    IncludedPermissionSets = "General Ledger Accounts - Edit";
    ExcludedPermissionSets = "General Ledger Accounts - View";
}
```

Security filters

Composing permission sets supports security filters.

Excluding permission sets currently *does not* apply security filters.

Old-time favorite behavior changed:

Allow sorting on flow fields when security filters are unrelated.

Inherent Permissions available for Apps

AL developers can elevate permissions for specific code paths.

New method annotation

- `InherentPermissions`

Can only elevate permissions to your own objects.

InherentPermissions available for Apps

Method annotation

```
[InherentPermissions(PermissionObjectType:Table, Database:MyTable, 'x', InherentPermissionScope:Entitlements)]
```

```
[InherentPermissions(PermissionObjectType:Table, Database:MyTable, 'x', InherentPermissionScope:Permissions)]
```

```
[InherentPermissions(PermissionObjectType:Table, Database:MyTable, 'x', InherentPermissionScope:Both)]
```

```
// Default value : InherentPermissionScope:Both
```

When and how to use Inherent permissions

Small dedicated procedures performing a task

- Avoid adding InherentPermissions at top level
- Ideally avoid calling other methods or raising events

Critical code paths

- Code that should run, regardless of the user

'System tasks' that do not expose data to users

- Initialization of default values
- Derived information like: Counts of records, is feature enabled

No need for Stan to restrict access

- Stan cannot remove privileges to run this code

Inherent Entitlements available for Apps

AL developers can elevate entitlements for specific objects.

New property InherentEntitlements

Can only elevate entitlements to your own objects

Reporting

Layout picker on the request page

End users can change the layout for the report on the request page

Possible to navigate to report layouts page from request page

Layout picker on the request page

Before

Customer - Top 10 List

Printer (Handled by the browser) v

Use default values from Last used options and filters v

Options

Show Sales (LCY) v

Number of Customers 10

Chart Type Bar chart v

Filter: Customer

× No. v

× Customer Posting Group v

× Currency Code v

Send to... Print Preview Cancel

Now (2022 release wave 2)

Customer - Top 10 List

Printer (Handled by the browser) v

Report Layout Customer Top-10 (Printing) ...

Use default values from Last used options and filters v

Options

Show Sales (LCY) v

Number of Customers 10

Chart Type Bar chart v

Filter: Customer

× No. v

× Customer Posting Group v

Send to... Print Preview Cancel

Approvals

... opens the Report Layouts page

The screenshot shows a 'Report Layouts' dialog box overlaid on a report viewer. The dialog box has a title bar with 'Report Layouts' and search, refresh, and close icons. It contains a table with the following data:

Report ID ↑	Layout Name	Description	Extension	Type ↑
111	./CustomerTop10List.rdlc	./CustomerTop10List.rdlc	Base Application by Microsoft	RDLC
111	Customer Top-10 (Printing)	Use for printing.		RDLC
→ 111	Customer Top-10 (Visualization)	Use this report layout for mon...		Excel

A blue callout box points to the third row of the table with the text: "Shows all layouts from the current report." At the bottom of the dialog box are 'OK' and 'Cancel' buttons. Below the dialog box, the report viewer's toolbar is visible, showing buttons for 'Email Status', 'Send to...', 'Print', 'Preview', and 'Cancel'.

After choosing a new layout...

The screenshot shows a configuration window for a report titled "Customer - Top 10 List". The window contains several settings:

- Printer:** (Handled by the browser)
- Report Layout:** Customer Top-10 (Visualization) (highlighted)
- Use default values from:** Last used options and filters
- Options section:**
 - Show:** Sales (LCY)
 - Number of Customers:** 10
 - Chart Type:** Bar chart
- Buttons:** Send to..., Download, Cancel

Annotations:

- A blue box at the top right says "Excel Layout is now selected" with an arrow pointing to the "Report Layout" dropdown.
- A blue box at the bottom left says "Request page exit controls are dynamically updated depending on the layout format" with an arrow pointing to the "Send to...", "Download", and "Cancel" buttons.

Bonus: administer layouts on the Report Layouts page

The screenshot displays the 'Report Layouts' page in a web application. A context menu is open over a report layout entry. A callout box points to the menu icon with the text 'Add/Delete/Edit/Export/Import'. The context menu includes options: Manage, New Layout, Edit Info, Run Report, Set Default, Export Layout, Replace Layout, and Show as menu. The background table lists report layouts with columns for Report ID, Layout Name, Extension, and Type.

Report ID ↑	Layout Name	Extension	Type ↑
111	./Customer	omerTop10List.rdlc	Base Application by Microsoft RDLC
111	Customer T	r printing.	RDLC
→ 111	Customer T	is report layout for mon...	Excel

Buttons at the bottom of the page include: Send to..., Print, Preview, Cancel, OK, and Cancel.

Reduced number of steps for basic report operations

Operation	Before	2022 release wave 2
Adding a layout	<ul style="list-style-type: none">- Exit the request Page- Search and open the Report Layouts page- Filter the layouts for your desired report.- Use action 'New Layout'.	<ul style="list-style-type: none">- Open the layout selector- Use action 'New Layout'
Deleting a layout	<ul style="list-style-type: none">- Exit the request Page- Open the Report Layouts page- Filter the layouts for your desired report.- Select the layouts and delete.	<ul style="list-style-type: none">- Open the layout selector- Select layouts and delete
Changing the default layout	<ul style="list-style-type: none">- Exit the request page.- Open Report Layout Selection page.- Filter for your report.- Select desired layout format.- Select from available layouts.	<ul style="list-style-type: none">- Open the layout selector- Select desired layout and use 'Set Default' action.

Miscellaneous reporting improvements

PrintOnlyifDetail is now available in SaaS

New Word reporting trigger OnIntermediateDocumentReady

Better filenames in OneDrive for reports sent to inbox

Go dos

Update your upgrade code

Uptake the new DataTransfer feature to make your upgrade code faster (and more stable).

Move .NET addins to .NET Standard

.NET addins using .NET framework will no longer work in 2023 release wave 1.

Reduce database locks

Use the debugger to display database locks. Optimize your code to reduce locking issues.

Redesign your app permissions

Stop copying our permission sets for excluding permissions (the old way).

Use the new permission system building blocks to make your app permissions easier to understand and maintain.

Thank you

