

# Integrate Db2 for z/OS database changes in your enterprise DevOps pipeline

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# Goal of integrating database changes in the enterprise DevOps pipeline (US Insurance)

- ✓ Enable continuous delivery by mitigating DBA dependency for database code deployments
- ✓ Enable self-service options for application developers through automation

# Approach(US Insurance)

## Integration

- Integrate DBA into the DevOps project
- Review existing DDL processes

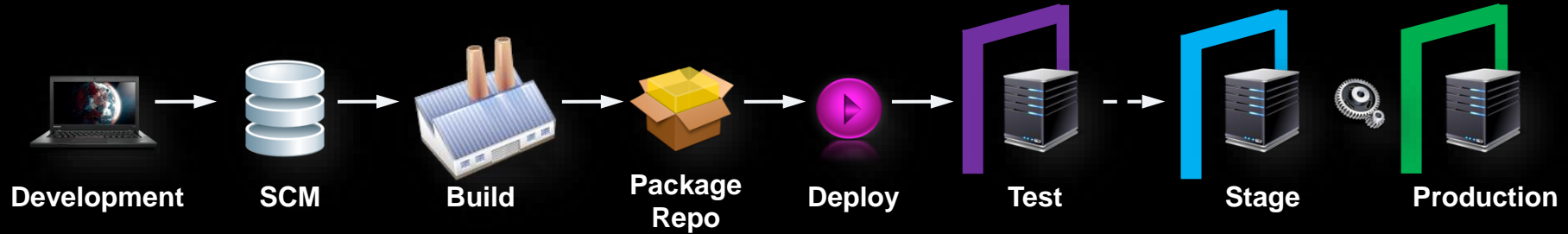
## Automation

- Partner with enterprise DevOps team to utilize pipeline automation tools
- Streamline database code deployments through automation

## Implementation

- Enable self-service deployments as part of BAU process
- Shift DBA role from deployment to development, provide more value-added services

# Accelerating delivery for the Enterprise



Collaborative  
Tracking &  
Planning



Continuous  
Delivery



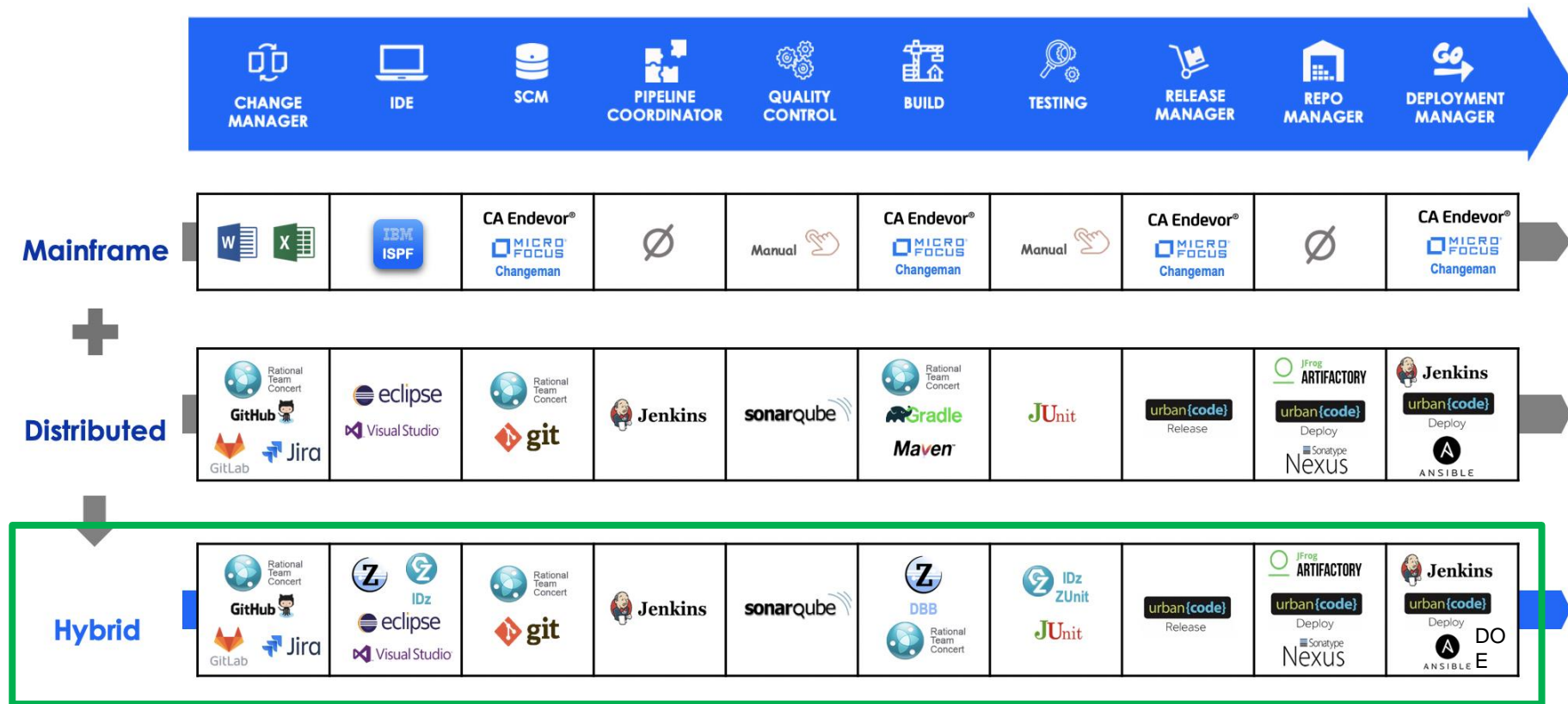
Continuous  
Testing



Continuous  
Integration



# Goal: a single, hybrid pipeline supporting all DevOps activities



# IBM Db2 DevOps experience for z/OS integrated in Pipeline

## Move Db2 for z/OS changes at the same speed as application changes



### Line of Business

- Bring applications to market faster to respond to customer needs
- Gain business agility and competitive advantage



### Architect

- Build integrated dev teams
- Single enterprise pipeline for hybrid applications



### Db2 for z/OS DBA

- Can establish and enforce rules and processes
- Avoid human errors
- Free time of simple, repetitive work for innovative projects



### App Dev Team

- Can self-service DBA requests and self-provision test environments  
Can meet deadlines



### Release Engineer

- Builds fast & reliable pipeline
- Transforms source code into viable product

### Personas using Db2 DevOps Experience

# IBM Db2 DevOps experience for z/OS – Features



- Ability to create and delete Db2 for z/OS sandbox environment for testing without IT time and assistance
- Make Db2 syntax changes using object-aware Data Definition Language (DDL) editor
- Integrate Db2 database object management into existing continuous delivery development processes

- Define teams of users, environments, and application components for developers to use in their application development
- Discover and select application's Db2 database components to be managed and processed together
- Set rules and storage limits for the defined teams
- Review and approve developer schema changes

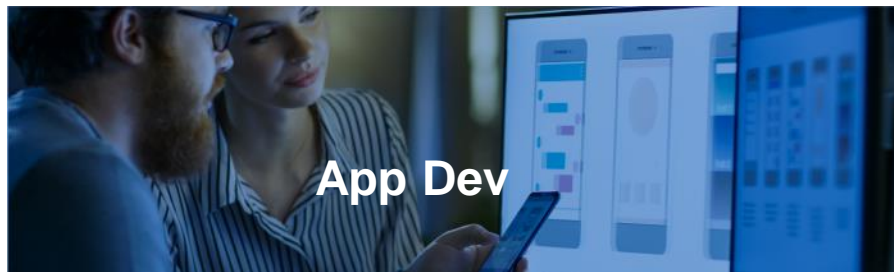


OPEN MAINFRAME PROJECT

**Zowe**

[zowe.org](https://zowe.org)

# Pain points managing database changes



## Application Developer

I have to open a ticket and wait, wait ...

Change request for initial dev env and for any other env.  
and for any change iteration

Didn't work before

Have to remember previous change ...

Loose momentum in the development effort, its very disruptive

Lower priority work is done before the high priority work because of the wait

Cause of frustration and motivation to look for alternatives



## DBA

- Manually monitors ticket queues
- Executes many simple DDL change requests daily, very repetitive; no time for innovative projects, performance evaluation and application tuning
- Room for human errors, missing deadlines
- Difficult to enforce standardization,
- Security changes an afterthought

↓ DBA controls DB2 rules and data ↓





# Pain points managing database changes (US Insurance)

- AD have **dependency** on DBAs for code deployment
- Multiple communication between DBA, AD and Data Modeler creates **bottlenecks**
- **Rework** is often required before code can be deployed, hindering **continuous flow**
- Annually, an average of **11,000 tasks** are assigned to DBAs to repeat deployment tasks
- Process has to be **repeated** for all environments

## Metrics of interest

- Avg time AD has to wait for completion of DBA request  
**56 hours**
- Estimated time DBAs spent annually for db code deployment  
**8,500 hours**
- Estimated percent of requests require additional clarification, rework ...  
**92 %**

# Demo user stories - ALTER ADD COLUMN

**Today:** Database changes not supported in existing pipeline for Cobol application changes

- Schema is pre-existing JCL job executed during setup
- Install not part of the demo
- No Db2 changes as part of the current pipeline



As a **developer**, I want to make application code changes as well as DDL changes in my sandbox environment independently, so that I can develop and test new features more efficiently.



As a **DBA**, I want to enforce Db2 standards and rules, so that application developers can execute DDL changes independently without messing up my Db2.

# Information to prepare

Identify **application components** that need to be processed in the pipeline

Understand the **roles and responsibilities** - they need to be reflected in Db2 DevOps Experience team definitions

Understand the **DBA rules** – they need to be defined in Db2

DevOps Experience business rules

- Rules and processes may be outdated and
  - Not exploit all available Db2 and tools functionality
  - Follow old recommendation

CICS Cobol using Db2 for z/OS  
Cobol source code  
DDL  
Static packages, DBRMs

**Legend:**

**R - Responsible.** Person responsible for execution.  
**A - Accountable.** Person accountable (Oversight/Review).  
**C - Consulted.** Individuals whose input is necessary.  
**I - Informed.** Stakeholders who need to be informed.  
*If there is no accountability indicated for a task, the person responsible assumes accountability.*

	AD	DBA	Data Modeler
Create the DDL	A	C	R
Build and push code to DevOps (Git)	R	C	
Create a pull request for the code changes	R	I	
Review and approve the pull request	A	R	
Deploy database code changes to all lower regions	R		
Deploy database code changes to Production	R	I	
Rollback database code changes	R	C	

**Table name:**

- Up to 18 character name, consisting of an upper case 'T' (Table), followed by upper case letters, digits and underscores.
- The 2nd and 3rd characters are an 'Application ID' Code
- The next 15 characters are available for the table name abbreviation using the same standard abbreviations as those developed for columns.

**Taatttt...**

**T**

**aa**

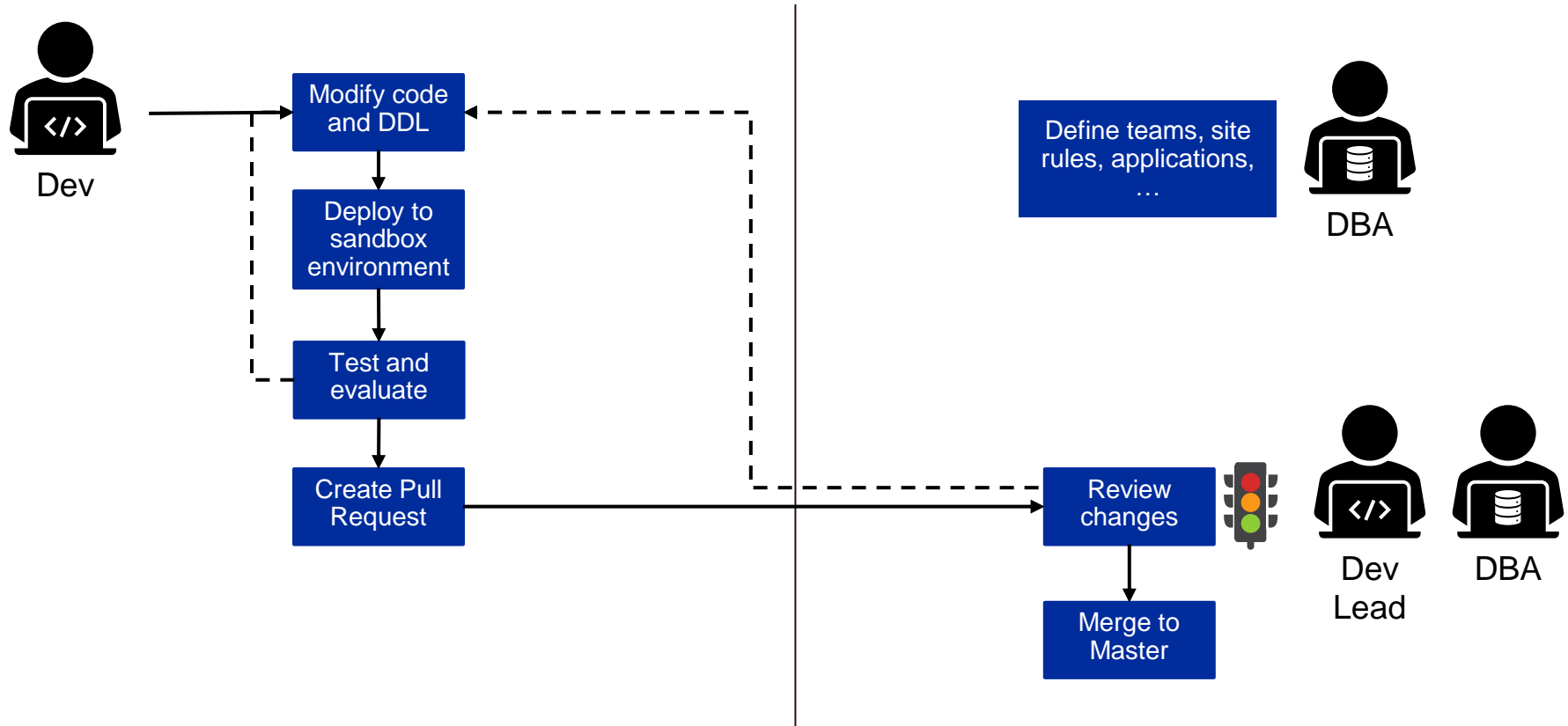
**tttt....**

A constant that identifies the object as a Table

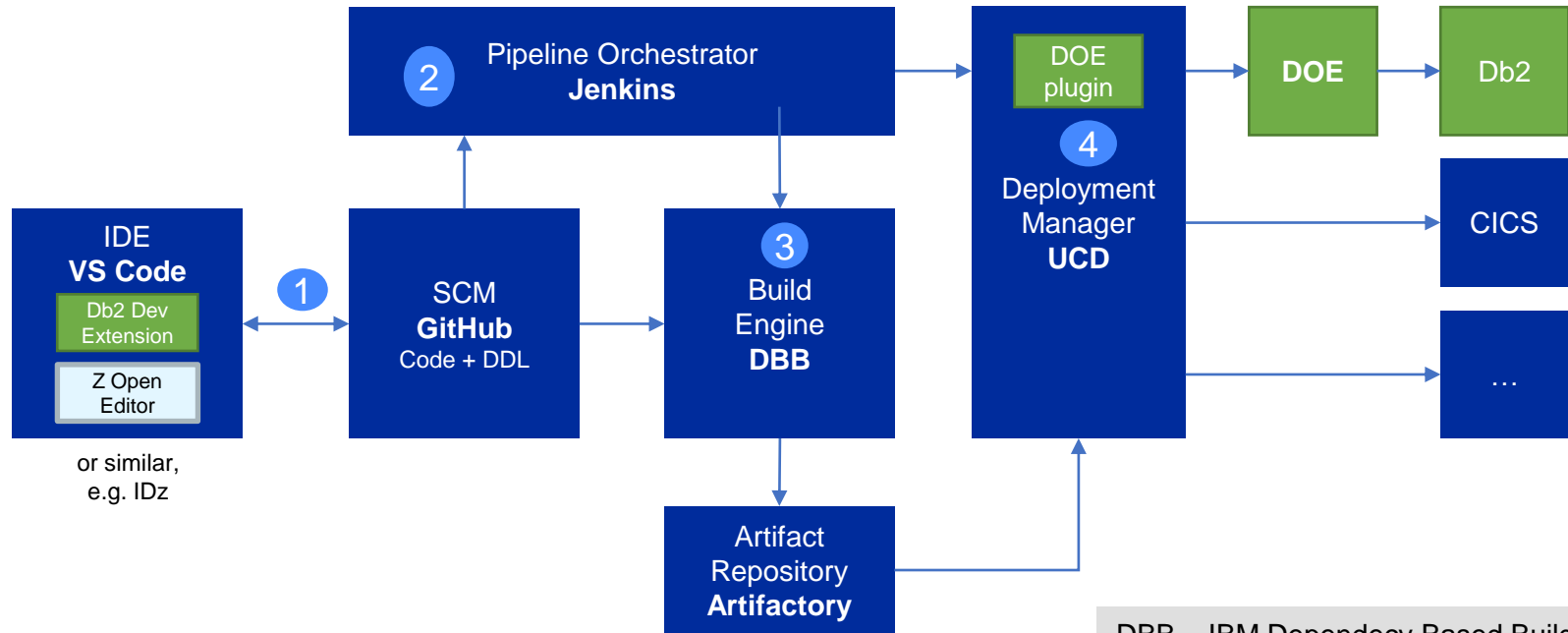
'Application ID' Code

Represents a descriptive name that uniquely identifies the table

# Steps by role

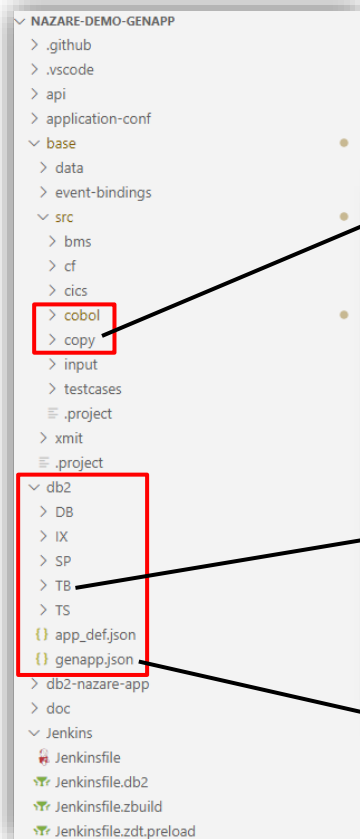


# Demo architecture and components



DBB = IBM Dependency Based Build  
UCD = IBM UrbanCode Deploy  
DOE = IBM Db2 DevOps Experience

# IDE and code/DDI change



```
SET CURRENT SQLID='GENCDB0';
CREATE TABLE GENCDB0.CUSTOMER
(CUSTOMERNUMBER INTEGER NOT NULL GENERATED
AS IDENTITY
(START WITH 1000001, INCREMENT BY 1, CACHE
NO ORDER, MAXVALUE 2147483647, MINVALUE 1000001),
FIRSTNAME CHAR(10) FOR SBCS DATA WITH DEFAULT NULL,
LASTNAME CHAR(20) FOR SBCS DATA WITH DEFAULT NULL,
DATEOFBIRTH DATE WITH DEFAULT NULL,
HOUSENAME CHAR(20) FOR SBCS DATA WITH DEFAULT NULL,
HOUSENUMBER CHAR(4) FOR SBCS DATA WITH DEFAULT NULL,
POSTCODE CHAR(8) FOR SBCS DATA WITH DEFAULT NULL,
PHONEHOME CHAR(20) FOR SBCS DATA WITH DEFAULT NULL,
PHONEMOBILE CHAR(15) FOR SBCS DATA WITH DEFAULT NULL,
EMAILADDRESS CHAR(100) FOR SBCS DATA WITH DEFAULT NULL,
PHONECC CHAR(5) FOR SBCS DATA WITH DEFAULT NULL,
CONSTRAINT CUSTOMERNUMBER
PRIMARY KEY (CUSTOMERNUMBER))
IN GENCDB0.GENCTS01
AUDIT NONE
DATA CAPTURE NONE
CCSID EBCDIC
NOT VOLATILE
APPEND NO ;
COMMIT;
```

```
03 CA-CUSTOMER-REQUEST REDEFINES CA-REQUEST-SPECIFIC.
05 CA-FIRST-NAME PIC X(10).
05 CA-LAST-NAME PIC X(20).
05 CA-DOB PIC X(10).
05 CA-HOUSE-NAME PIC X(20).
05 CA-HOUSE-NUM PIC X(4).
05 CA-POSTCODE PIC X(8).
05 CA-NUM-POLICIES PIC 9(3).
05 CA-PHONE-MOBILE PIC X(15).
05 CA-PHONE-CC PIC X(5).
05 CA-PHONE-HOME PIC X(20).
05 CA-EMAIL-ADDRESS PIC X(100).
05 CA-POLICY-DATA PIC X(32267).
```

```
{
  "name": "CUSTOMER_SECURE",
  "type": "TB",
  "uri": "TB/CUSTOMER_SECURE.sql"
},
{
  "qualifier": "GENCDB0",
  "name": "CUSTOMER",
  "type": "TB",
  "uri": "TB/CUSTOMER.sql"
},
{
  "qualifier": "GENCDB0"
```







# Jenkins pipeline

## Branch db2dev\_integration

Full project name: GenAppNazarePipelineDB2/db2dev\_integration



### Last Successful Artifacts

 BuildReport.html	10.71 KB  <a href="#">view</a>
 BuildReport.json	4.12 KB  <a href="#">view</a>
 LGACDB01.cobol.log	87.46 KB  <a href="#">view</a>



### Recent Changes

## Stage View

	Init	Git Clone/Refresh	Db2: Init	DBB Build & zUnit Test & zUnit Code Coverage (master)	UCD Version/Package	Db2: Deploy Schema	UCD Deploy
Average stage times: (Average full run time: ~8min 25s)	191ms	10s	2s	12s	6s	6min 30s	16s
#7 Jan 13 14:22 1 commit	207ms	7s	2s	13s	15s	2min 41s	55s
#6 Jan 13 1	243ms	22s	5s	13s	20s	2min 22s	1min 3s

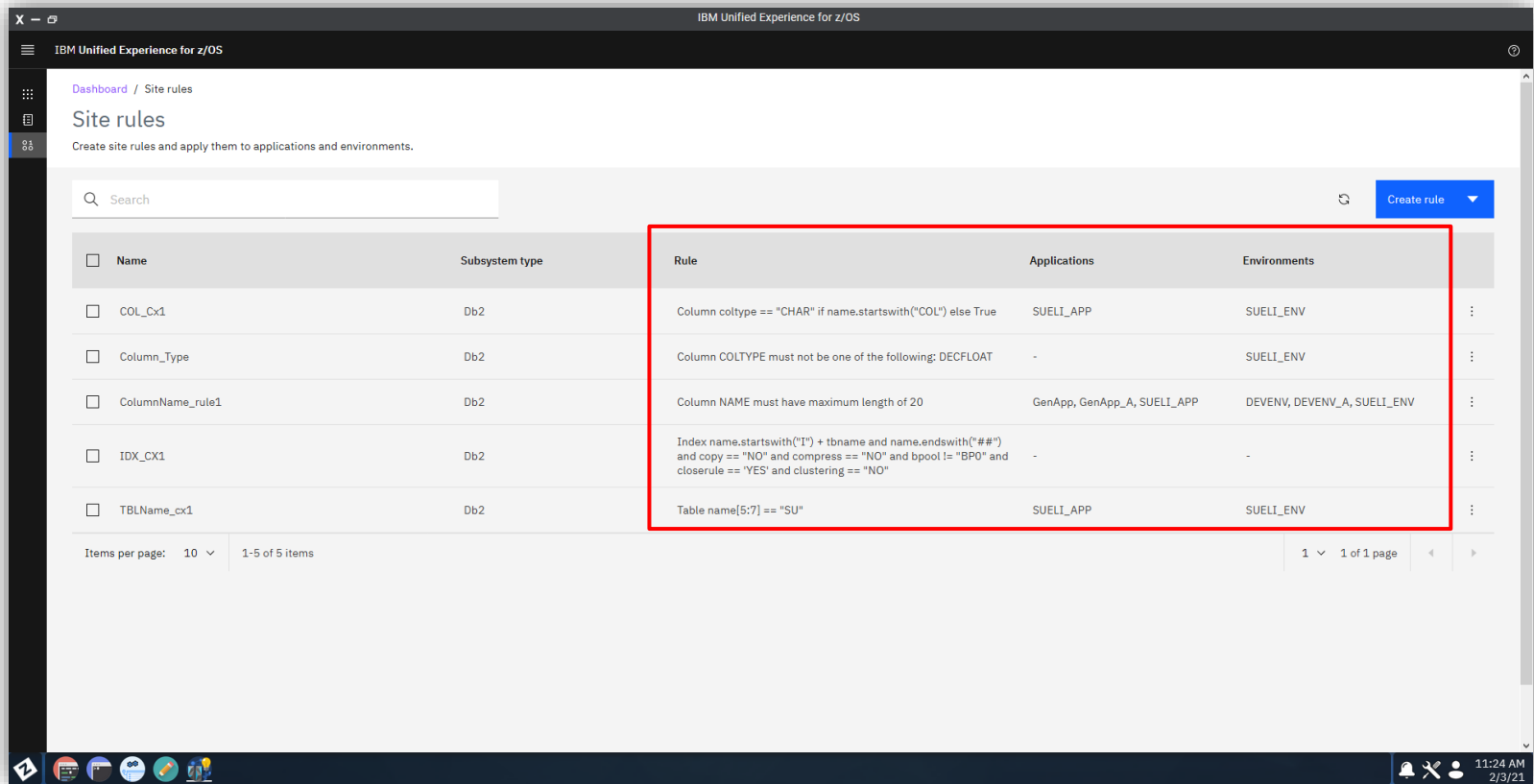
# Db2 DevOps experience teams

The screenshot displays the 'Teams' page in the IBM Unified Experience for z/OS. The page title is 'Teams' and it includes a subtitle: 'Create a team and associate it with environments. You can optionally select members and administrators of the team.' There is a search bar labeled 'Search teams' and a 'Create team' button. The teams are listed in a grid, each showing the team name, the number of assigned environments, and a list of those environments. A red box highlights the first three teams: DEVTEAM, DEVTEAM\_A, and DEVTEAM1.

Team Name	Assigned environments	Count
DBATEAM1	DB2DOE_INT, DB2DOE_ENV1	2
DEVTEAM	DEVENV	1
DEVTEAM_A	DEVENV_A	1
DEVTEAM1	DB2DOE_INT, DB2DOE_ENV1	2
HOLSTE_TEAM	HOLSTE_ENV	1
RTS_TMP_TEAM	RTS_TMP_ENV	1
SUELI_TEAM	SUELI_ENV	1
TOSHEN_TEAM	TOS_HEN_TGT, TOS_HEN_SRC	2
vk_naz_team	vk_naz_master	2



# Db2 DevOps experience site rules



IBM Unified Experience for z/OS

Dashboard / Site rules

## Site rules

Create site rules and apply them to applications and environments.

Search

Create rule

<input type="checkbox"/>	Name	Subsystem type	Rule	Applications	Environments	
<input type="checkbox"/>	COL_Cx1	Db2	Column coltype == "CHAR" if name.startwith("COL") else True	SUELI_APP	SUELI_ENV	⋮
<input type="checkbox"/>	Column_Type	Db2	Column COLTYPE must not be one of the following: DECFLOAT	-	SUELI_ENV	⋮
<input type="checkbox"/>	ColumnName_rule1	Db2	Column NAME must have maximum length of 20	GenApp, GenApp_A, SUELI_APP	DEVENV, DEVENV_A, SUELI_ENV	⋮
<input type="checkbox"/>	IDX_CX1	Db2	Index name.startwith("I") + tbname and name.endwith("#") and copy == "NO" and compress == "NO" and bpool != "BP0" and closerule == "YES" and clustering == "NO"	-	-	⋮
<input type="checkbox"/>	TBLName_cx1	Db2	Table name[5:7] == "SU"	SUELI_APP	SUELI_ENV	⋮

Items per page: 10 1-5 of 5 items

1 1 of 1 page

11:24 AM 2/3/21

# GitHub repository

IBMZSoftware / nazare-demo-genapp

forked from ian-burnett/cics-genapp

Code Issues 3 Pull requests 1 Projects 0 Wiki Insights Settings More

CB12: General insurance application (GENAPP) for IBM CICS TS <http://www-01.ibm.com/support/docview...> Edit

Manage topics

995 commits 90 branches 0 releases 16 contributors

Your recently pushed branches:

db2dev\_integration (10 minutes ago) Compare & pull request

Branch: db2dev\_integra... New pull request

Create new file Upload files Find file Clone or download

This branch is 954 commits ahead, 4 commits behind ian-burnett:master. Pull request Compare

benedict-holste	Add PHONECC column, i.e. run the demo	Latest commit 65a35d1 10 minutes ago
.github	Update CODEOWNERS	28 days ago
.vscode	Add VSCode User Build config file.	2 months ago
Jenkins	Update Jenkinsfile	28 days ago
api	Update of API	2 years ago
application-conf	Integer zUnit in "on premise" pipeline	2 months ago
base	Add PHONECC column, i.e. run the demo	10 minutes ago
db2-nazare-app	test db2	10 months ago
db2	Add PHONECC column, i.e. run the demo	10 minutes ago
doc	Move documentation to correct location.	4 years ago
licence	Move licence files to common location.	4 years ago
lite	Move documentation to correct location.	4 years ago
policy-cloud	Project reorg (#19)	4 years ago

# UCD deployment process w/ rule violation

Step	Progress	Start Time	Duration	Status	
▼ 1. ⚙️ Install: "Db2zSchemaIntegration_dev"	1 / 1	5:09:39 PM	0:00:23	Failed	
▼ 🗺️ Db2zSchemaIntegration_dev	1 / 1	5:09:39 PM	0:00:23	Failed	
▼ 📄 DeploySchema (Db2zSchemaIntegration_dev 2021-01-29T08:09:37.009)		5:09:39 PM	0:00:23	Failed	⋮
1. 📄 DownloadArtifacts		5:09:40 PM	0:00:03	Success	⋮
2. ⚙️ Analyze		5:09:43 PM	0:00:15	Failed	⋮
3. 📄 DetermineApproval				Not Started	
4. 👤 Approval required					
5. ✅ Manual Task: RequestApproval					
6. ⚙️ Apply				Not Started	
Total Execution	1 / 1	5:09:39 PM	0:00:23	Failed	

Analysis failed due to syntax or site rule violations.  
TB CUSTOMER: Site rule COL\_Cx1 violated for attribute COLSITERULEcoltype == "CHAR" if name.startswith("COL") else True

# UCD deployment process w/o approval

Step	Progress	Start Time	Duration	Status
▼ 1. Install: "Db2zSchemaIntegration_dev"	1 / 1	5:23:29 PM	0:00:58	Success
▼ Db2zSchemaIntegration_dev	1 / 1	5:23:29 PM	0:00:58	Success
▼ DeploySchema (Db2zSchemaIntegration_dev 2021-01-29T08:23:27.023)		5:23:29 PM	0:00:58	Success
1. DownloadArtifacts		5:23:29 PM	0:00:03	Success
2. Analyze		5:23:32 PM	0:00:22	Success
3. DetermineApproval		5:23:54 PM	0:00:11	Success
4. Approval required		5:24:05 PM	0:00:00	Success
5. <input checked="" type="checkbox"/> Manual Task: RequestApproval				Not Started
6. Apply		5:24:05 PM	0:00:17	Success
Total Execution	1 / 1	5:23:29 PM	0:00:58	Success

**OBJECT COMPARISON REPORT**  
=====

Only changed, added and deleted objects will be reported  
Masked values will be applied to ignored fields of new objects.

Source:  
Extracted from location \*FROM DDL FILE\* at 2021-01-29 11:23 by SYSADM

Target:  
Extracted from DBC1 at 2021-01-29 11:23 by SYSADM

Target system is DB2 Release 1215

Compare table source(GENCKWOC.CUSTOMER) and target(GENCKWO.CUSTOMER)

(A)Column COLSITERULE appended  
Table will be altered

Name	Value
approvalRequired	no

# UCD deployment process w/ approval

Step	Progress	Start Time	Duration	Status	
▼ 1. Install: "Db2zSchemaIntegration_dev"	1 / 1	5:32:06 PM	0:03:19	Success	
▼ Db2zSchemaIntegration_dev	1 / 1	5:32:07 PM	0:03:19	Success	
▼ DeploySchema (Db2zSchemaIntegration_dev 2021-01-29T08:32:04.032)		5:32:07 PM	0:03:19	Success	⋮
1. DownloadArtifacts		5:32:07 PM	0:00:03	Success	⋮
2. Analyze		5:32:10 PM	0:00:22	Success	⋮
3. DetermineApproval		5:32:32 PM	0:00:10	Success	⋮
4. Approval required		5:32:42 PM	0:00:00	Success	⋮
5. Manual Task: RequestApproval		5:32:42 PM	0:02:21	Complete	⋮
6. Apply		5:35:03 PM	0:00:13	Success	⋮
Total Execution	1 / 1	5:32:06 PM	0:03:19	Success	

## OBJECT COMPARISON REPORT

=====

Only changed, added and deleted objects will be reported  
Masked values will be applied to ignored fields of new objects.

Source:

Extracted from location \*FROM DDL FILE\* at 2021-01-29 11:32 by SYSADM

Target:

Extracted from DBC1 at 2021-01-29 11:32 by SYSADM

Target system is DB2 Release 1215

Compare table source(GENCKDB0.CUSTOMER) and target(GENCKWO.CUSTOMER)  
ADB7192I ALTER TABLE DROP COLUMN RESTRICT statement cannot be ge

Reason code

(D)Column COLSITERULE dropped  
Table GENCKWO.CUSTOMER will be dropped  
Table will be recreated

Table data will not be converted  
Not eligible for FORMAT INTERNAL processing

## Name

## Value

approvalRequired

yes

## Approval Log

### Status

Complete

### Completed By

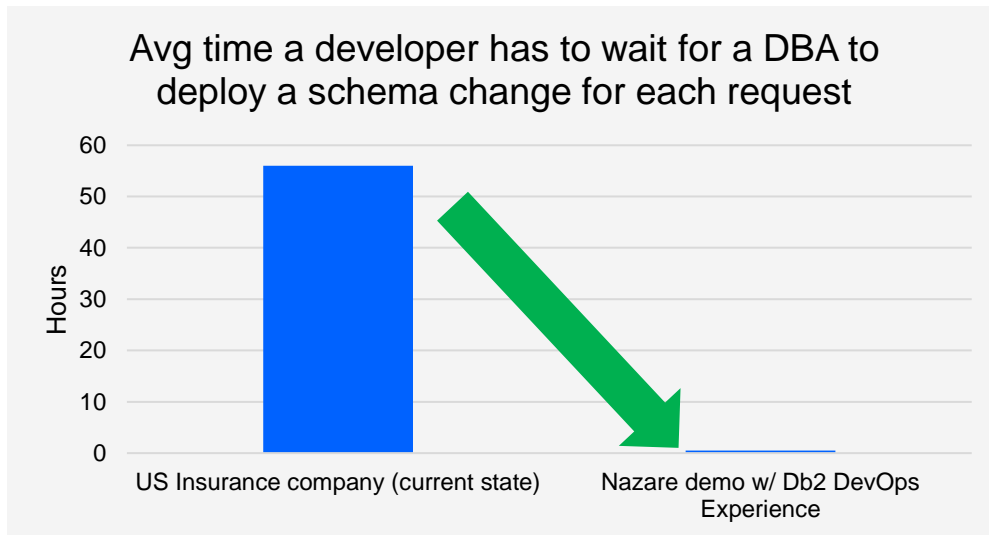
DOEDBA

### Completed On

1/29/2021, 5:35 PM

# Business value

- For many DBA requests, avg time can be **reduced from days to minutes**
- **Rework requests to AD** are part of the pipeline flow



# Thank you

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