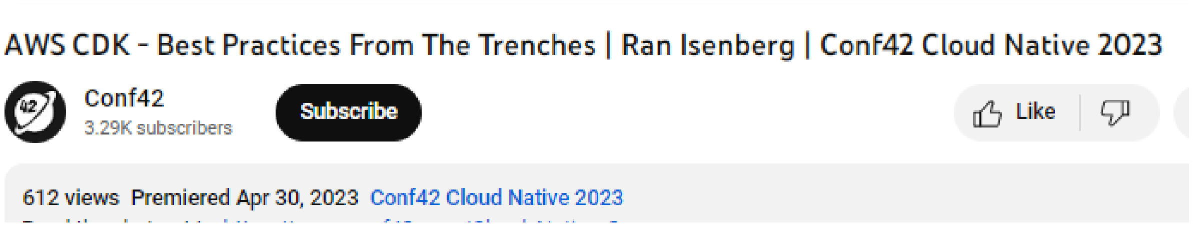
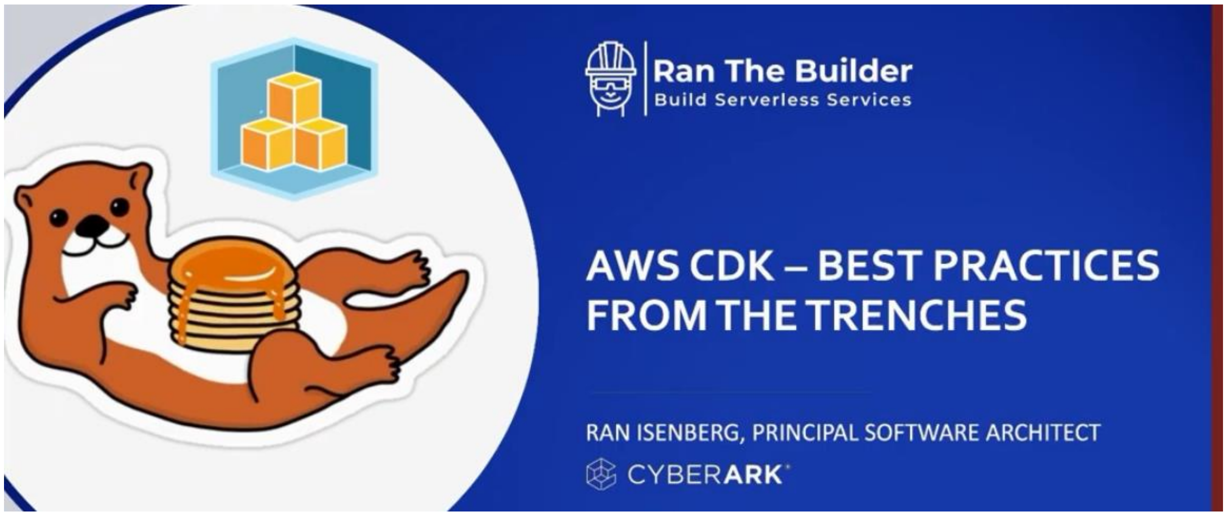


AWS CDK - Best Practices From The Trenches | Ran Isenberg | Conf42 Cloud Native 2023

612 views Premiered Apr 30, 2023 Conf42 Cloud Native 2023

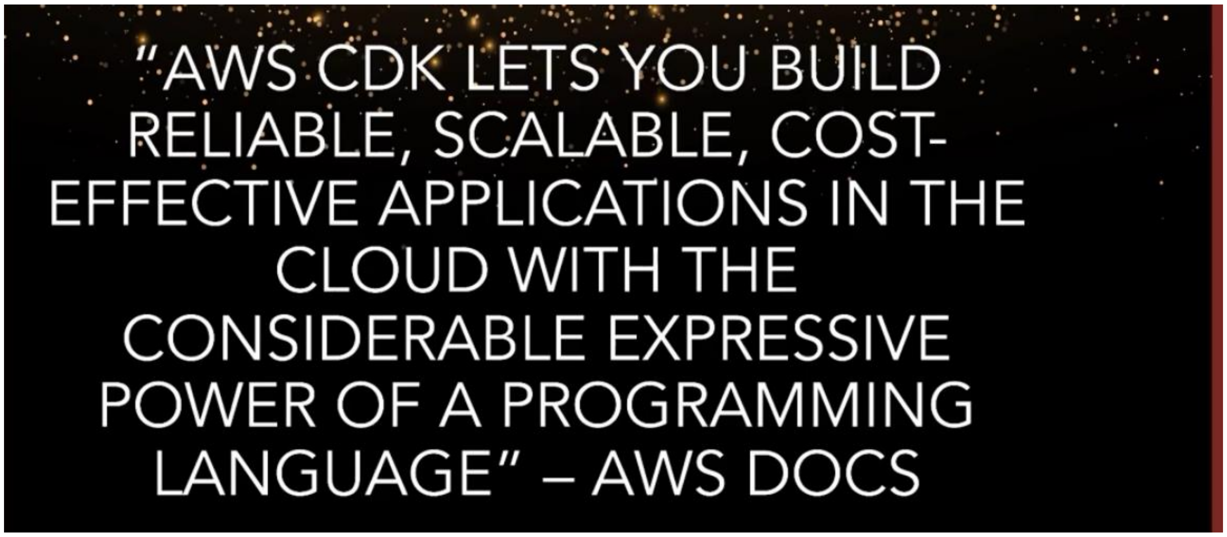


Ran The Builder
Build Serverless Services

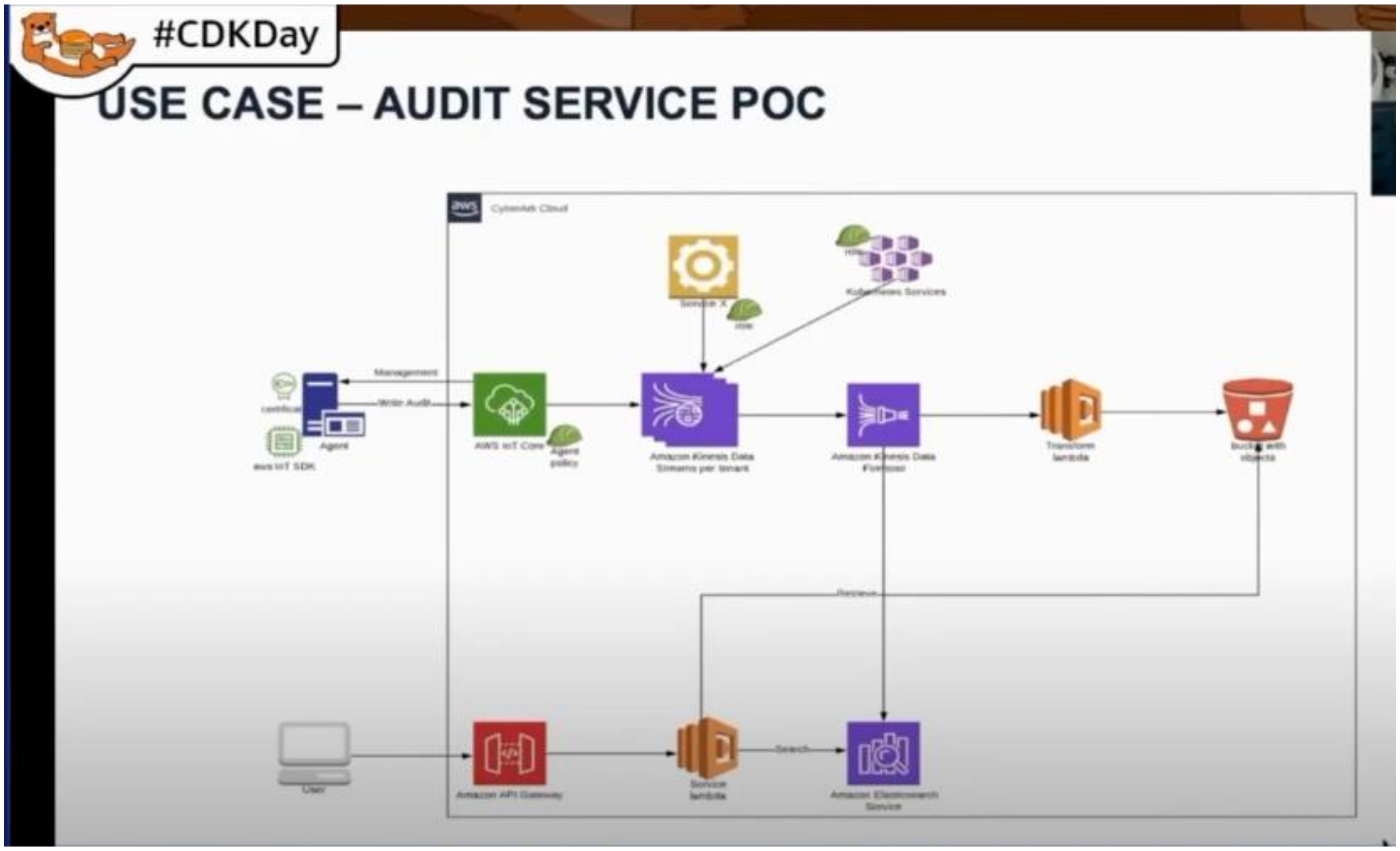
AWS CDK – BEST PRACTICES FROM THE TRENCHES

RAN ISENBERG, PRINCIPAL SOFTWARE ARCHITECT

CYBERARK



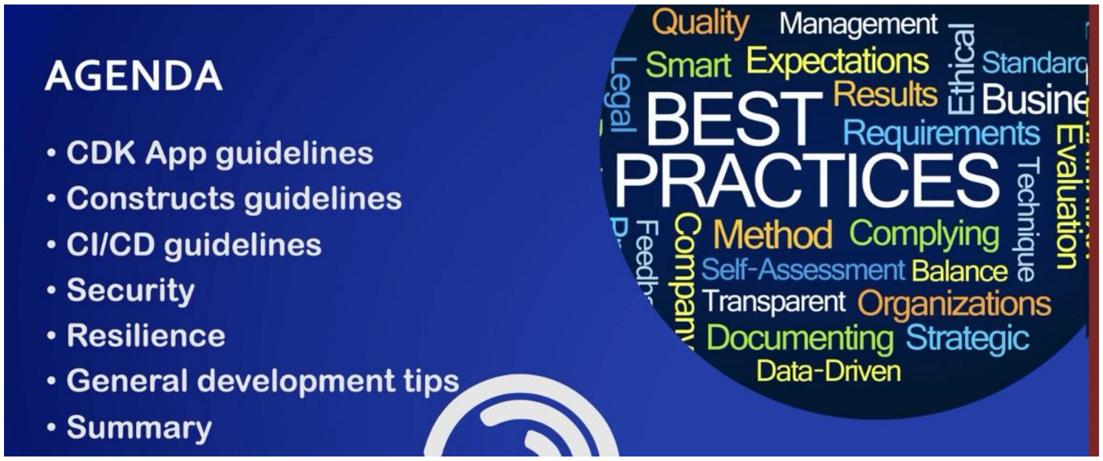
"AWS CDK LETS YOU BUILD RELIABLE, SCALABLE, COST-EFFECTIVE APPLICATIONS IN THE CLOUD WITH THE CONSIDERABLE EXPRESSIVE POWER OF A PROGRAMMING LANGUAGE" – AWS DOCS



USE CASE – AUDIT SERVICE POC

This POC is an ETL log service that transforms the streaming data with a Lambda before saving it off into a database.

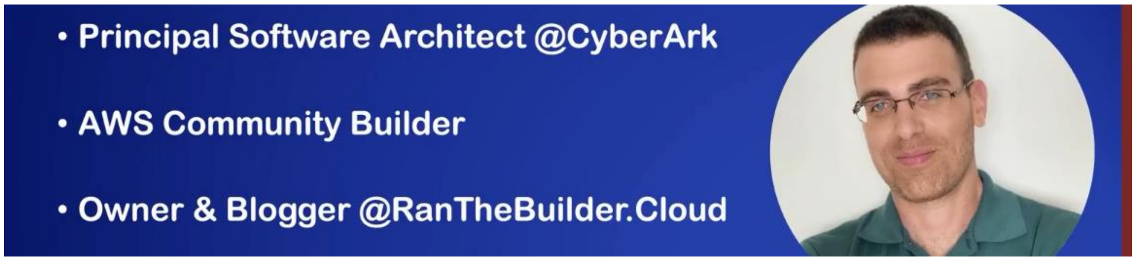
With great power comes great responsibility.
Uncle ben, 2002, Spiderman



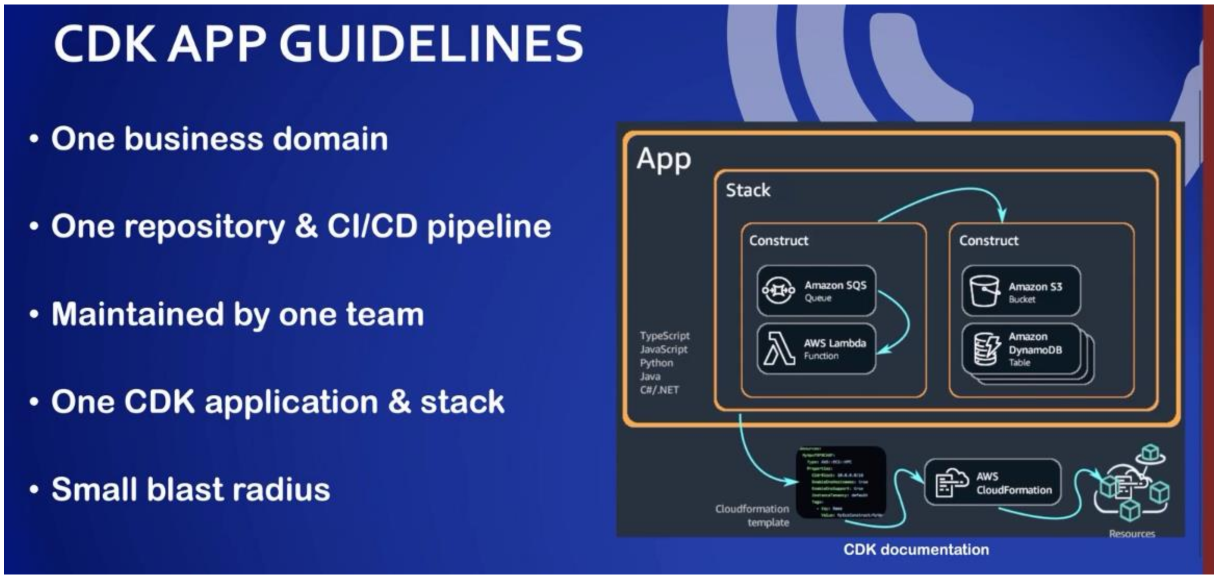
AGENDA

- CDK App guidelines
- Constructs guidelines
- CI/CD guidelines
- Security
- Resilience
- General development tips
- Summary

BEST PRACTICES
Quality
Management
Smart
Expectations
Ethical
Standard
Legal
Results
Busine
Requirements
Evaluation
Technique
Method
Complying
Company
Feedb
Self-Assessment
Balance
Transparent
Organizations
Documenting
Strategic
Data-Driven

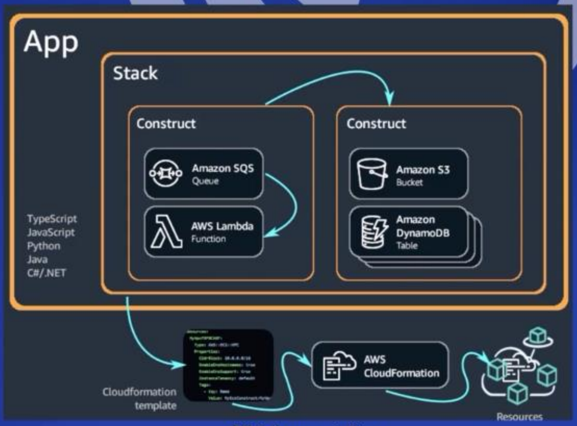


- Principal Software Architect @CyberArk
- AWS Community Builder
- Owner & Blogger @RanTheBuilder.Cloud

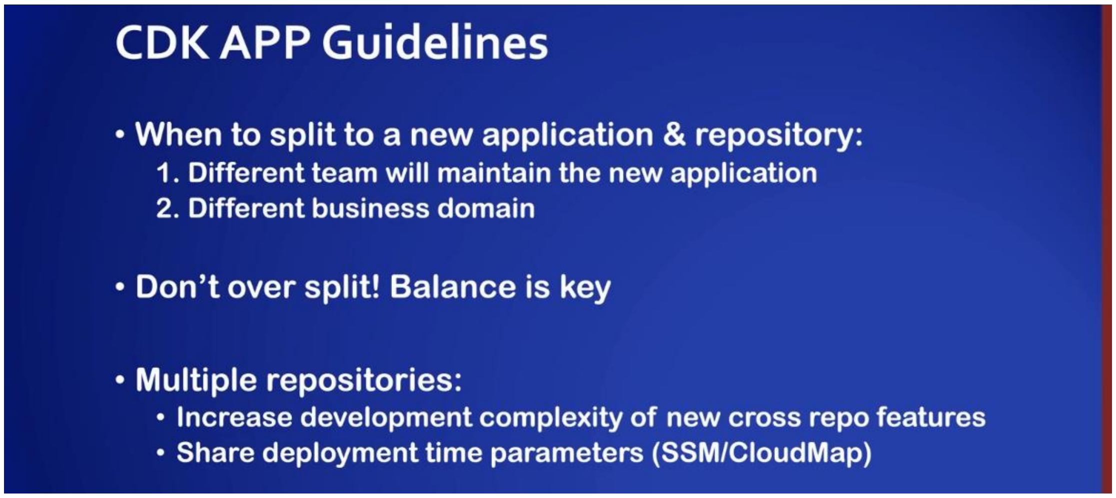


CDK APP GUIDELINES

- One business domain
- One repository & CI/CD pipeline
- Maintained by one team
- One CDK application & stack
- Small blast radius

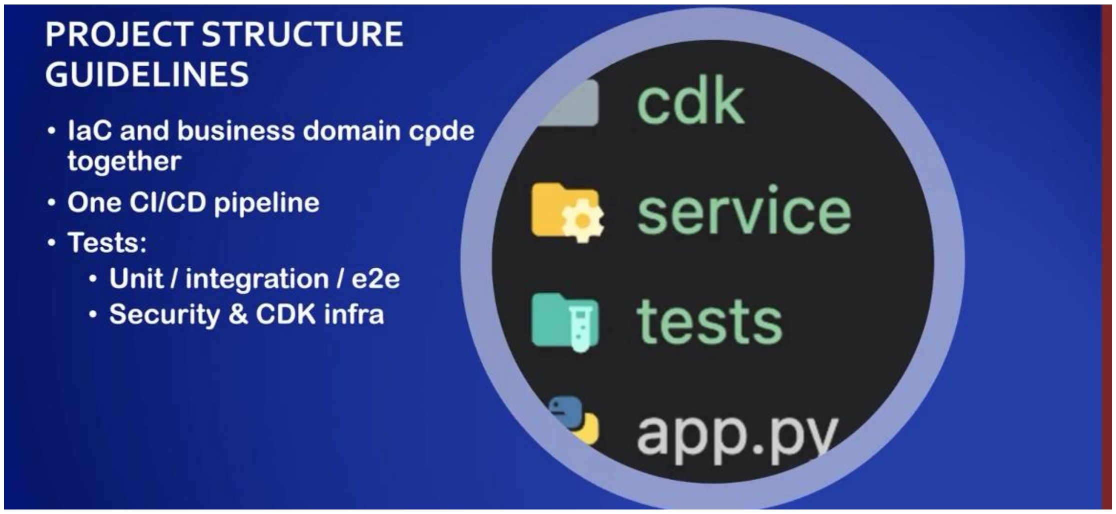


CDK documentation



CDK APP Guidelines

- When to split to a new application & repository:
  1. Different team will maintain the new application
  2. Different business domain
- Don't over split! Balance is key
- Multiple repositories:
  - Increase development complexity of new cross repo features
  - Share deployment time parameters (SSM/CloudMap)

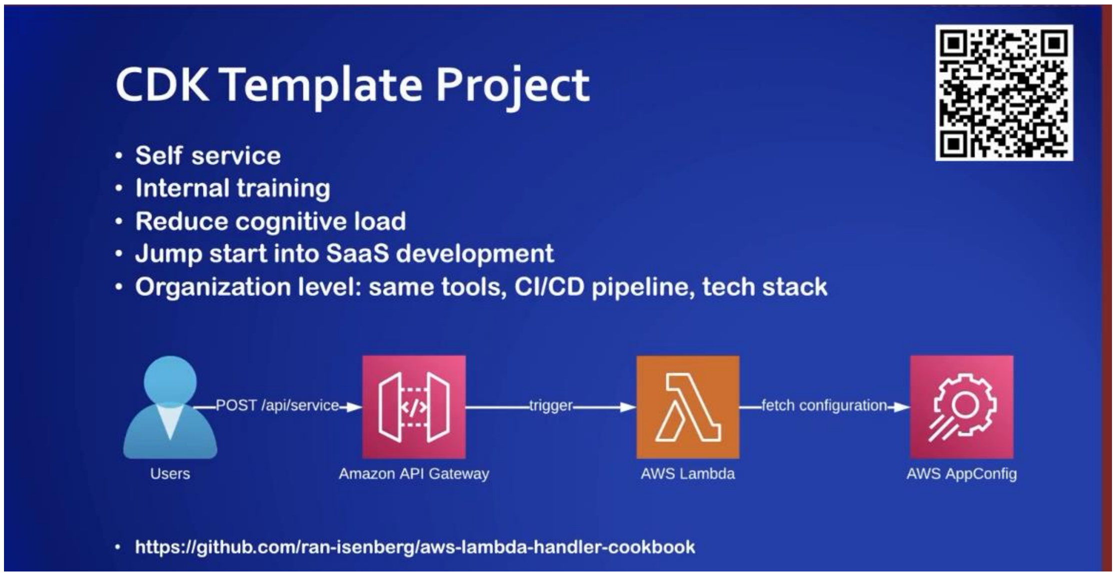


PROJECT STRUCTURE GUIDELINES

- IaC and business domain cpde together
- One CI/CD pipeline
- Tests:
  - Unit / integration / e2e
  - Security & CDK infra

cdk
service
tests
app.py

It is recommended to have 3 folders, a CDK folder, a main service folder for the business domain logic as Lambdas, and Tests folder



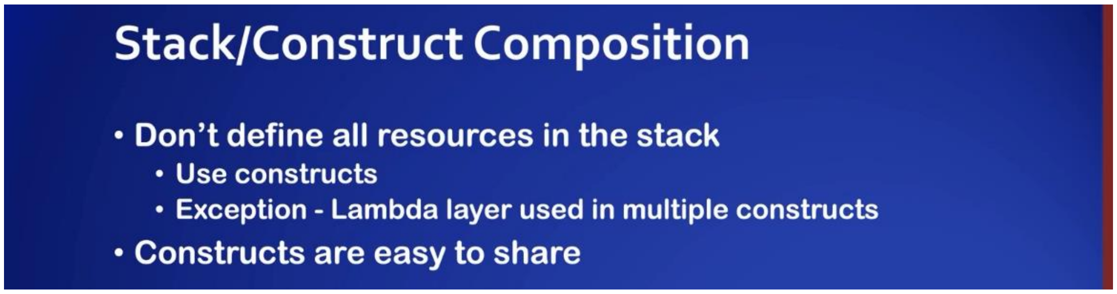
CDK Template Project

- Self service
- Internal training
- Reduce cognitive load
- Jump start into SaaS development
- Organization level: same tools, CI/CD pipeline, tech stack

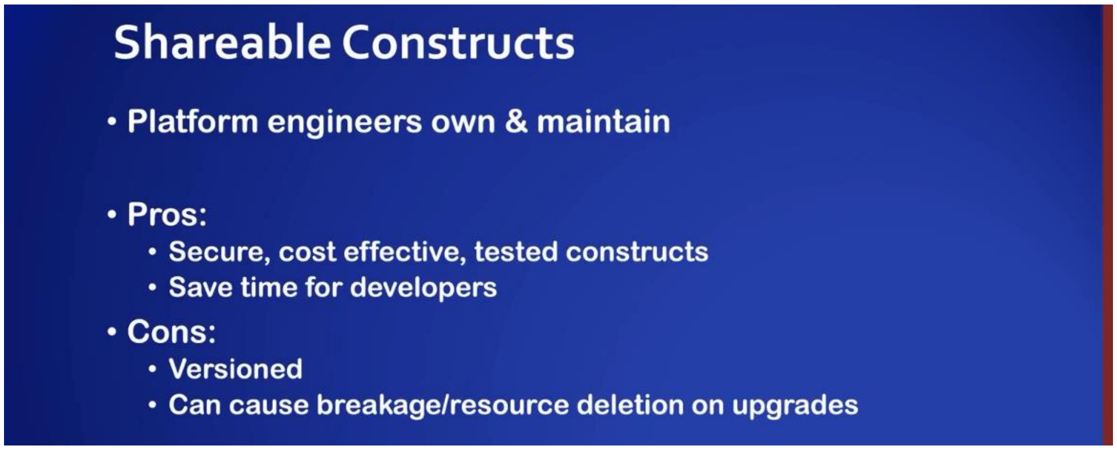
- https://github.com/ran-isenberg/aws-lambda-handler-cookbook

You can create a CDK Template project that teams can use in a self-service manner to get all the common things having the best practice patterns and they can just start writing the main business logic code.

CONSTRUCT GUIDELINES

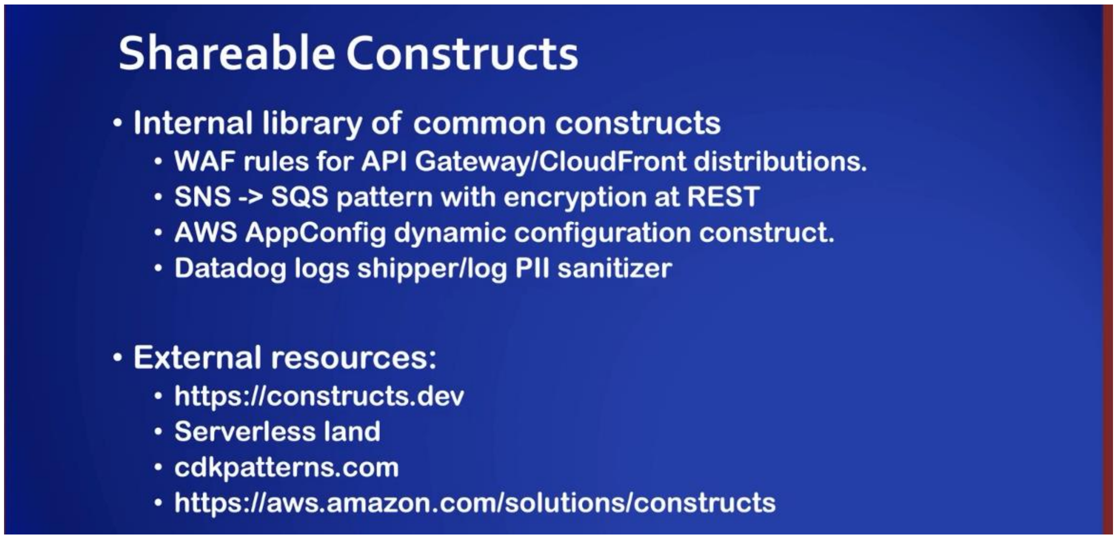

Stack/Construct Composition

- Don't define all resources in the stack
  - Use constructs
  - Exception - Lambda layer used in multiple constructs
- Constructs are easy to share

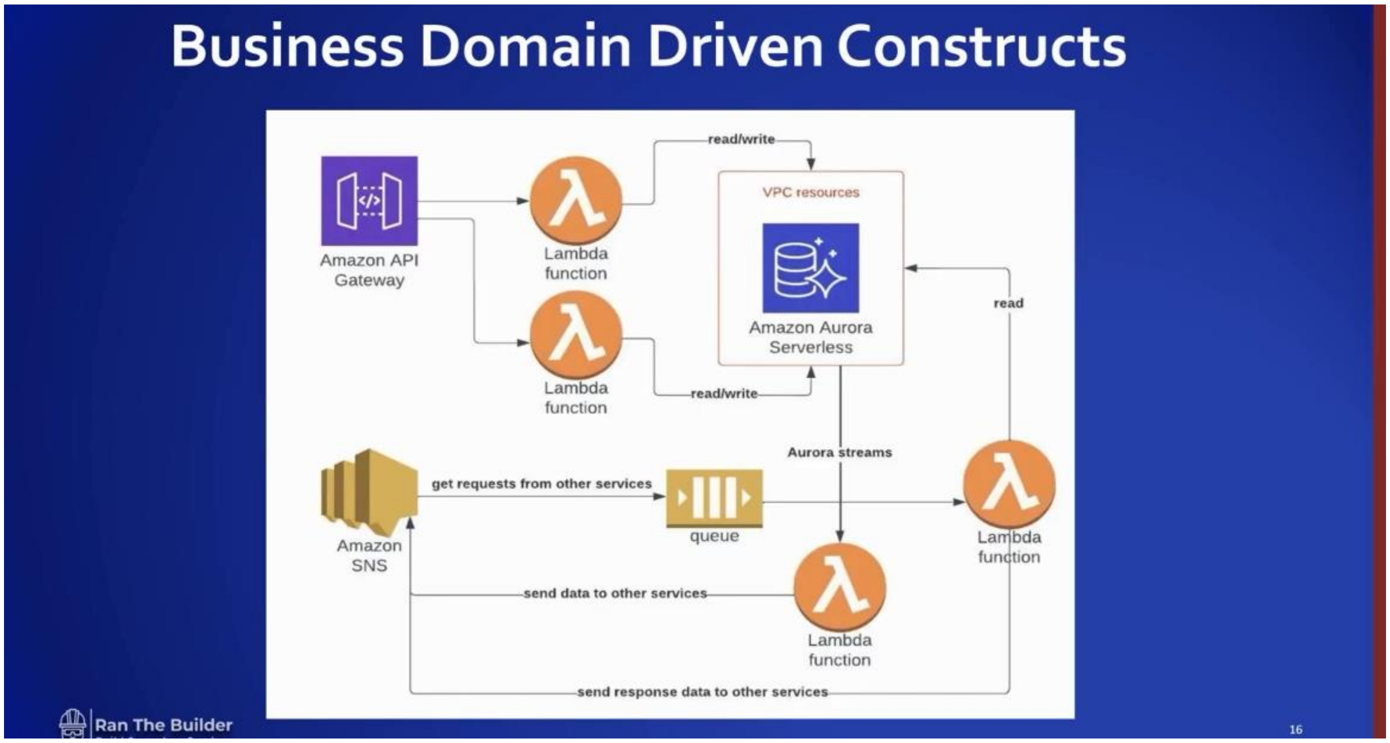

Shareable Constructs

- Platform engineers own & maintain
- Pros:
  - Secure, cost effective, tested constructs
  - Save time for developers
- Cons:
  - Versioned
  - Can cause breakage/resource deletion on upgrades

We have a versioned Python library of CDK constructs that our developers can pick and choose from.

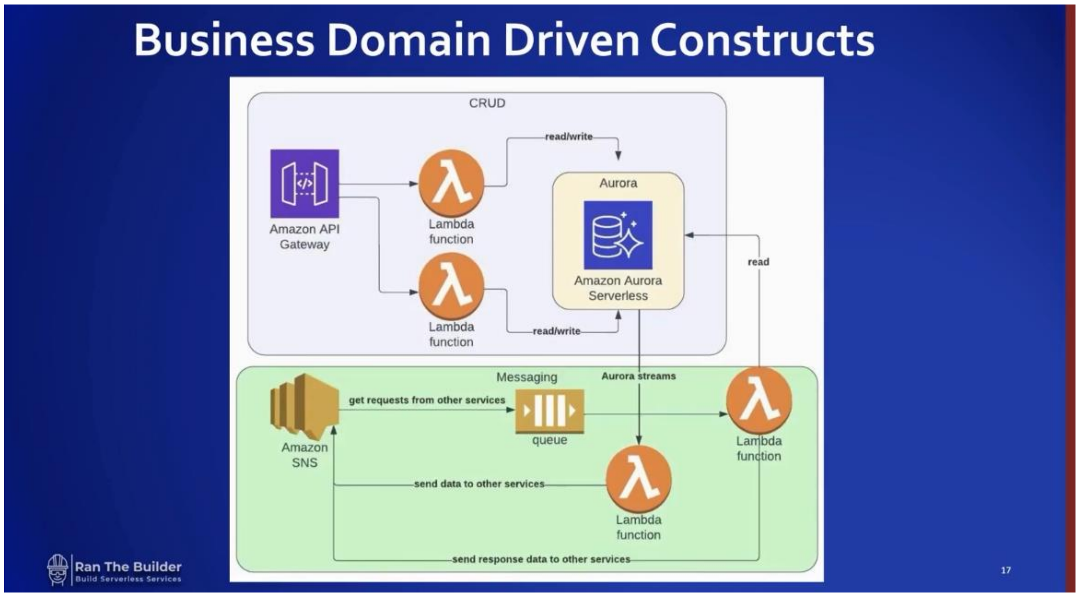

Shareable Constructs

- Internal library of common constructs
  - WAF rules for API Gateway/CloudFront distributions.
  - SNS -> SQS pattern with encryption at REST
  - AWS AppConfig dynamic configuration construct.
  - Datadog logs shipper/log PII sanitizer
- External resources:
  - https://constructs.dev
  - Serverless land
  - cdkpatterns.com
  - https://aws.amazon.com/solutions/constructs



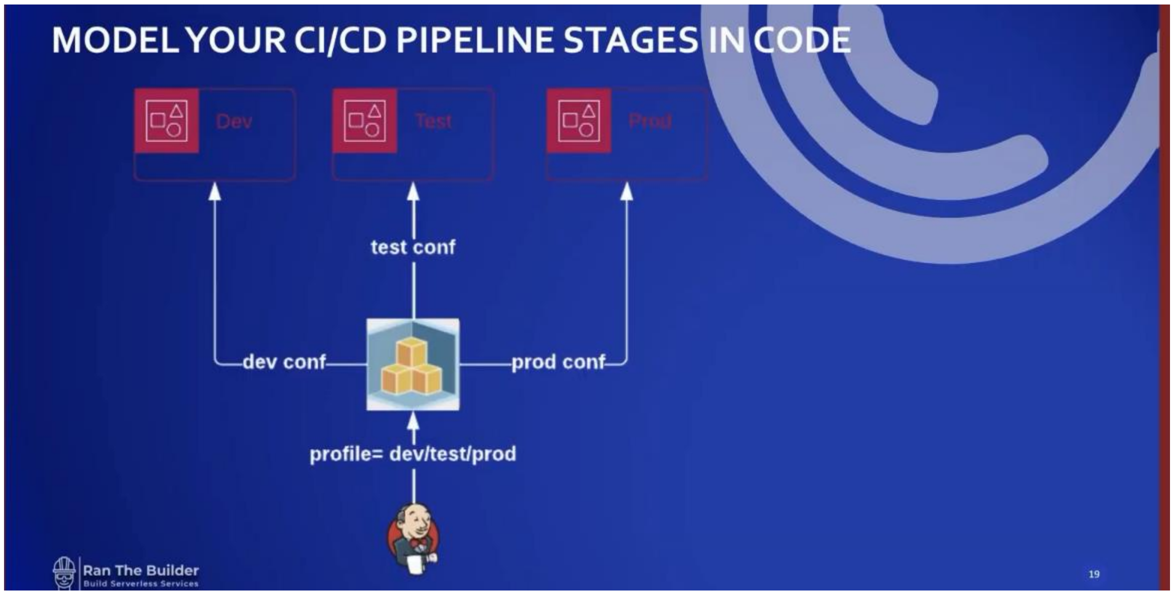
Business Domain Driven Constructs

How can we split this design into smaller separate constructs to enable sharing in future?

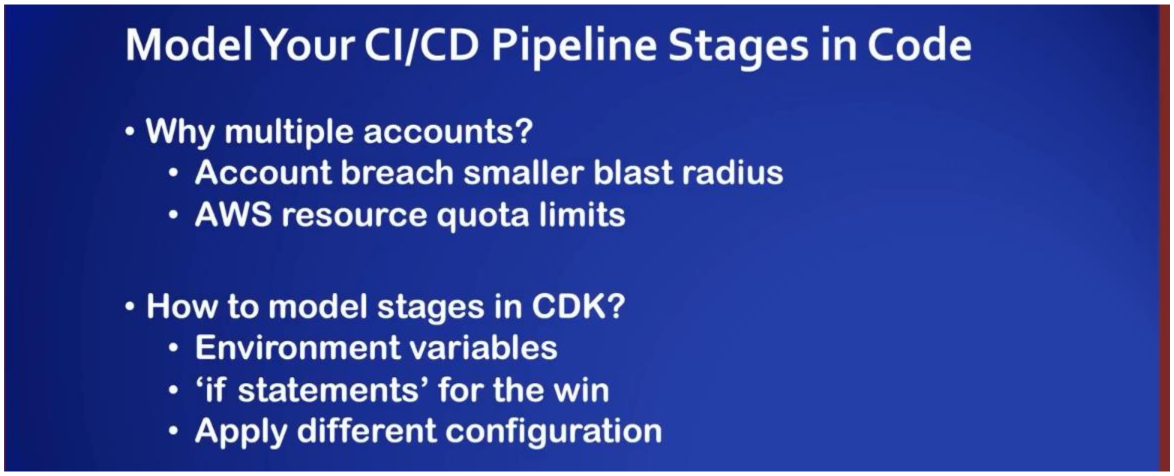


Business Domain Driven Constructs

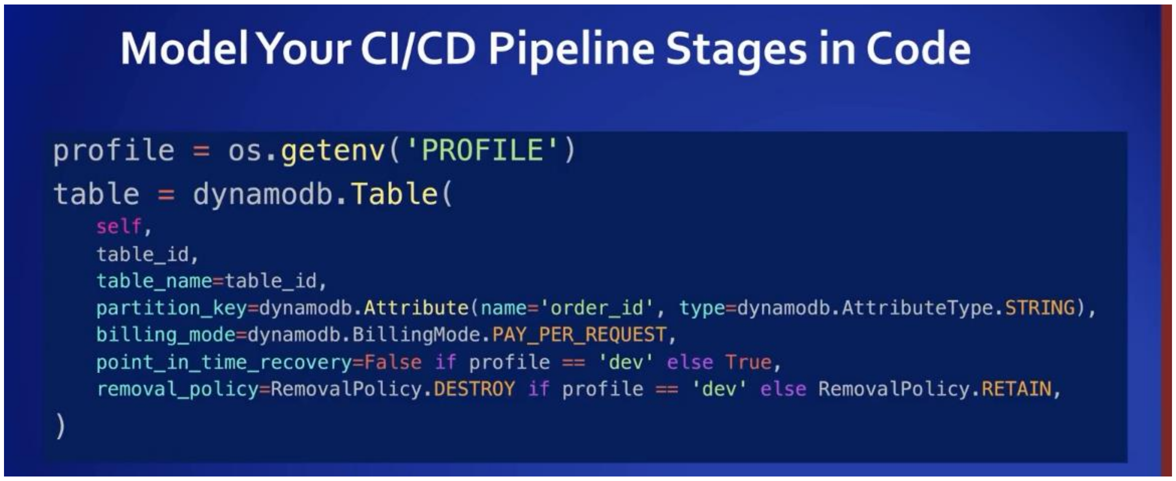
CI/CD GUIDELINES


MODEL YOUR CI/CD PIPELINE STAGES IN CODE

We use Jenkins to set the environment variables and inject them into the CDK for different configurations and accounts


Model Your CI/CD Pipeline Stages in Code

- Why multiple accounts?
  - Account breach smaller blast radius
  - AWS resource quota limits
- How to model stages in CDK?
  - Environment variables
  - 'if statements' for the win
  - Apply different configuration


Model Your CI/CD Pipeline Stages in Code

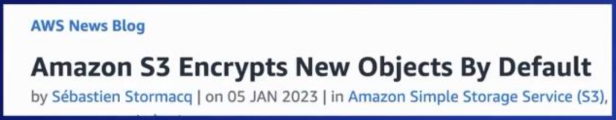
```
profile = os.getenv('PROFILE')
table = dynamodb.Table(
    self,
    table_id,
    table_name=table_id,
    partition_key=dynamodb.Attribute(name='order_id', type=dynamodb.AttributeType.STRING),
    billing_mode=dynamodb.BillingMode.PAY_PER_REQUEST,
    point_in_time_recovery=False if profile == 'dev' else True,
    removal_policy=RemovalPolicy.DESTROY if profile == 'dev' else RemovalPolicy.RETAIN,
)
```

SECURITY GUIDELINES

Secrets in CDK

- NEVER write hardcoded secrets in CDK or config files
- Store as GitHub/Jenkins/pipeline secret
  - Inject to CDK as environment variable/parameter during deploy
- Deploy secrets:
  - AWS Secrets Manager
  - SSM parameter store encrypted string
- Consume in Lambda from SSM/Secrets manager:
  - Secret name as lambda env. variable

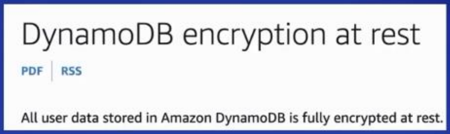
Some Security Defaults Are Not Good Enough



AWS News Blog

Amazon S3 Encrypts New Objects By Default

by Sébastien Stormacq | on 05 JAN 2023 | in Amazon Simple Storage Service (S3),



DynamoDB encryption at rest

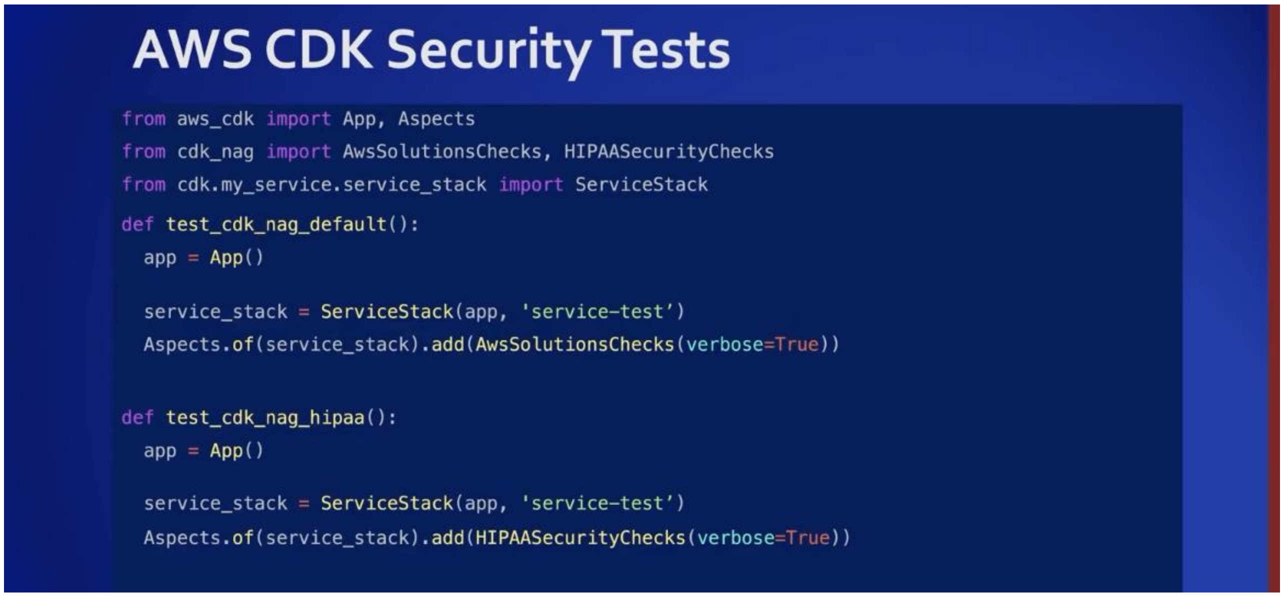
PDF | RSS

All user data stored in Amazon DynamoDB is fully encrypted at rest.

- What about SNS encryption at rest?
  - Disabled by default
- Security defaults differ by service
- AWS sets better defaults over time

Some Security Defaults Are Not Good Enough

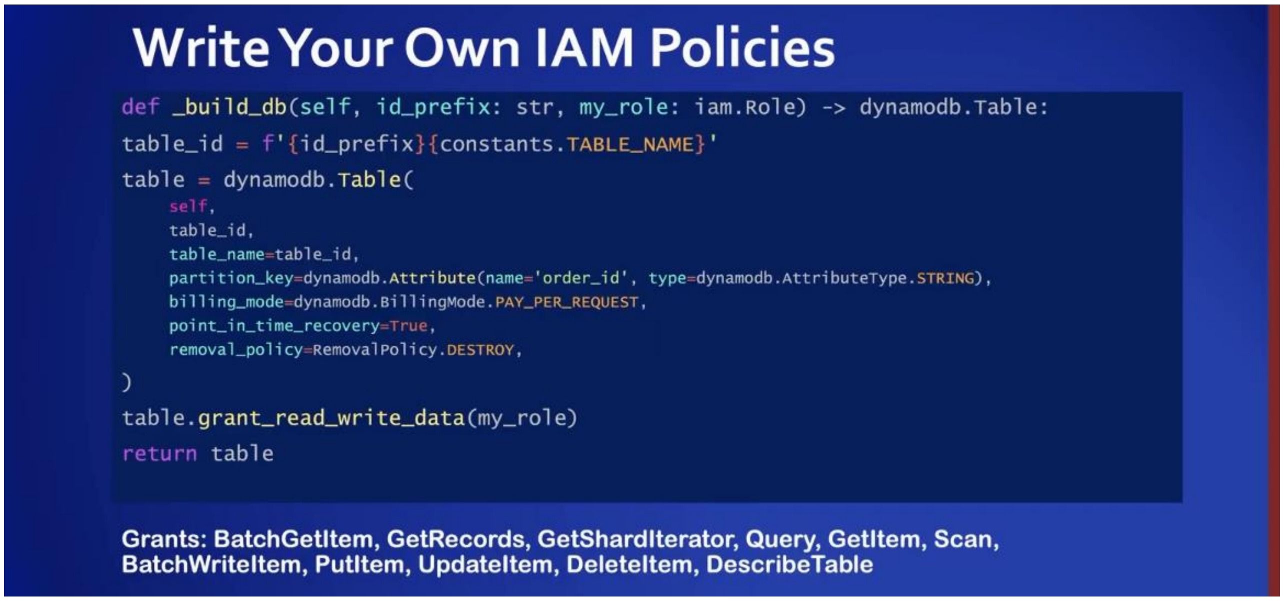
- Shared responsibility model
- Don't expect AWS to do all the work for you
- Enable security best practices for all resources
- Security Review, scheduled PT
- Run CDK security tests – CDK nag



AWS CDK Security Tests

```
from aws_cdk import App, Aspects
from cdk_nag import AwsSolutionsChecks, HIPAASecurityChecks
from cdk.my_service.service_stack import ServiceStack

def test_cdk_nag_default():
  app = App()

  service_stack = ServiceStack(app, 'service-test')
  Aspects.of(service_stack).add(AwsSolutionsChecks(verbose=True))


def test_cdk_nag_hipaa():
  app = App()

  service_stack = ServiceStack(app, 'service-test')
  Aspects.of(service_stack).add(HIPAASecurityChecks(verbose=True))
```

This tool is called **CDK Nag** for CDK security tests before push/deploy

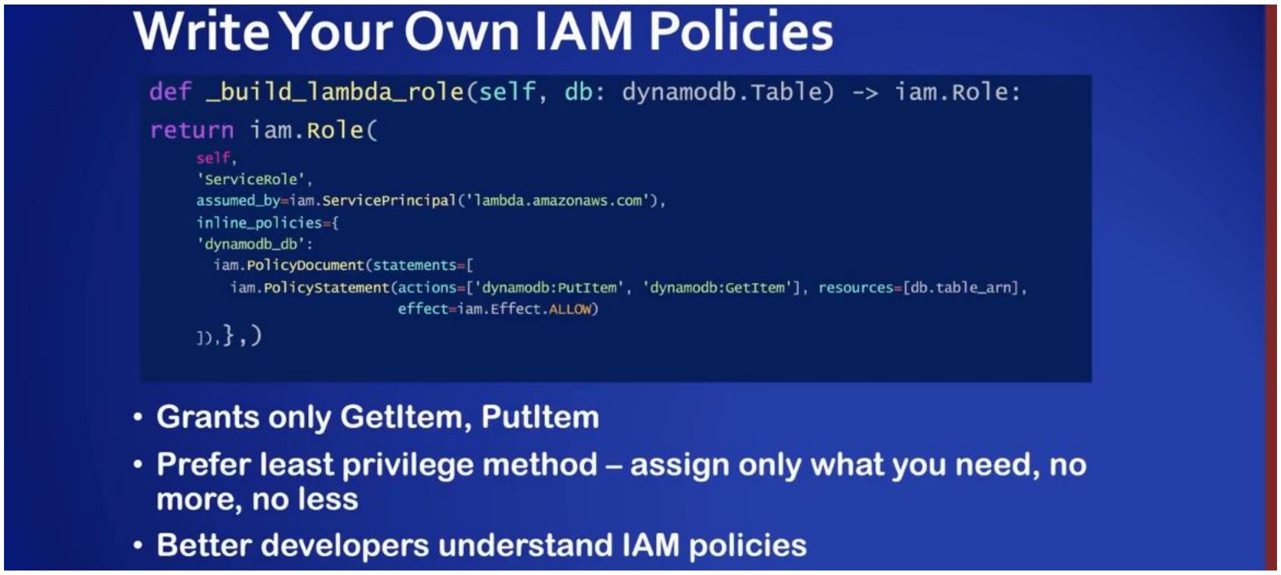


Write Your Own IAM Policies

```
def _build_db(self, id_prefix: str, my_role: iam.Role) -> dynamodb.Table:
table_id = f'{id_prefix}{constants.TABLE_NAME}'
table = dynamodb.Table(
     self,
     table_id,
     table_name=table_id,
     partition_key=dynamodb.Attribute(name='order_id', type=dynamodb.AttributeType.STRING),
     billing_mode=dynamodb.BillingMode.PAY_PER_REQUEST,
     point_in_time_recovery=True,
     removal_policy=RemovalPolicy.DESTROY,
)
table.grant_read_write_data(my_role)
return table
```

Grants: BatchGetItem, GetRecords, GetShardIterator, Query, GetItem, Scan, BatchWriteItem, PutItem, UpdateItem, DeleteItem, DescribeTable

You always want to assign the least amount of privileges using the CDK to write your own IAM rules and policies

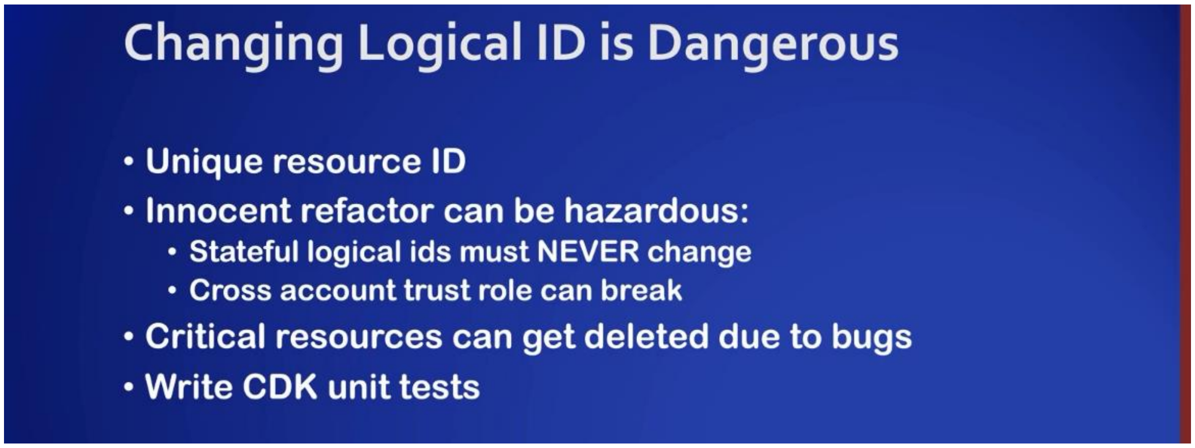


Write Your Own IAM Policies

```
def _build_lambda_role(self, db: dynamodb.Table) -> iam.Role:
return iam.Role(
     self,
     'ServiceRole',
     assumed_by=iam.ServicePrincipal('lambda.amazonaws.com'),
     inline_policies={
     'dynamodb_db':
       iam.PolicyDocument(statements=[
         iam.PolicyStatement(actions=['dynamodb:PutItem', 'dynamodb:GetItem'], resources=[db.table_arn],
                             effect=iam.Effect.ALLOW)
     ]),},)
```

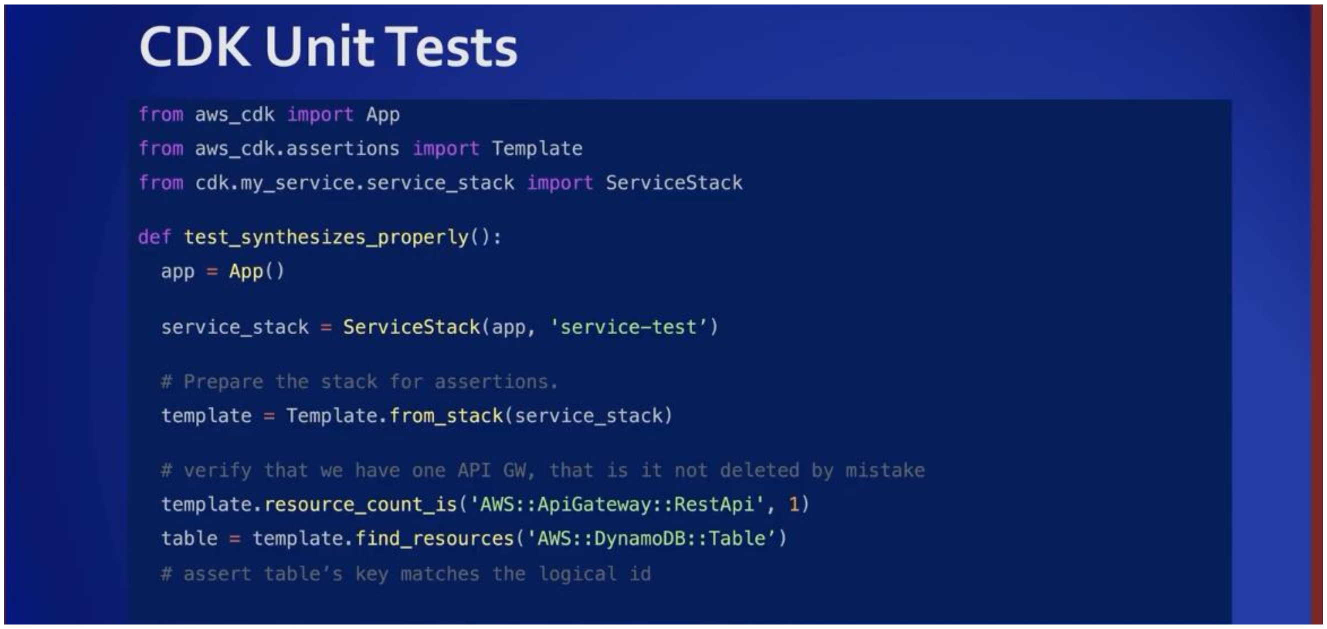
- Grants only GetItem, PutItem
- Prefer least privilege method – assign only what you need, no more, no less
- Better developers understand IAM policies

RESILIENCE GUIDELINES


Changing Logical ID is Dangerous

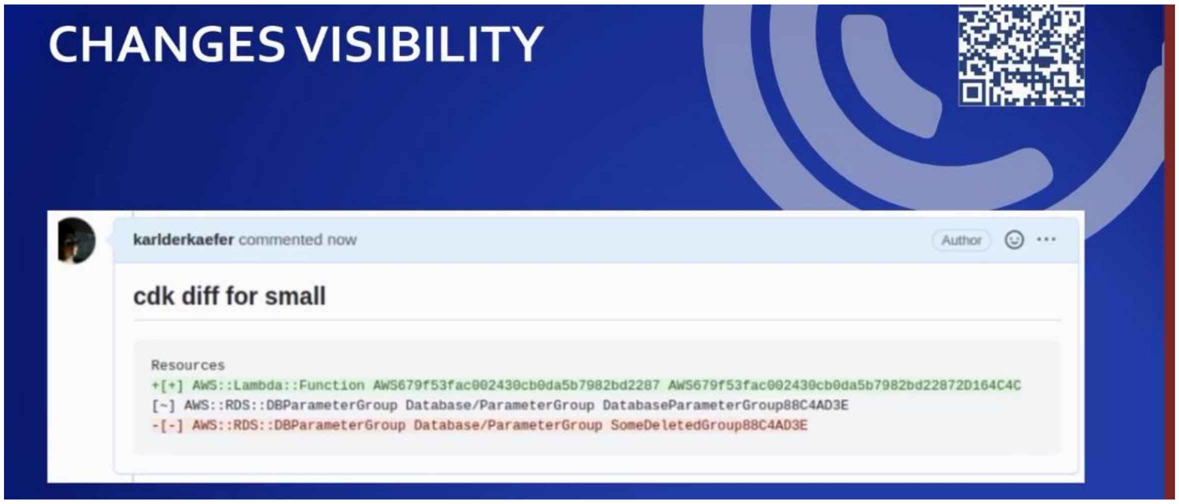
- Unique resource ID
- Innocent refactor can be hazardous:
  - Stateful logical ids must NEVER change
  - Cross account trust role can break
- Critical resources can get deleted due to bugs
- Write CDK unit tests

Changing logical IDs mean the CDK will delete that resource and recreate it, this is not what we want when redeploying


CDK Unit Tests

```python
from aws_cdk import App
from aws_cdk.assertions import Template
from cdk.my_service.service_stack import ServiceStack

def test_synthesizes_properly():
  app = App()

  service_stack = ServiceStack(app, 'service-test')

  # Prepare the stack for assertions.
  template = Template.from_stack(service_stack)

  # verify that we have one API GW, that is it not deleted by mistake
  template.resource_count_is('AWS::ApiGateway::RestApi', 1)
  table = template.find_resources('AWS::DynamoDB::Table')
  # assert table's key matches the logical id
```

The CDK unit tests should run before push/deploy of your code.



CHANGES VISIBILITY

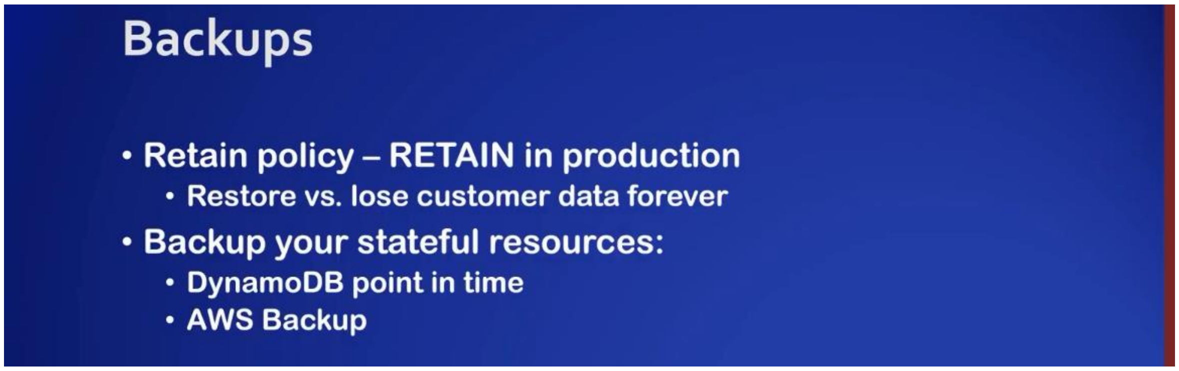
karlderkaefer commented now

Author

cdk diff for small

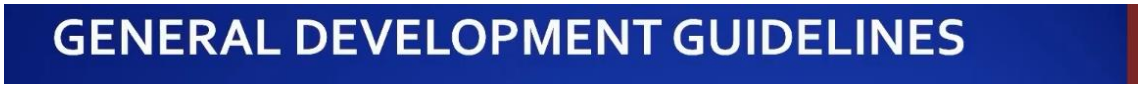
```
Resources
+[+] AWS::Lambda::Function AWS679f53fac002430cb0da5b7982bd2287 AWS679f53fac002430cb0da5b7982bd22872D164C4C
[~] AWS::RDS::DBParameterGroup Database/ParameterGroup DatabaseParameterGroup88C4AD3E
-[-] AWS::RDS::DBParameterGroup Database/ParameterGroup SomeDeletedGroup88C4AD3E
```

This **cdk diff** tool is OSS and allows you to see the changes made to the code before push/deploy

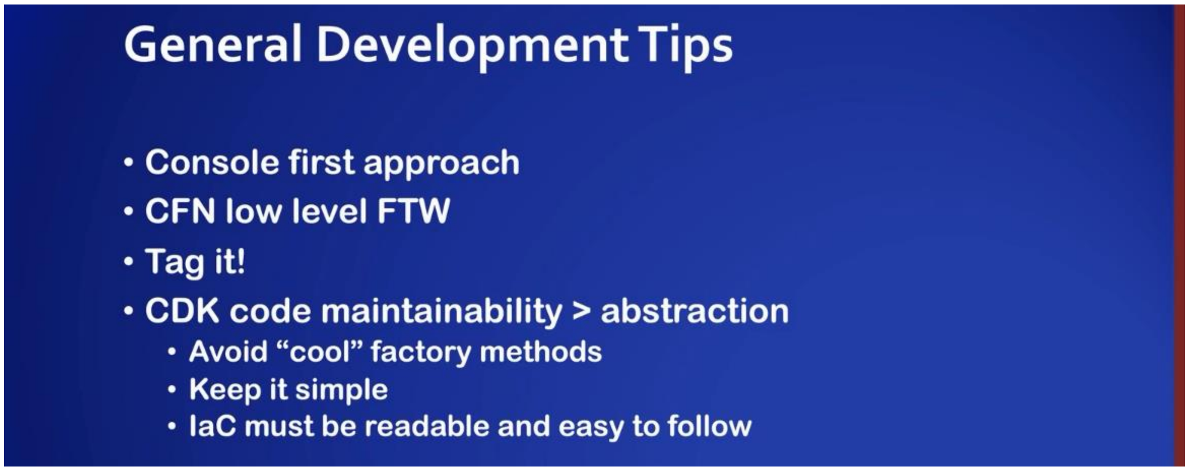


Backups

- Retain policy – RETAIN in production
  - Restore vs. lose customer data forever
- Backup your stateful resources:
  - DynamoDB point in time
  - AWS Backup



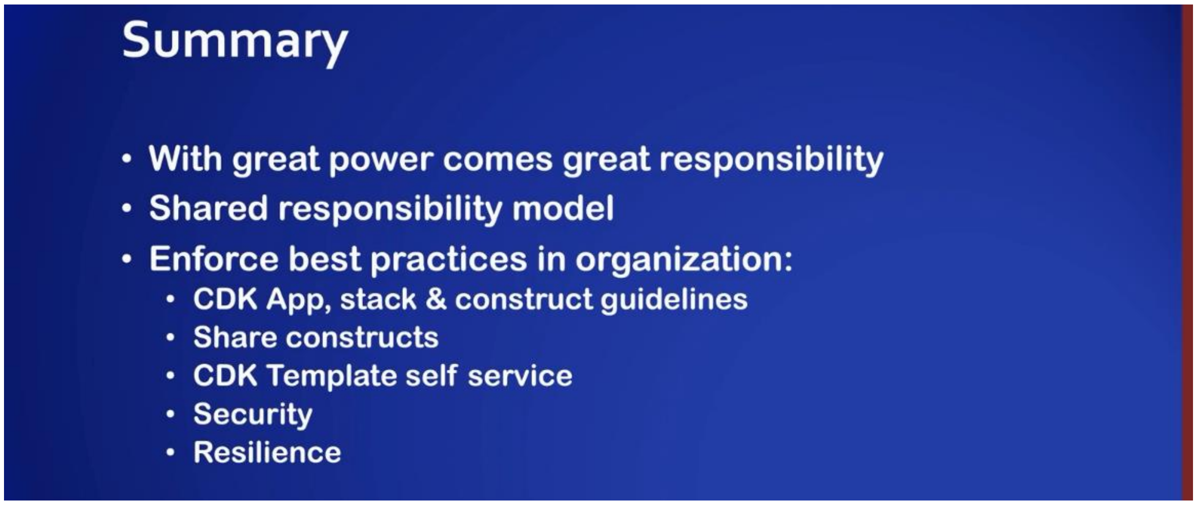
GENERAL DEVELOPMENT GUIDELINES



General Development Tips

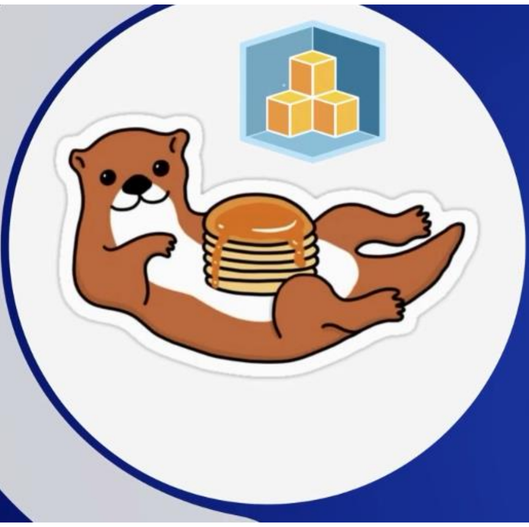
- Console first approach
- CFN low level FTW
- Tag it!
- CDK code maintainability > abstraction
  - Avoid “cool” factory methods
  - Keep it simple
  - IaC must be readable and easy to follow

CFN is Cloud Formation and we can go lower than the CDK to implement specific functionalities



Summary

- With great power comes great responsibility
- Shared responsibility model
- Enforce best practices in organization:
  - CDK App, stack & construct guidelines
  - Share constructs
  - CDK Template self service
  - Security
  - Resilience



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Build Serverless Services

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THANK YOU!

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