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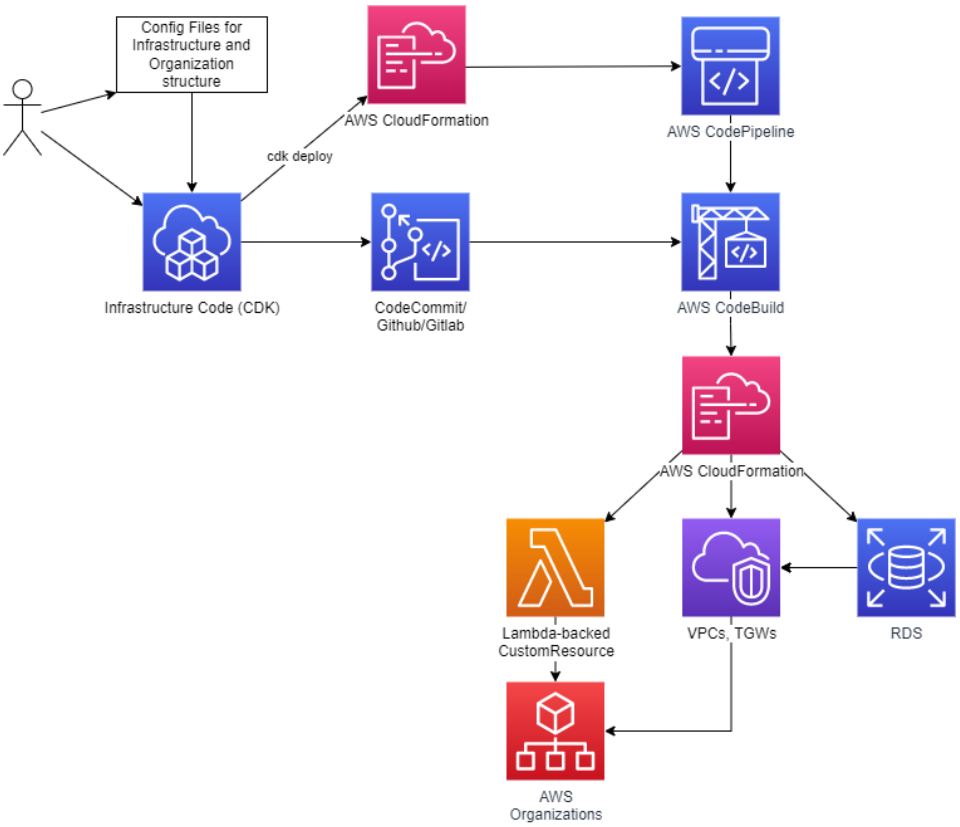
Networking Pipeline using AWS CDK

A common task for ProServe engagements is to deploy a landing zone for new projects. This can be a time-consuming process that contains instructions and steps other consultants have already followed before. This project utilizes the AWS CDK to provide a generic, easily configurable Infrastructure as Code (IaC) template. Using customizable configuration files, this project automates the process of setting up a networking pipeline that can provide the basics of an AWS cloud environment to help enable consultants in the deployment of landing zones. Further infrastructure can then be defined as needed by modifying the forked code.

Architecture Diagram:



Solution Overview:

The following AWS tools/services are spun up by CloudFormation for this project:

- CodePipeline
- CodeBuild
- Lambda
- AWS Organizations
- VPC, TGW, Subnets
- RDS

Deploying the Project:

- Fork and clone the GitHub repository.
- Initialize and bootstrap CDK for our main AWS admin account.
- Customize inputs for pipeline, AWS Organizations, and networking. (configuration instructions below)
- Push CDK code and configuration files to targeted repository.
- cdk deploy

Configuring the Project:

Pipeline**:**

This project has two files related to the deployment of CI/CD pipelines: cdk-iac-app.ts and pipeline-stack.ts.

In pipeline-stack.ts*,* change the CodePipelineSource connection to your targeted repository.

In cdk-iac-app.ts, create a PipelineStack for each pipeline you would need, specifying an environment and branch for each pipeline created.

AWS Organizations**:**

In our CDK code, we use a Lambda-backed Custom Resource in order to use the AWS SDK and create organizational units, add/create AWS accounts to our organization, and to move those accounts to an organizational unit. Using a configuration file (*aws_config/organization.json*), you can specify your organization structure under **OUConfig** and accounts under **AccountsConfig**. If any required parameters are missing, errors can be found logged in the CloudWatch logs of the lambda function.

Config file:

- Example:

aws_config > {} organization.json > ...

```json
{
  "OUConfig": {
    "OrganizationRootId": "r-jsik",
    "OrganizationalUnits": [
      {
        "ParentName": "Root",
        "Name": "Workload"
      },
      {
        "ParentName": "Root",
        "Name": "Network"
      },
      {
        "ParentName": "Workload",
        "Name": "Prod"
      },
      {
        "ParentName": "Workload",
        "Name": "Dev"
      }
    ]
  },
  "AccountsConfig": {
    "Accounts": [
      {
        "Email": "example+prod3@gmail.com",
        "Name": "Prod Acc 3",
        "OrganizationalUnit": "Prod"
      },
      {
        "Email": "example+dev3@gmail.com",
        "Name": "Dev Acc 3",
        "OrganizationalUnit": "Dev"
      }
    ]
  }
}
```

- Organizational Units (**OUConfig**):
  - OrganizationRootId: the ID of your root organization.
    - Can be found on the AWS Organization page of the AWS console.
  - OrganizationalUnits: OUs to be created.
    - Each OU must have “Name” and “ParentName” filled.
    - List any parent OUs before their children.
- Account Creation and Accounts Structure (**AccountsConfig**):
  - Accounts: accounts to be created/added to organization.
    - Each account must have “Email” and “Name” filled.
    - If “OrganizationalUnit” is missing, the account will be added to the root organization.

Networking:

After creating the organization structure, currently this project will require a manual step at this point. We have to create IAM credentials for our networking and workload accounts, then save those credentials as profiles in *.aws/credentials*. Then bootstrap those accounts with the following CLI commands (replace the bolded sections as described):

cdk bootstrap ***account-id/region*** *--no-bootstrap-customer-key –cloudformation execution-policies 'arn:aws:iam::aws:policy/AdministratorAccess' --trust* ***main-aws-account-id*** *--trust-for-lookup* ***main-aws-account-id*** *–profile* ***profile-name***

Replace hardcoded account IDs in env props.

A deployment will then spin up a TGW from the network account and share it with the workload accounts. The deployment will then fail due to our TGW id being hardcoded. Once that happens, simply update the hardcoded id with our just spun-up TGW and deploy/commit again.

Code Deep Dive:

The deploy stage consists of the following stacks:

- OrgActivitiesStack (*org-activities-stack.ts*):
  - Creates a lambda function using the code in *lambda/create-org.js*
  - Configures and attaches Organizations IAM policies/roles for the *create-org* lambda.
  - Creates a Provider and CustomResource to trigger the lambda on create or change, and get its response.
  - Reads *aws_config/organization.json* and the CustomResource sets the json as the payload for our Provider, which sends it to our *create-org* lambda.
- NetworkingStack (networking-stack.ts):
  - Creates our main networking VPC with 2 public subnets and 2 private subnets
  - Creates a transit gateway (TGW) and attaches it to the network VPC
  - Creates a Resource Access Manager (RAM) Resource Share to share the TGW with workload accounts.
  - Outputs the TGW id
  - Spins up an RDS database instance
- BasicVpcStack (basic-vpc-stack.ts):
  - Creates a VPC for the workload account with a single isolated subnet
  - Attaches the VPC to our shared TGW
  - Create a new route table (CDK/CloudFormation cannot lookup existing route tables)
  - In this route table, create a new route to redirect traffic to our TGW.
  - Connect the route table to the workload VPC's subnet(s)

Cleanup:

To clean up, delete the entire stack through the AWS CloudFormation console, or in the CLI we can use the CDK command “cdk destroy”.

Notes:

- Features that could be implemented:
    - Batch script could automate initial cdk set up and enablement of aws organizations resource sharing
        - “`aws ram enable-sharing-with-aws-organization`”
    - **Organizations:**
        - OU deletion
        - Moving accounts that are already in the organization
            - Seems to not be worth implementing: can tree traverse OUs and call describeOU() on each OU to find accounts, but could potentially take a lot of API calls. (SourceParentId is a required parameter, so we need to find the account’s current OU before moving)
        - Account deletion
            - Could do: listAccounts() to get accountIds -> check against config file -> if not in config -> closeAccount(accountId)
            - Seems too convoluted to test:
                - Prerequisites to be able to delete an account (needs own billing, etc)
                - only 10% of active accounts can be closed in 30 days
    - **Networking:**
        - TGW ID is currently hardcoded, could be made soft
            - Potential solution using RAM, SSM and lambda functions to share the TGW id across accounts
    - Consider separating our Networking account into both a networking and a shared services account
    - Use aurora instead of RDS