AWS re:Invent

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SEC326

Establishing a data perimeter on AWS, featuring Goldman Sachs

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Agenda

Data perimeter concept

Data perimeter capabilities and implementation

Automating and enforcing data perimeter controls in the Goldman Sachs environment

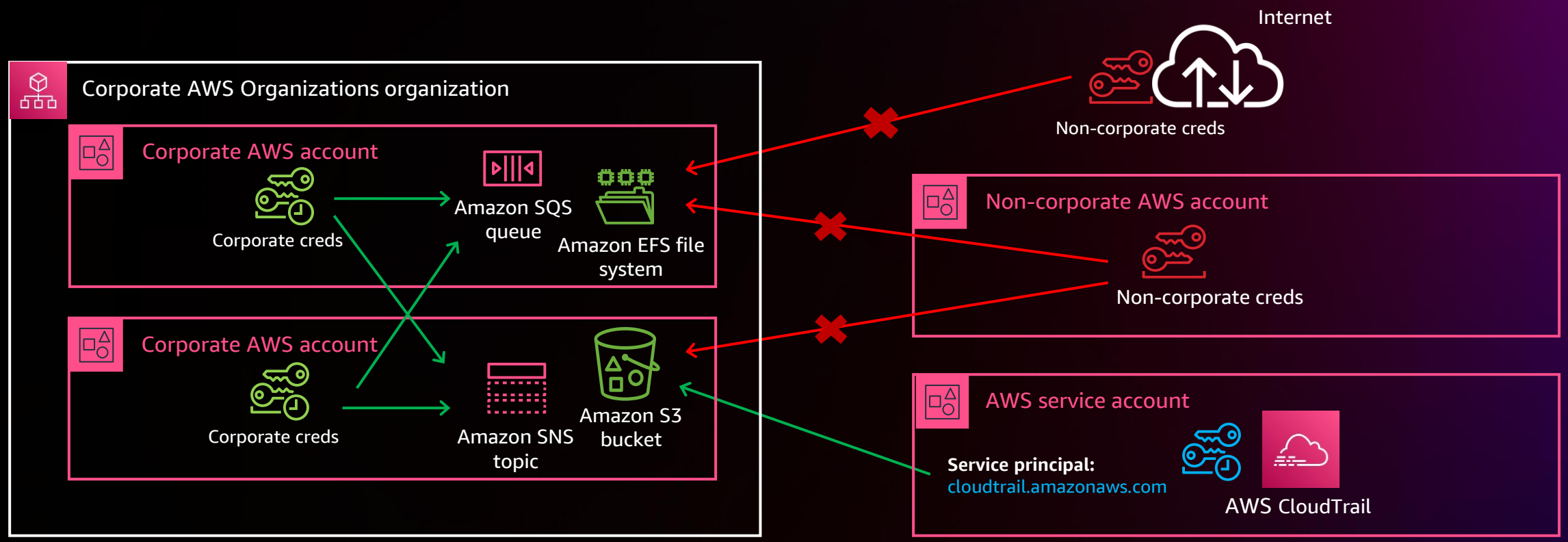
Data perimeter concept

What is a data perimeter?

A set of preventive guardrails in your AWS environment which help ensure that only your trusted identities are accessing trusted resources from expected networks

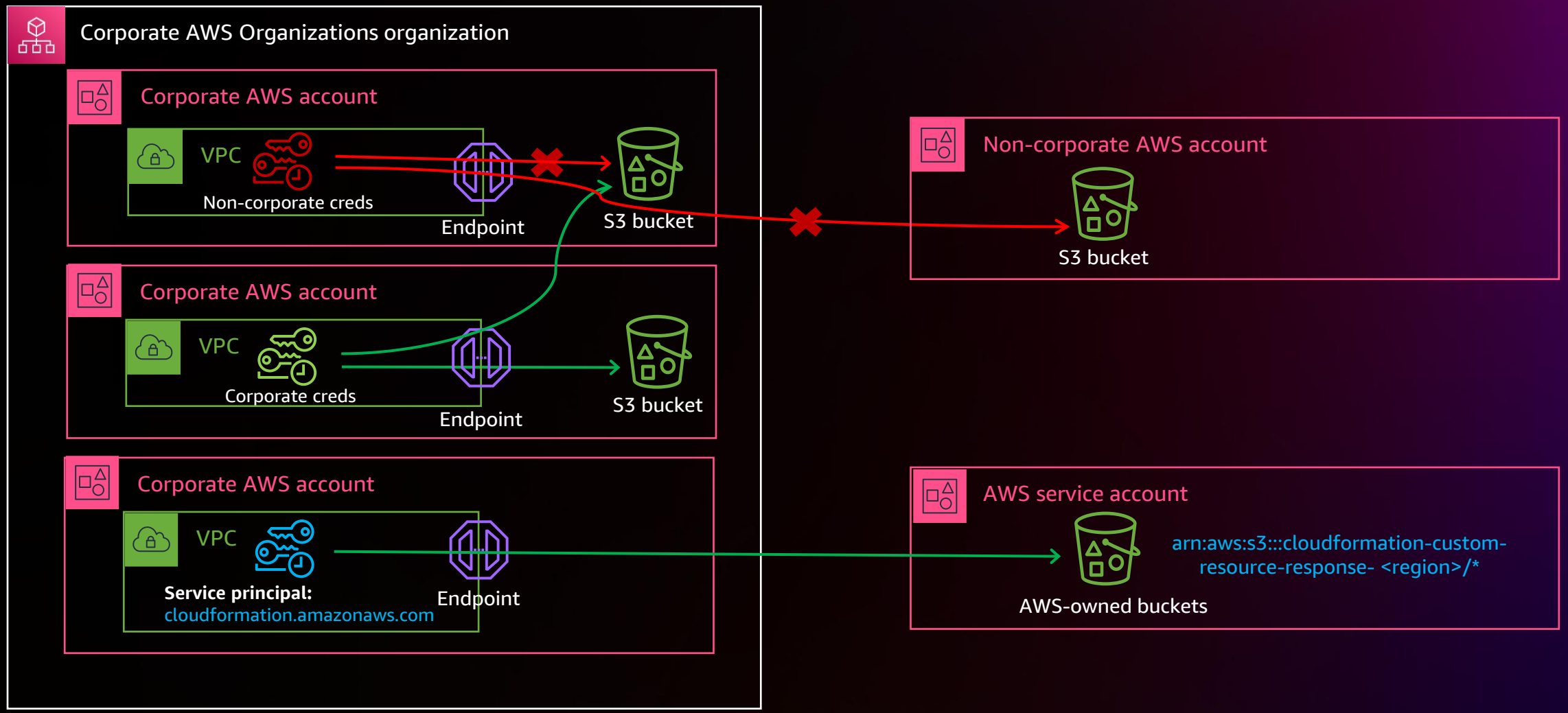
Identity perimeter

ONLY TRUSTED IDENTITIES CAN ACCESS MY RESOURCES



Identity perimeter

ONLY TRUSTED IDENTITIES ARE ALLOWED FROM MY NETWORK



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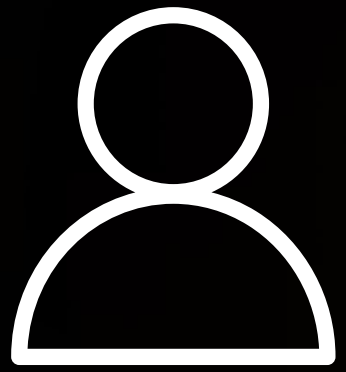


Identity

My corporate credentials

aws:PrincipalOrgID

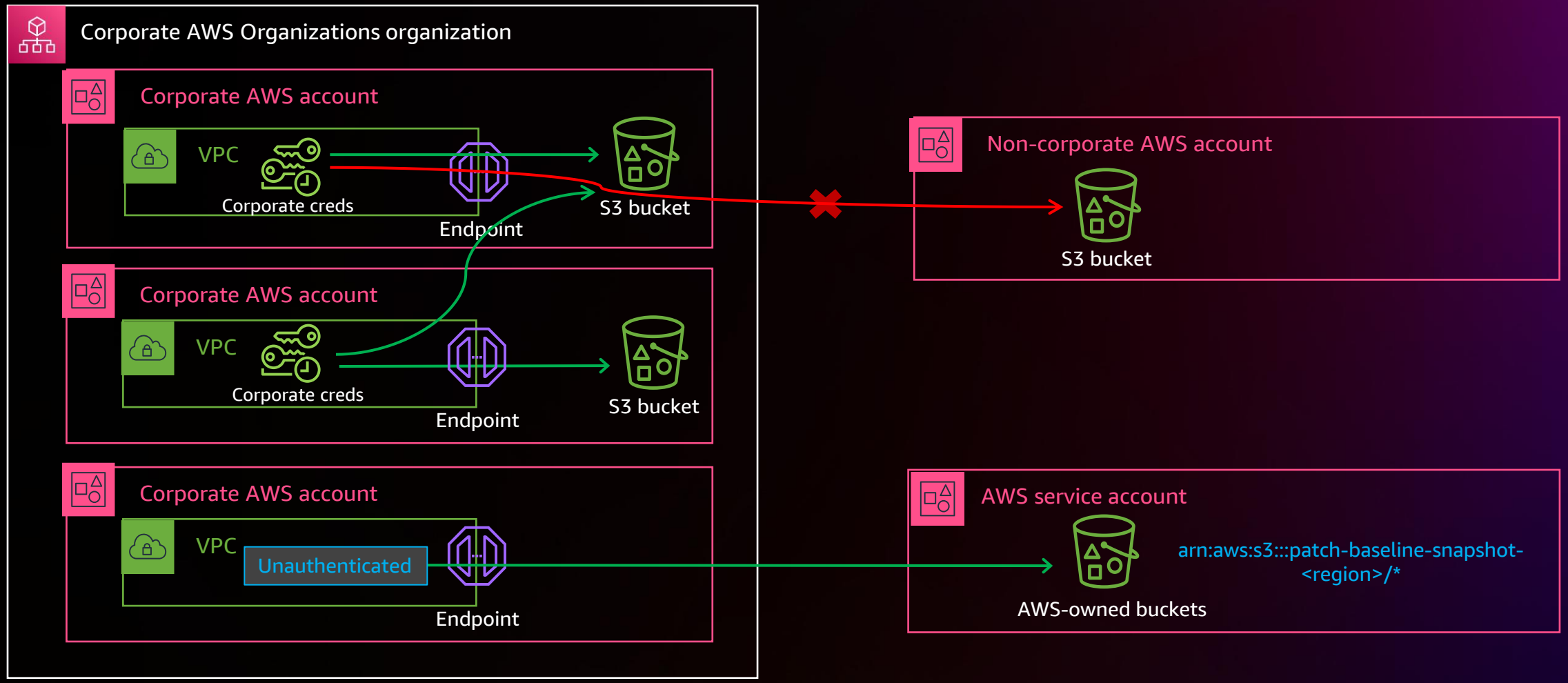
AWS service principal

aws:PrincipalIsAWSService

Resource perimeter

MY IDENTITIES CAN ACCESS ONLY TRUSTED RESOURCES

ONLY TRUSTED RESOURCES CAN BE ACCESSED FROM MY NETWORK



Resource perimeter

MY IDENTITIES CAN ACCESS ONLY TRUSTED RESOURCES

ONLY TRUSTED RESOURCES CAN BE ACCESSED FROM MY NETWORK

Resource

My corporate resources

aws:ResourceOrgID

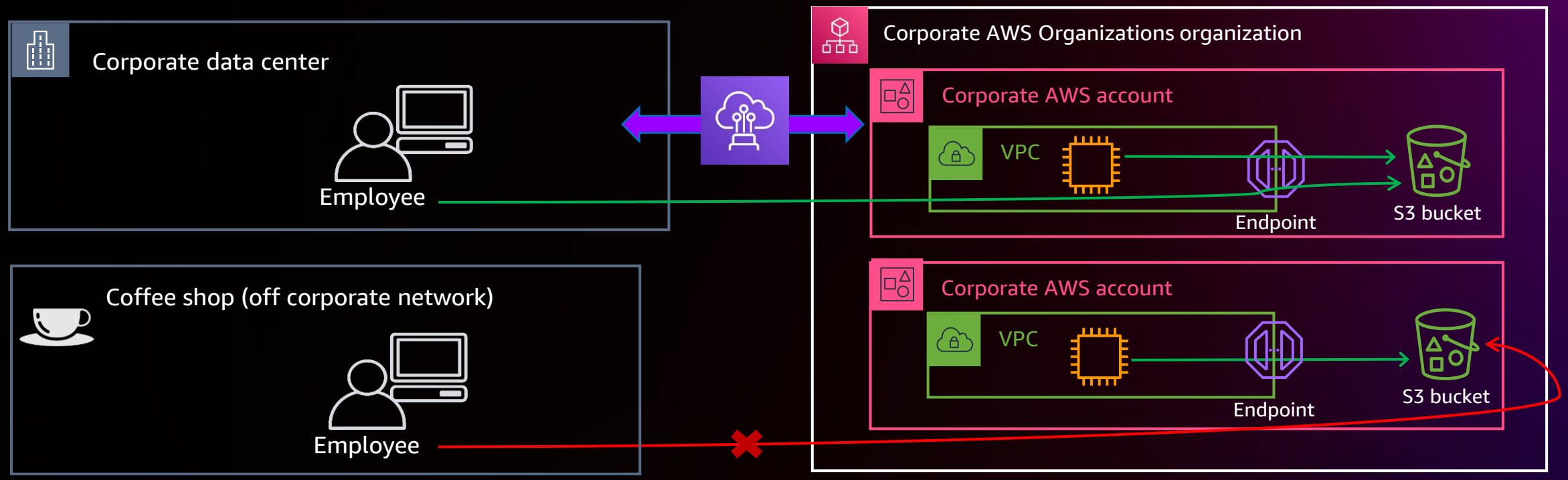
AWS resources

arn:aws:s3:::patch-baseline-snapshot-<region>/*

Network perimeter

MY RESOURCES CAN ONLY BE ACCESSED FROM EXPECTED NETWORKS

MY IDENTITIES CAN ACCESS RESOURCES ONLY FROM EXPECTED NETWORKS



Network perimeter

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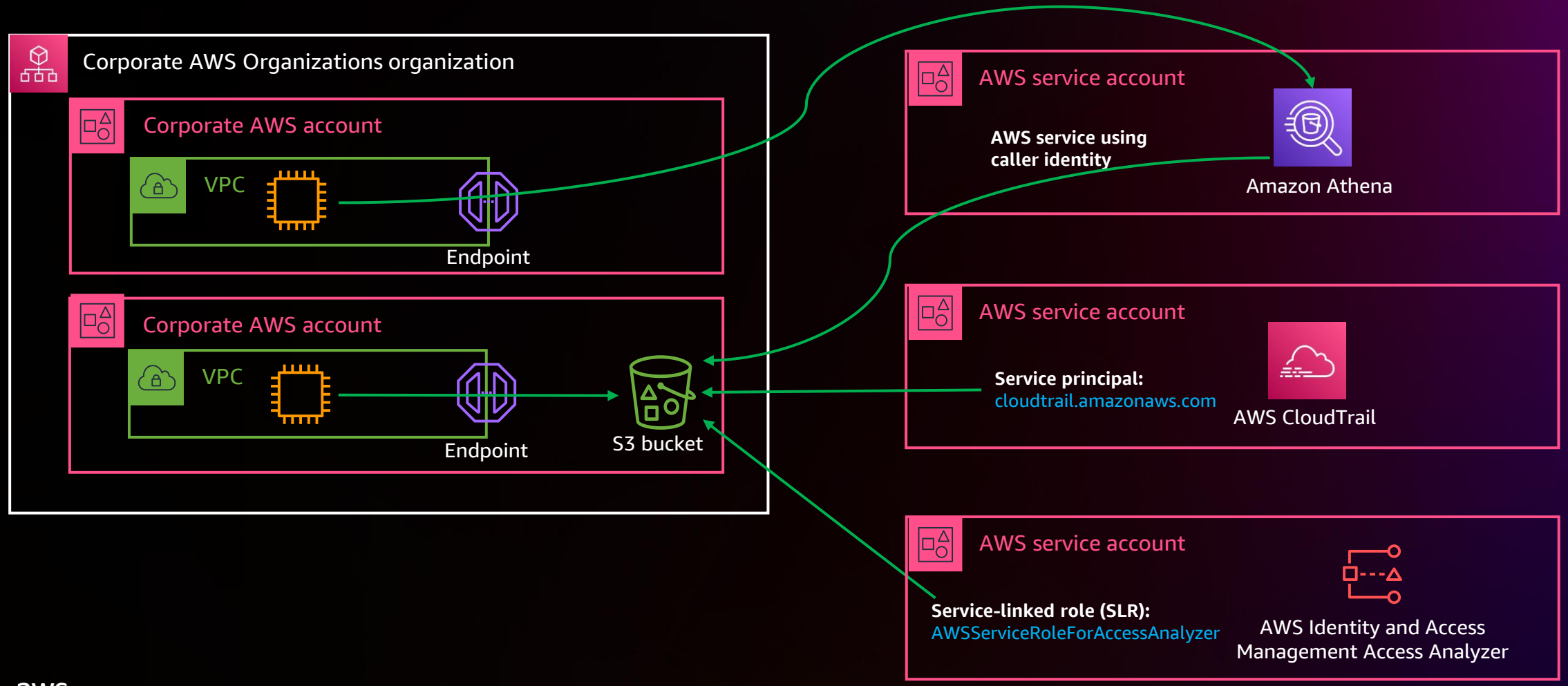


Network perimeter

MY RESOURCES CAN ONLY BE ACCESSED FROM EXPECTED NETWORKS

MY IDENTITIES CAN ACCESS RESOURCES ONLY FROM EXPECTED NETWORKS

Network

My corporate data center/My corporate AWS network

aws:SourceIp/aws:SourceVpc

AWS service using caller identity — aws:viaAWSService

AWS service principal — aws:PrincipalIsAWSService

SLR — arn:aws:iam::012345678901:role/aws-service-role/*

Data perimeter controls

Perimeter	Intent/Control objective	Applied on	Using	Primary IAM feature
Identity	Only trusted identities can access my resources	Resources	Resource-based policy	aws:PrincipalOrgID aws:PrincipalIsAWSService
	Only trusted identities are allowed from my network	Network	VPC endpoint policy	aws:PrincipalOrgID aws:PrincipalIsAWSService
Resource	My identities can access only trusted resources	Identities	SCP policy	aws:ResourceOrgID
	Only trusted resources can be accessed from my network	Network	VPC endpoint policy	aws:ResourceOrgID
Network	My identities can access resources only from expected networks	Identities	SCP policy	aws:SourceIp aws:SourceVpc/aws:SourceVpce aws:ViaAWSService
	My resources can only be accessed from expected networks	Resources	Resource-based policy	aws:SourceIp aws:SourceVpc/aws:SourceVpce aws:ViaAWSService aws:PrincipalIsAWSService

Automating and enforcing data perimeter controls in the Goldman Sachs environment

Who is Goldman Sachs?

Goldman Sachs

- Leading investment bank and financial services company
- $2T+ AUS, 100 Locations
- Technology-first – 12,000+ engineers

Cloud enablement @ Goldman Sachs

- 80+ enterprises
- Advisory, implementation, and security
- Continuous deployment – Cloud Fast Track

Agenda

The Problem: Cloud security at scale

Our answer: Cloud Fast Track

Available tools in the AWS toolbox: Data perimeter

Guardrails: Policy as code for data perimeter

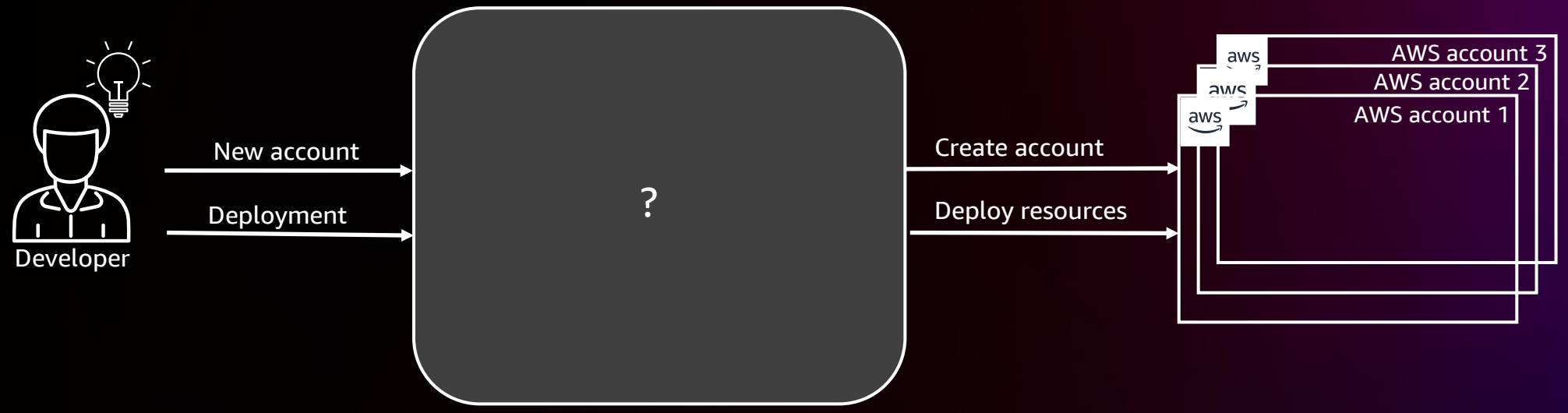
Conclusion: Examples, demo, learnings

The Problem

CLOUD SECURITY AT SCALE

Desired state

WHAT IF...

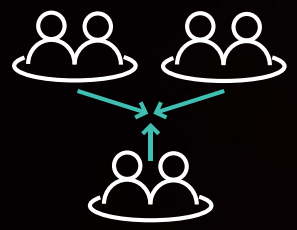


Tenets

SECURE CONTINUOUS DEPLOYMENT AT SCALE

Self-service

We succeed if you never have to talk to us



Shared responsibility

We provide a secure platform, you build a secure app

Secure by design

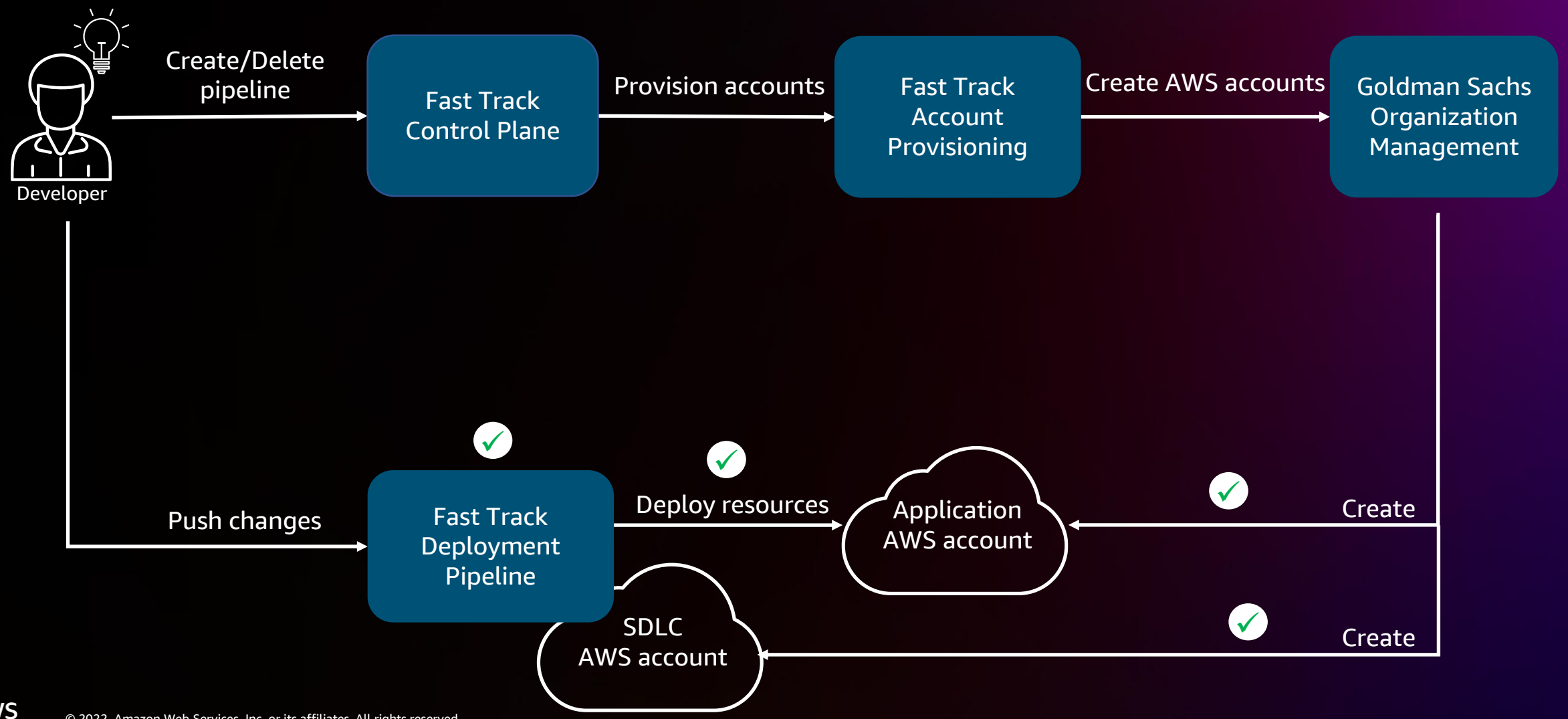
Implement policy as code to ensure firm-compliant resources

Cloud native

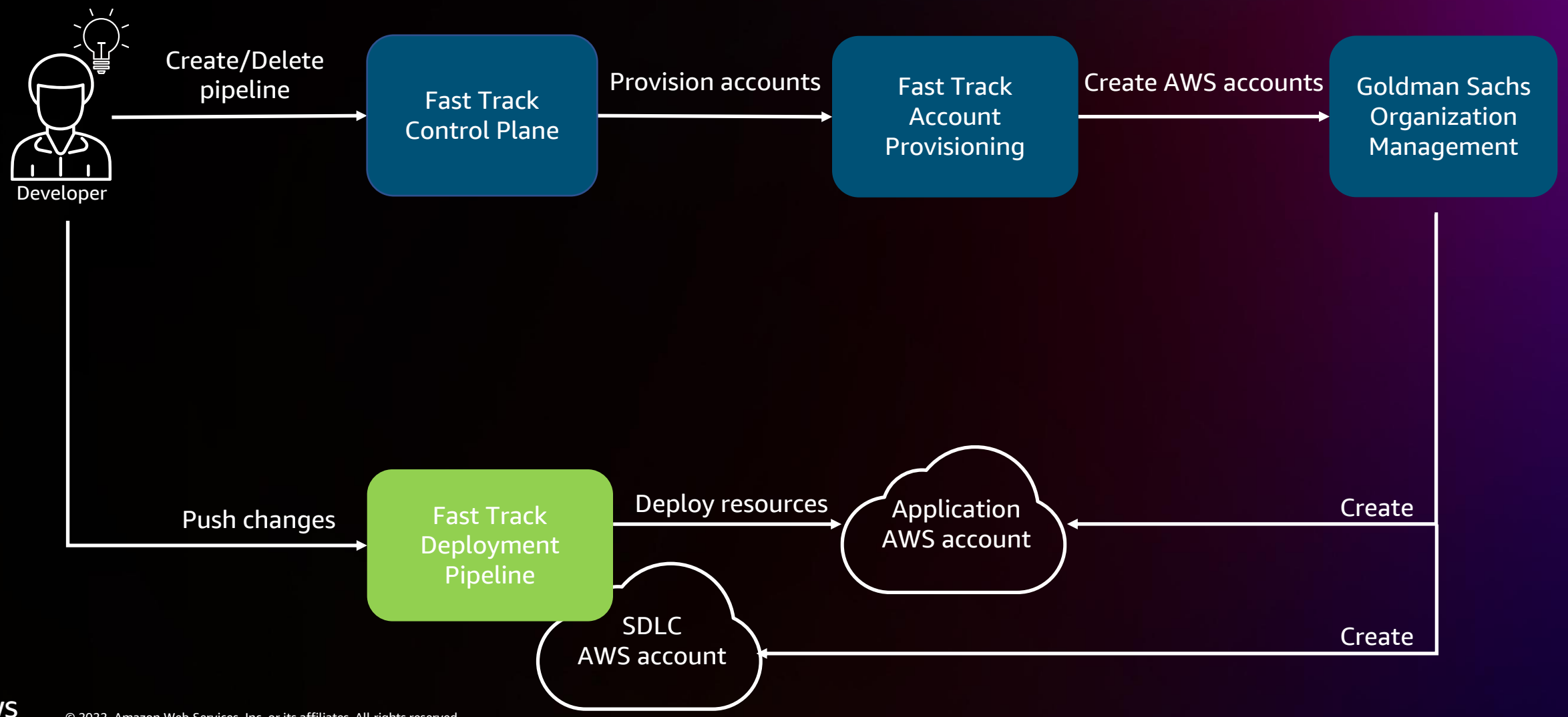
Use public tooling and documentation

Enter Cloud Fast Track

CUSTOMER JOURNEY

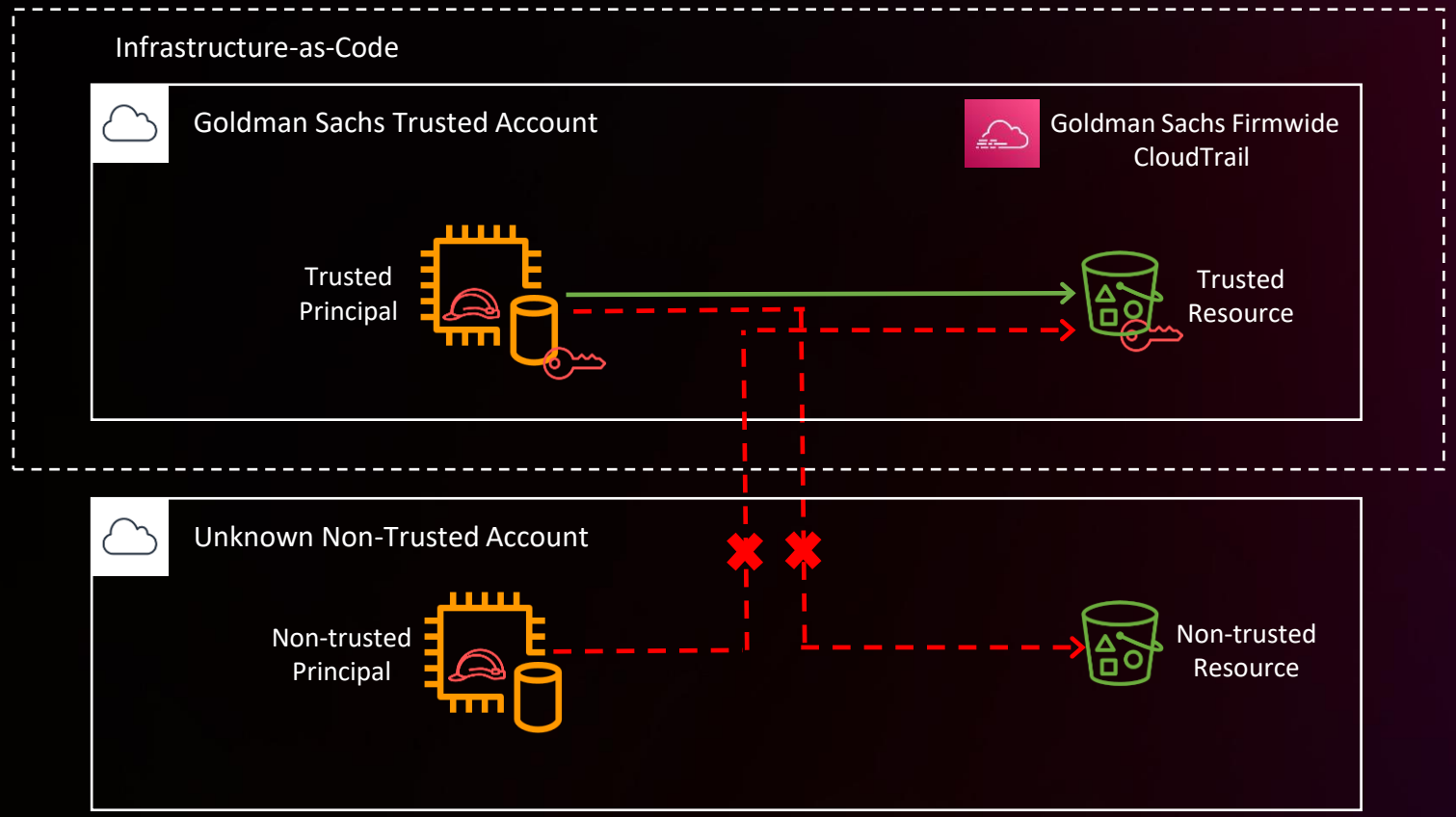


Nuts and bolts: Checkpoint 5



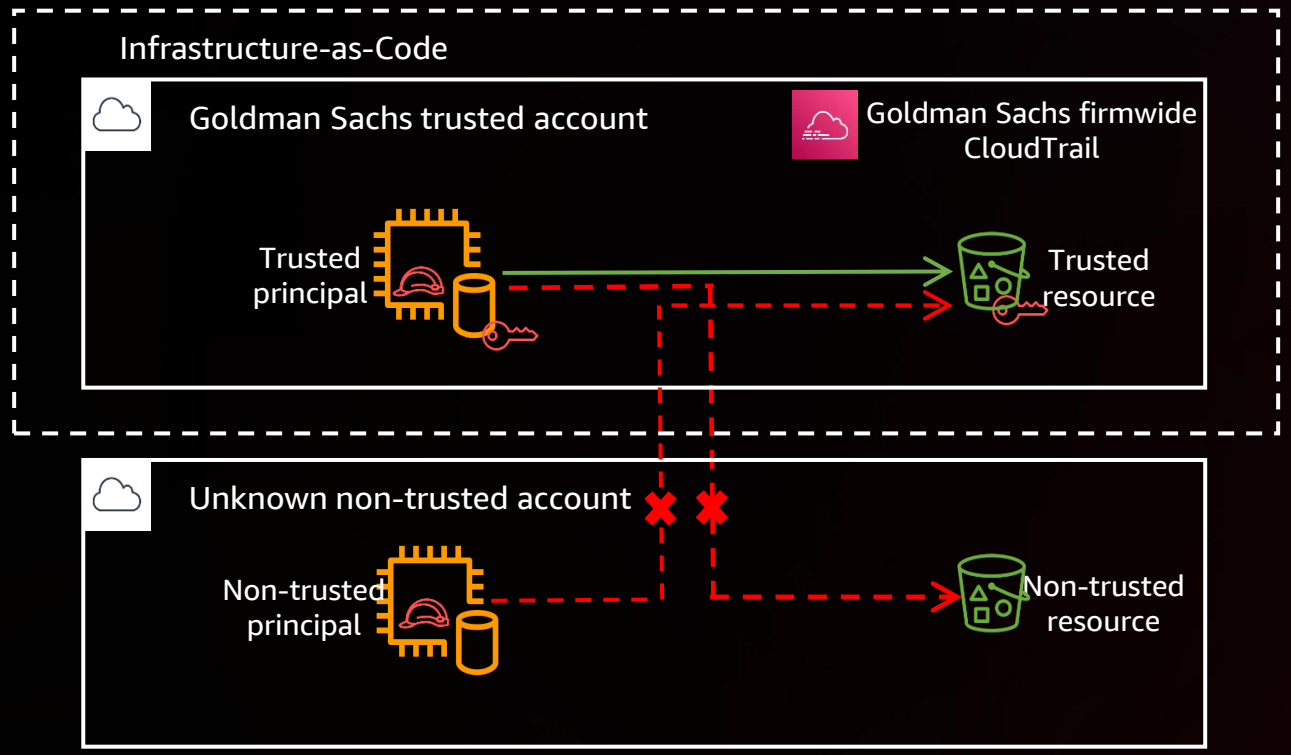
Secure deployment – Threats

WHAT THREAT VECTORS ARE WE SECURING AGAINST?



Secure deployment – Control examples

SO HOW DO YOU SECURE YOUR DEPLOYMENTS?

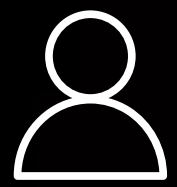


Thou shall:

- Always attach a vended permission boundary to your AWS::IAM::Role
- Only allow actions on AWS::KMS::Key from principals in the trusted org path
- Only use vended AWS::EC2::VPC
- Always encrypt AWS::S3::Bucket with KMS-CMK

AWS tools – Security engineering

AWS OFFERINGS



Trusted identities

Principals within your AWS accounts, or AWS services acting on your behalf

- aws:PrincipalOrgID
- aws:PrincipalOrgPaths
- aws:PrincipalAccount
- aws:PrincipalIsAWSService

Trusted resources

Resources owned by your AWS accounts or by AWS services acting on your behalf

- aws:ResourceOrgID
- aws:ResourceOrgPaths
- aws:ResourceAccount

Expected networks

Your on-premises data centers and virtual private clouds (VPCs), or networks of AWS services acting on your behalf

- aws:SourceIp
- aws:SourceVpc
- aws:SourceVpce

How do you enforce controls?

SO YOU WANT TO WRITE GUARDRAILS?

- Guardrails: Policy as code
  - Coarse-grained controls
  - Written in Rego and evaluated using Open Policy Agent (OPA)
- Analogy
  - No matter how bad you drive, you can never drive outside the guardrails
- Enforcement
  - Through managed pipelines

Why guardrails?

ARE YOU OVER-ENGINEERING?

- Highly customizable
  - Security that works for YOUR organization
- Faster iteration cycle
  - Proactive compliance: No need for manual security reviews, commits, deployments
- Faster evaluation
  - 1000+ line CFN template, 200+ Rego policies, <1s evaluation time
- Elaborate feedback
  - No more generic 403 Not Authorized

Guardrails demo

GUARDRAILS, HOW DO THEY WORK?

quotes-service-stack.ts — quotes-service

TS quotes-service-stack.ts M

lib > TS quotes-service-stack.ts > QuotesServiceStack > constructor

```
127         });
128
129         const alb = new ApplicationLoadBalancer(this, "ApplicationLoadBalancer", {
130             vpc: vpc,
131             internetFacing: true,
132             ipAddressType: IpAddressType.IPV4,
133             securityGroup: this.albSecurityGroup,
134             vpcSubnets: corpFacing,
135             http2Enabled: false,
136             loadBalancerName: `${serviceName}-loadbalancer`
137         });
138
139         ecsSecurityGroup.connections.allowFrom(alb, ec2.Port.tcp(8080), "Application Port");
140
141         const listener = alb.addListener("ApplicationListener", {
```

PROBLEMS 3 OUTPUT DEBUG CONSOLE TERMINAL GITLENS bash

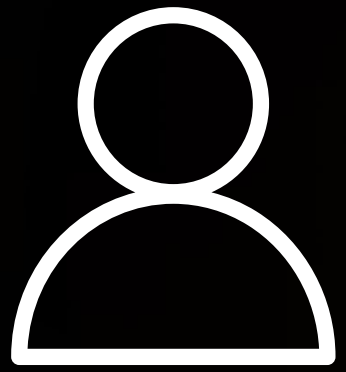
```
[nix-shell:~/Projects/CloudFastTrackExamples/quotes-service]$
```

before-accelerator* 1 0 2 Jest: AWS Jest-WS: 0 1 0 6 GitLab: Pipeline passed GitLab: Create MR. Prettie

Recap: Identity perimeter

ONLY TRUSTED IDENTITIES CAN ACCESS MY RESOURCES

ONLY TRUSTED IDENTITIES ARE ALLOWED FROM MY NETWORK



Identity

My corporate credentials

aws:PrincipalOrgID/aws:PrincipalOrgPaths

AWS service principal

aws:PrincipalIsAWSService

Fast Track: Identity perimeter (1/2)

ONLY TRUSTED IDENTITIES CAN ACCESS MY RESOURCES

ONLY TRUSTED IDENTITIES ARE ALLOWED FROM MY NETWORK

```
cfn_resource_type = "AWS::SecretsManager::ResourcePolicy"

explicitly_allowed_resources[resource] {
    some resource
    all_resources[resource]
    resource_policy := all_resources[resource].ResourcePolicy
    expected_denies := [
        s | s := required_deny_statements[_];
        iam.get_policy_deny_statements(resource_policy, s)
    ]
    count(expected_denies) == count(required_deny_statements)
}
```

For this resource

Fetch resource policy

Filter all deny policies

Assert expected denies

Fast Track: Identity perimeter (2/2)

ONLY TRUSTED IDENTITIES CAN ACCESS MY RESOURCES

ONLY TRUSTED IDENTITIES ARE ALLOWED FROM MY NETWORK

```
cfn_resource_type = "AWS::SecretsManager::ResourcePolicy"
required_deny_statements := [
    {
        "Action": "secretsmanager:*",
        "Condition": {
            "BoolIfExists": {
                "aws:PrincipalIsAWSService": "false“
            },
            "ForAllValues:StringNotLikeIfExists": {
                "aws:PrincipalOrgPaths": [
                    path | path := cft_managed_parameters.VENDED_PRINCIPAL_ORG_PATHS[_]
            ]},
        },
        "Effect": "Deny",
        "Principal": {"AWS": "*"},
        "Resource": "*",
    },
]
```

For this resource

AWS service principal

Whitelisted org paths

Recap: Resource perimeter

MY IDENTITIES CAN ACCESS ONLY TRUSTED RESOURCES

ONLY TRUSTED RESOURCES CAN BE ACCESSED FROM MY NETWORK

Resource

My corporate resources:

aws:ResourceOrgID

Custom perimeter: Lambda bootstrap

Use whitelisted bucket

Fast Track: Resource perimeter (1/2)

MY IDENTITIES CAN ACCESS ONLY TRUSTED RESOURCES

ONLY TRUSTED RESOURCES CAN BE ACCESSED FROM MY NETWORK

```
endpointPolicy(): PolicyStatement[] {
  const endpointStatements = new Array<PolicyStatement>();
    endpointStatements.push(
      new PolicyStatement({
        effect: Effect.DENY,
          actions: ["*"],
          resources: ["*"],
          principals: [new StarPrincipal()],
          conditions: {
            StringNotEquals: {
              "aws:ResourceOrgID": [ this.props.parentStackProps.orgId, SharedNames.FASTTRACK_ORG_ID ]
            },
            BoolIfExists: {
              "aws:PrincipalIsAWSService": "false"
            }
        }})
```

For whitelisted orgs

AWS principal

Fast Track: Resource perimeter (2/2)

MY IDENTITIES CAN ACCESS ONLY TRUSTED RESOURCES

ONLY TRUSTED RESOURCES CAN BE ACCESSED FROM MY NETWORK

```
resource_type = "AWS::Lambda::Function“

bootstrap_s3_code_bucket_noncompliant_resources(resource_type) = noncompliant_resources {
        explicitly_allowed_bucket_reference = {resource |
                some resource
                all_resources[resource]
                input.Resources[resource].Properties.Code.S3Bucket == cft.VENDED_CODE_BUCKET_NAME
        }

        noncompliant_resources := {r | all_resources[r]} - explicitly_allowed_bucket_reference
        ...
}
```

For this resource

Use vended bucket

Non-compliant resource

Network perimeter

MY RESOURCES CAN ONLY BE ACCESSED FROM EXPECTED NETWORKS

MY IDENTITIES CAN ACCESS RESOURCES ONLY FROM EXPECTED NETWORKS

Network

My corporate data center/My corporate AWS network

aws:SourceIp/aws:SourceVpc

AWS service using caller identity aws:viaAWSService

AWS service principal aws:PrincipalIsAWSService

SLR arn:aws:iam::012345678901:role/aws-service-role/*

Custom: Vended VPCs, Vended PLs

Fast Track: Network perimeter (1/2)

MY RESOURCES CAN ONLY BE ACCESSED FROM EXPECTED NETWORKS

MY IDENTITIES CAN ACCESS RESOURCES ONLY FROM EXPECTED NETWORKS

```
resource = “AWS::ElasticLoadBalancingV2::TargetGroup”

explicitly_allowed_resources[resource] {
        some resource
        resource_definition := all_resources[resource]
        resource_definition.TargetType == "ip"
        cft_managed_parameters.VENDED_VPC_IDS[resource_definition.VpcId]
}

noncompliant_resources = {r | all_resources[r]} - explicitly_allowed_resources)
```

For TargetGroup resource

If TargetType is set to IP

Assert vended-VPC usage

Fast Track: Network perimeter (2/2)

MY RESOURCES CAN ONLY BE ACCESSED FROM EXPECTED NETWORKS

MY IDENTITIES CAN ACCESS RESOURCES ONLY FROM EXPECTED NETWORKS

```
security_group_resource = "AWS::EC2::SecurityGroup“

vended_prefix_list_id[resource] {
        …
        some resource, egress_rules
        input.Resources[resource].Type == security_group_resource
        cfthelpers.list_contains(
                input.Resources[resource].Properties.SecurityGroupEgress[egress_rules].DestinationPrefixListId,
                cft_managed_parameters.VENDED_PREFIX_LIST_IDS
        )
}
…
…
compliant_security_groups := same_stack_reference | vended_sg_id | vended_prefix_list_id
```

For SecurityGroup resource

Assert vended PLs are used

Impact statement

WHAT WE'VE ACCOMPLISHED

Policy as code for data perimeter:

- Infrastructure security reviews – No more
- App deployment – Self-service
- Account provisioning from weeks to minutes
- Continuous evaluation – drift detection and continuous evaluation

Learnings

WHAT WE COULD DO BETTER

- Day 1 culture
  - A journey, not a destination – Raise the floor every day
- See the forest for the trees
  - Enable use cases, not services
- Platform operationalization
  - Telemetry, monitoring, alarming

Available resources

Thank you!

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