StreamAlert

Serverless, Real-Time Data Analysis

airbnb

@jack_naglieri / Enigma 2017

Hypothetical: You just joined a new team, and need to collect, analyze, and alert on log data.

- Two colleagues on your team
- Thousands of laptops + production servers
- Must keep up with growth

Option 1: Develop and deploy your own tool

Option 1 - Develop and deploy your own tool

Challenges

- Engineering time and resources
- Responsible for:
  - Reliability
  - Security
  - Scalability

Have you had to rebuild a tool that you previously created?

Option 2: Deploy an existing tool - open source or commercial

Option 2 - Deploy an existing tool

Challenges

- Customizations necessary
- Scaling and upgrading are non-trivial
- Deployment challenges:
  - Time
  - Skillset required
  - Reliance on other teams

Has cost, time, or staffing prevented you from deploying a tool you needed?

Ideal Option

- Automated deployment
- Low operational overhead
- Built-in scalability and reliability
- Secure by default

Getting There

Cloud Infrastructure

Infrastructure as code

streamalert

What is StreamAlert?

- Serverless, real-time data analysis
- Point-in-time alerting
- Customizable to meet your needs

Benefits of StreamAlert

- Scalable to TBs/day
- Automated deployment
- Minimal system ownership
- Rules written in Python
- Low cost

What type of data can StreamAlert analyze?

JSON

{"name":"logged_in_users", "host":"ubuntu", "calendarTime":"Jan 10 17:49:07","columns":{"host":"10.0.0.2","username":"vagrant"}}

Syslog

Jan 10 17:49:07 ubuntu sshd[9644]: Accepted publickey for vagrant from 10.0.2.2 port 56738 ssh2

What type of data can StreamAlert analyze?

CSV

2,123456789010,eth0,10.0.0.1,10.0.0.2,56738,22,6,20,4249,ACCEPT,OK

Key Value

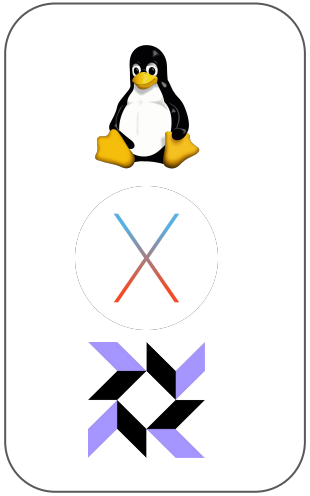
msg=audit(1364475353.159:24270): user pid=3280 uid=100 auid=500 ses=1

msg='op=PAM:authentication res=success

Example Logs

Environment

System



Network

[Web] Application

streamalert

Make the deployment of security tools simple.

Design

Data Analysis

Rules

Alerts

Deployment

Compute
- EC2
- EC2 Container Service
- Lightsail
- Elastic Beanstalk
- Lambda

Storage
- S3
- Elastic File System
- Glacier
- Storage Gateway

Database
- RDS
- DynamoDB
- ElastiCache
- Redshift

Networking & Content Delivery
- VPC
- CloudFront
- Direct Connect
- Route 53

Migration
- DMS
- Server Migration
- Snowball

Developer Tools
- CodeCommit
- CodeBuild
- CodeDeploy
- CodePipeline

Management Tools
- CloudWatch
- CloudFormation
- CloudTrail
- Config
- OpsWorks
- Service Catalog
- Trusted Advisor

Security, Identity & Compliance
- IAM
- Inspector
- Certificate Manager
- Directory Service
- WAF & Shield
- Compliance Reports

Analytics
- Athena
- EMR
- CloudSearch
- Elasticsearch Service
- Kinesis
- Data Pipeline
- QuickSight

Artificial Intelligence
- Lex
- Polly
- Rekognition
- Machine Learning

Internet Of Things
- AWS IoT

Game Development
- GameLift

Mobile Services
- Mobile Hub
- Cognito
- Device Farm
- Mobile Analytics
- Pinpoint

Application Services
- Step Functions
- SWF
- API Gateway
- AppStream
- Elastic Transcoder

Messaging
- SQS
- SNS
- SES

Business Productivity
- WorkDocs
- WorkMail

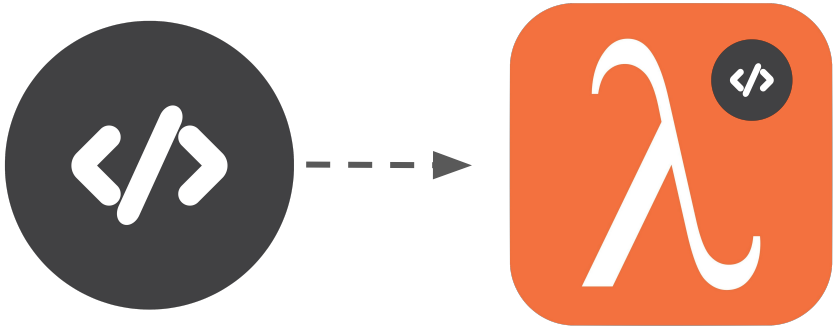
Desktop & App Streaming
- WorkSpaces
- AppStream 2.0

amazon web services

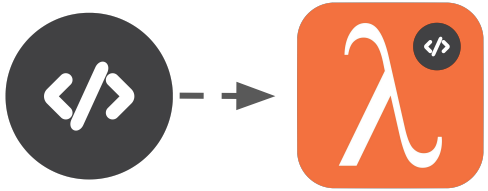
Serverless - Focus on the application logic, not the servers

Serverless Compute Model

1. Write Application
2. Upload to AWS Lambda
3. Run



Serverless Compute Pricing Model



compute + # of requests = total cost

duration: 100ms

memory: 128MB

1,000,000 req/day

$5.80/month

Built-in Security Benefits

1. Role Based Access Control via AWS IAM
2. Natural data segmentation
3. Isolated (containerized) log analysis
4. TLS

Design

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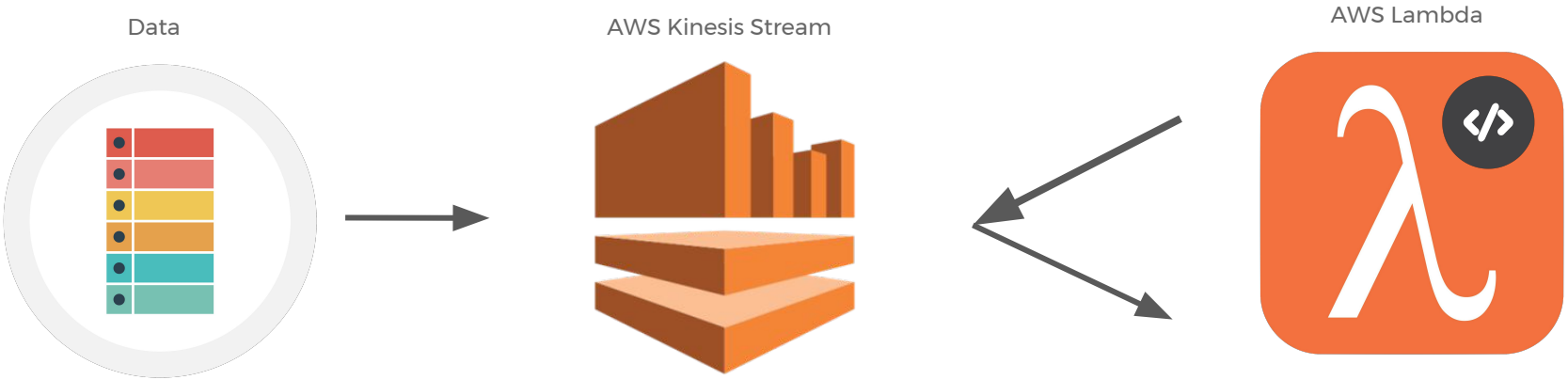
High Level



Data is sent to a Kinesis Stream; Lambda polls the stream and analyzes the data

AirbnbEng

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May 3 · 5 min read

Introducing Syslog to AWS Kinesis via Osquery

Logs awaiting collection (Logs in Yyteri by kallerna, licensed under Creative Commons)

osquery queries run on hosts

```
SELECT * FROM users;
SELECT * FROM processes;
SELECT * FROM syslog ...;
SELECT * FROM process_open_sockets ...;
```

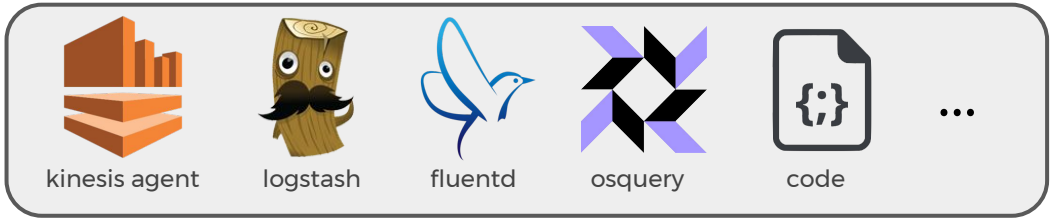
resulting data

```
{
  "hostIdentifier": "web01",
  "calendarTime": "Aug 10 10:13:54”
  "columns": {
    "remote_address": "51.32.104.190",
    "remote_port": "22",
    ...
}
...
```

AWS Kinesis Stream

AWS Lambda

Sending Data

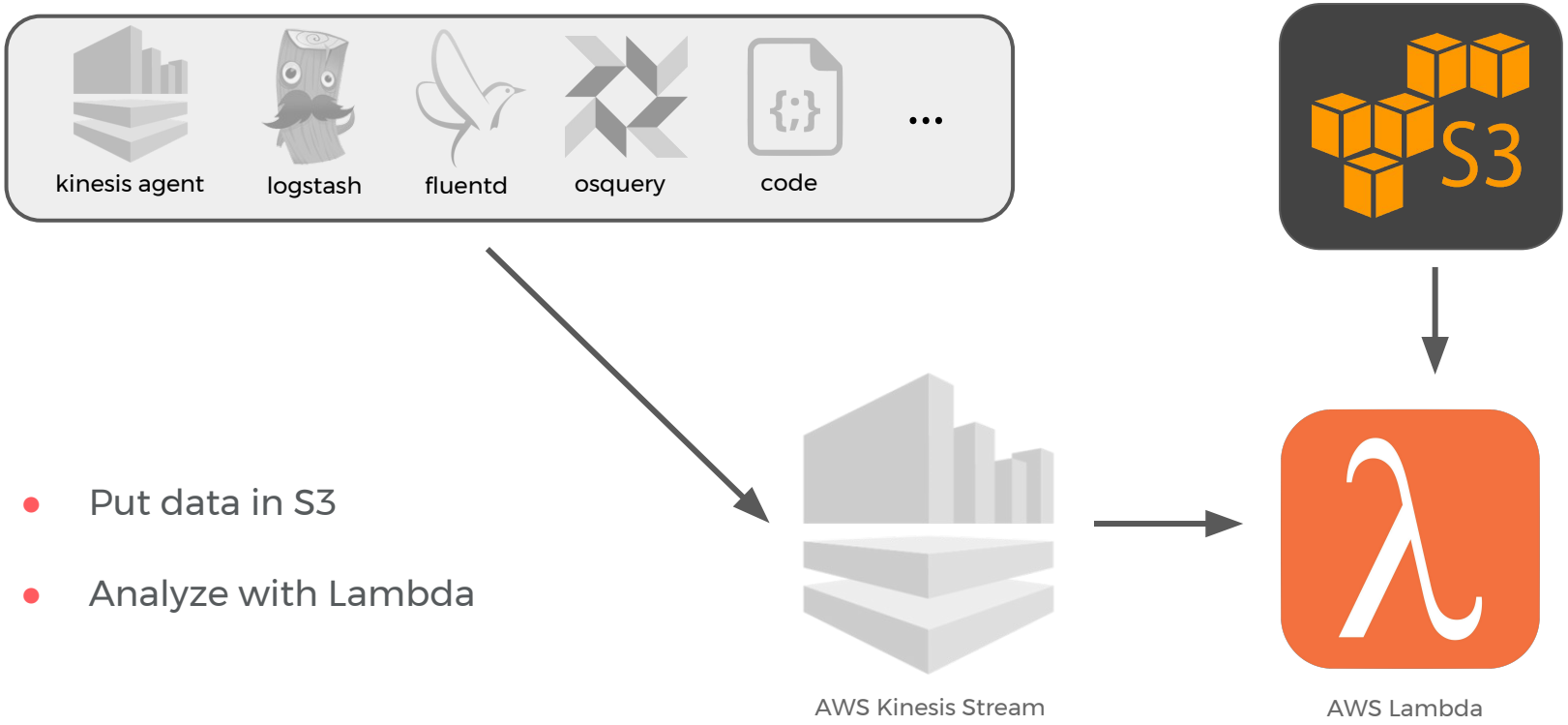


- Configure Agent
- Send to Stream
- Analyze with Lambda

AWS Kinesis Stream

AWS Lambda

Sending Data with S3



- Put data in S3
- Analyze with Lambda

Kinesis or **S3**
as a data source

- Records <= 1MB
- Performant push model

- Records > 1MB
- Less performant pull model
- Common datasource

Design

Data Analysis

Rules

Alerts

Deployment

Rules are expressed as Python functions!

Rule Layout

```
@rule(log_sources=[], match=[], outputs=[])
def rule_func(rec):
    """Description"""
    return True
```

Rule Processing Example

```
{
  "name": "logged_in_users",
  "hostIdentifier": "host1",
  "calendarTime": "Sat Dec 10 22:45:52 2016",
  "columns": {
    "host": "10.0.2.2",
    "user": "mike"
  }
}
```

Example Rule #1

```
@rule(log_sources=['osquery'], match=[], outputs=['pagerduty'])
def invalid_user(rec):
    """Catch unauthorized user logins"""
    auth_users = {'alice', 'bob'}
    query = rec['name']            # logged_in_users
    user = rec['columns']['user'] # mike

    return (
        query == 'logged_in_users' and
        user not in auth_users
    )
```

Example Rule #2

```
from netaddr import IPAddress, IPNetwork


@rule(log_sources=['osquery'], match=[], outputs=['pagerduty'])
def unauth_subnet(rec):
    """Catch logins from unauthorized subnets"""
    query = rec['name']
    ip = IPAddress(rec['columns']['host']) # 10.0.2.2
    valid_cidr = IPNetwork('10.2.0.0/24')


    return (
        query == 'logged_in_users' and
        ip not in valid_cidr
    )
```

Let’s reduce some repeated code with a ‘matcher’

Matcher

```
@matcher()
def logged_in_users(rec):
    query = rec['name']
    return query == 'logged_in_users'
```

```
from netaddr import IPAddress, IPNetwork

@rule(log_sources=['osquery'],
match=['logged_in_users'], outputs=['pagerduty'])
def invalid_subnet(rec):
    """Catch logins from unauthorized subnets"""
    ip = IPAddress(rec['columns']['host'])
    valid_cidr = IPNetwork('10.2.0.0/24')

    return ip not in valid_cidr
```

Matchers can also be used for determining:

- Environments
- Roles
- System Platforms

Design

Data Analysis

Rules

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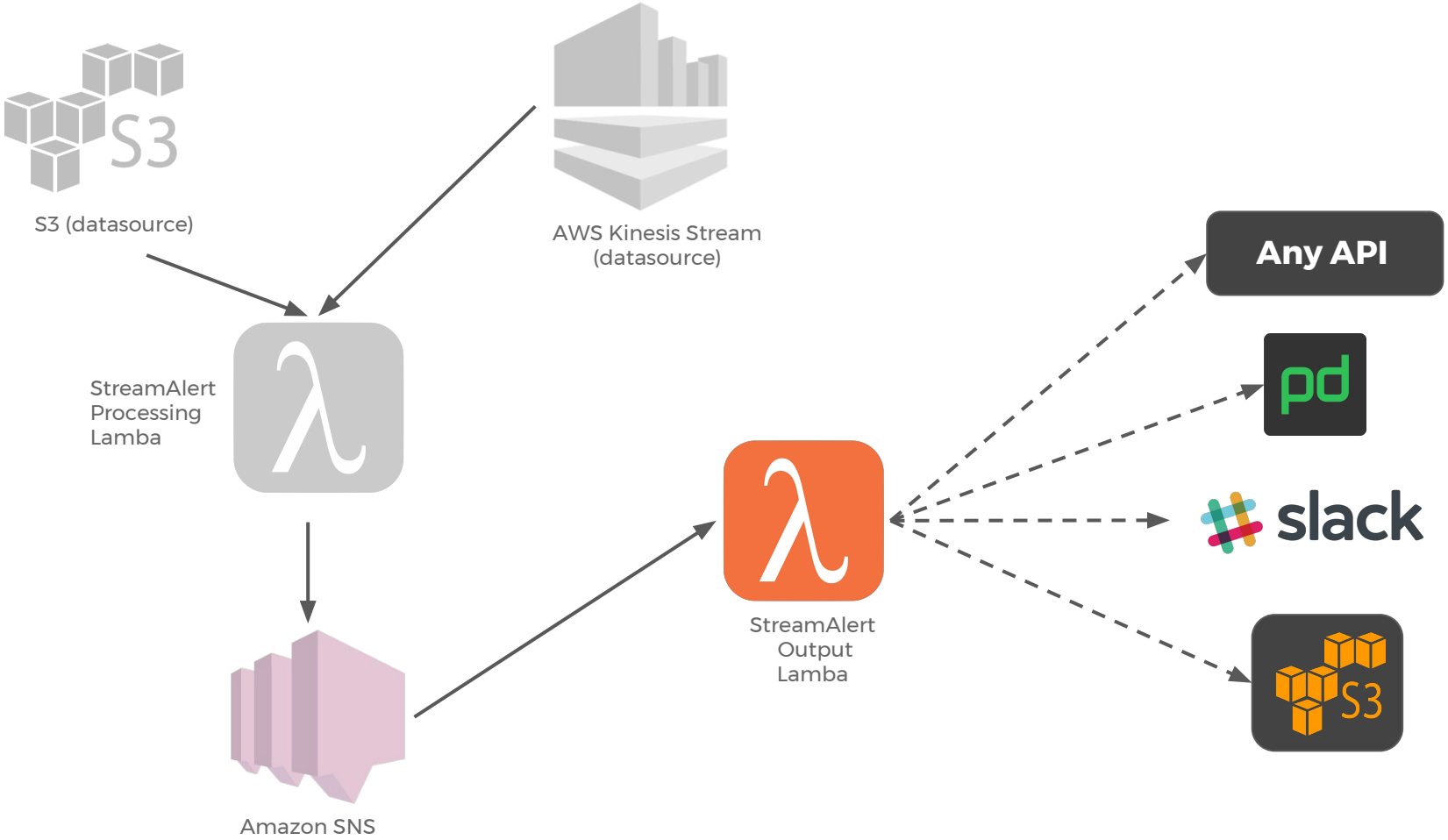
Deployment

Alert Output Configuration

```
@rule(log_sources=['osquery'],
match=['logged_in_users'], outputs=['pagerduty'])
def invalid_subnet(rec):
    """Catch logins from unauthorized subnets"""
    ip = IPAddress(rec['columns']['host'])
    valid_cidr = IPNetwork('10.2.0.0/24')

    return ip not in valid_cidr
```


S3
S3 (datasource)
AWS Kinesis Stream
(datasource)
Any API
pd
StreamAlert
Processing
Lamba
slack
StreamAlert
Output
Lamba
S3
Amazon SNS

INCIDENTS > INCIDENT DETAILS

#38232: StreamAlert Rule Triggered - demo_invalid_login

Edit


```
rule_name    demo_invalid_login
payload
    service    kinesis
    record
        unixTime        1470824034
        name            last
        hostIdentifier  demo.host.net
        columns
            username    joebob
            type        7
            tty         pts/0
            time        12345678
            pid         139
            host        10.0.0.2
```

StreamAlert BOT 2:42 PM

StreamAlert Rule Triggered

Rule	# of Alerts
demo_invalid_login	2
Service	**Entity**
kinesis	demo_kinsis_stream

Today at 2:42 PM


```
{
    "action": "added",
    "calendarTime": "Jan 10 2017",
    "columns": {
        "host": "10.0.0.2",
        "pid": "139",
        "time": "12345678",
        "tty": "pts/0",
        "type": "7",
        "username": "joebob"
    },
    "decorations": {
        "envIdentifier": "demo",
        "roleIdentifier": "demo"
    },
    "hostIdentifier": "demo.host.net",
    "name": "last",
    "unixTime": "1470824034"
}
```

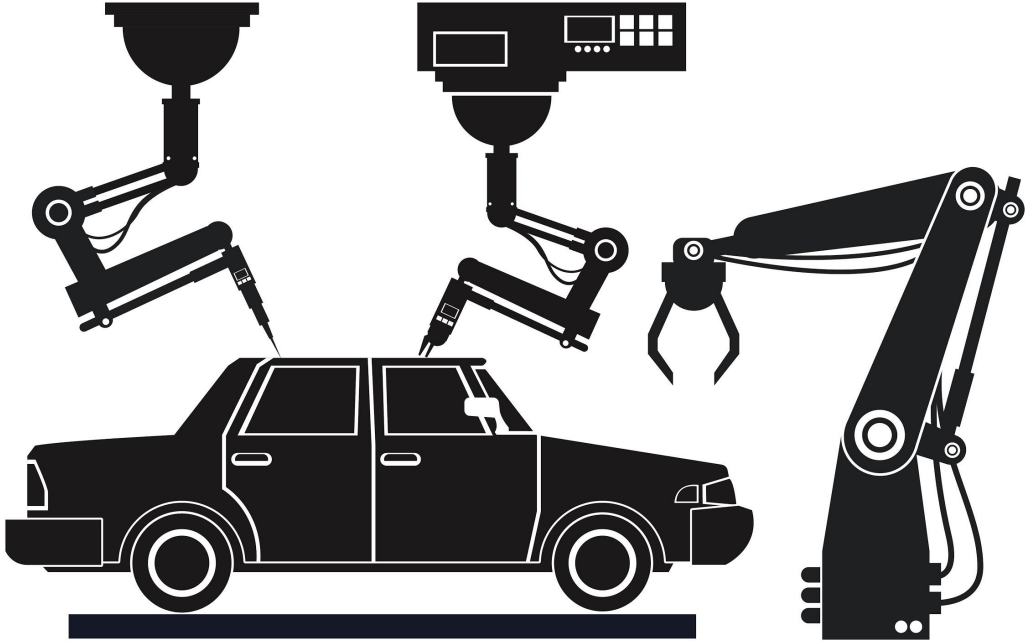
Design

Data Analysis

Rules and Alerts

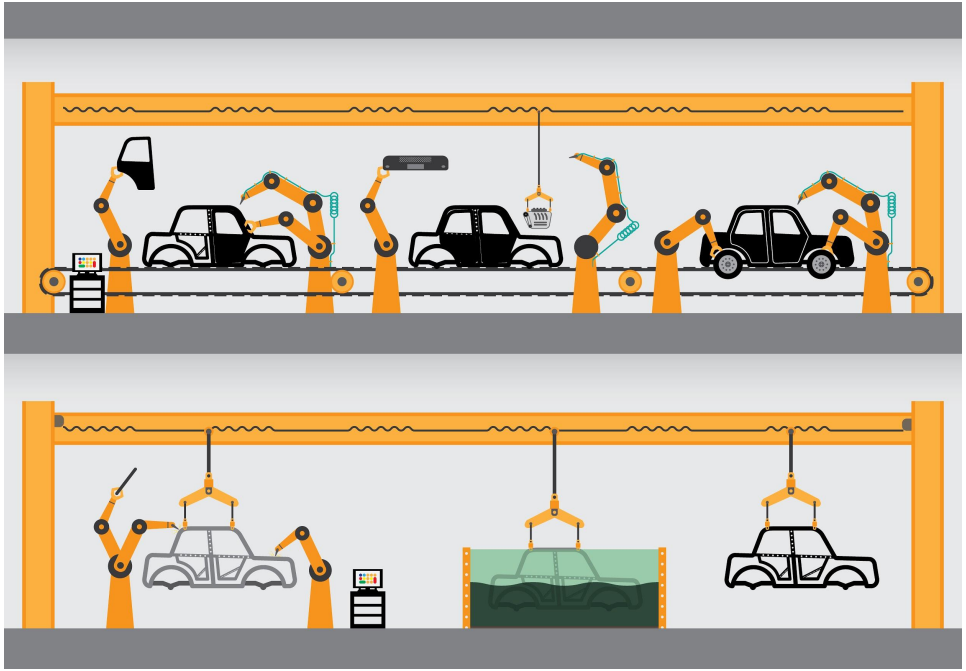
Deployment

Goal: Make Deployment Simple



Assembly Line

- Time/Cost Savings
- Accessible
- Interchangeable
- Repeatable



Building with Terraform

- Express complex infrastructure as code
- Interchangeable
- Consistent
- Abstracted with stream_alert_cli

web : github.com/airbnb/streamalert

twitter: @streamalert_io

Thank You!

- **@enigmaconf, @usenix**
- **@awscloud team** (services and support)

- **@mimeframe** (concept, website, guides, review)
- **@strcrzy** (core rules logic)
- **@zwass** (osquery kinesis output plugins)
- **@hackgnar** (osquery kinesis bug fixes)

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