

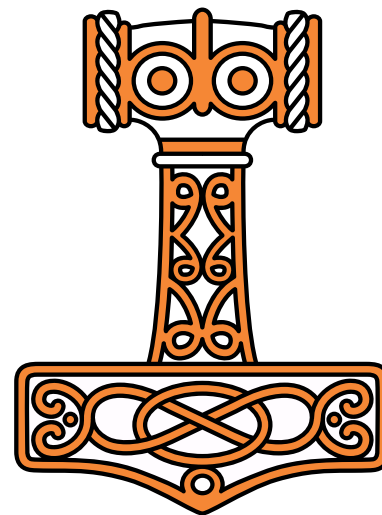


DIALOG

FinnAPL @ Suomenlinna, May 2023

Isolates in the Cloud

Morten Kromberg



Or: Parallel Cloud Computing with Dyalog APL



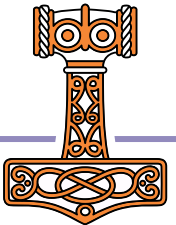
Parallelizable Code

(Thanks to Sampo Lappo)

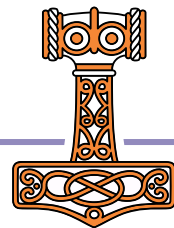
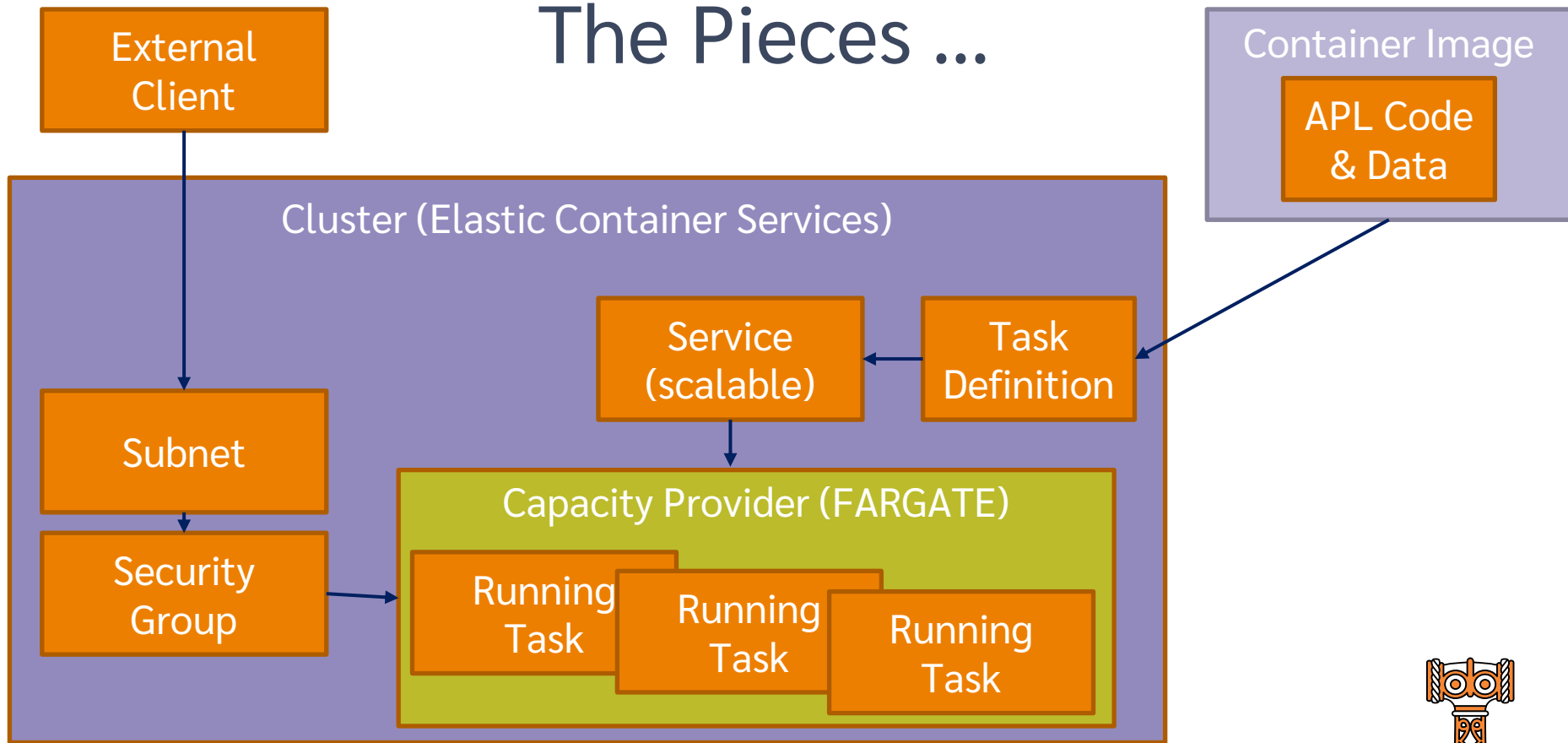
```
first_taxrate ← 0.5 × -1 + 139  
result ← first_taxrate, >CALCULATE_GINI first_taxrate
```



```
    2 seconds per CALCULATE_GINI  
× 39 initial tax rates  
= ~80 seconds
```



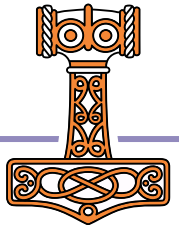
The Pieces ...



Before we start...

- Create an account at Amazon Web Services (AWS)
- Install and configure the Command Line Interface (AWS-CLI)
- Install Docker

All of these steps are described in the materials for Dyalog'22 workshop "SP2"



AWS Cost Management

- Home
- Cost Explorer
- Reports
- Budgets
- Cost Anomaly Detection
- Rightsizing recommendations
- Savings Plans
 - Overview
 - Inventory
 - Recommendations
 - Purchase Savings Plans
 - Utilization report
 - Coverage report
 - Cart 0
- Reservations
 - Overview
 - Recommendations
 - Utilization report
 - Coverage report

Cost summary

Current month costs Info	Forecasted month-end costs Info
\$4.51	\$11.67
Up 652% over last month	Up 754% over last month



May trends [Info](#)

Account usage

Morten Kromberg (352645159704) costs are up \$3.28 (995%)

Region usage

eu-west-3 costs are up \$3.34 (4,530%)

More resources [↗](#)

- [What is AWS Billing and Cost Management?](#)
- [Documentation](#)
- [FAQ](#)

(Re)Create Workspace

Container Image

APL Code
& Data

```
#!/usr/bin/dyalogscript INITSESSION=1
□SE.Link.Import # './taxmodel-source'
)SAVE ./taxmodel.dws
```

The screenshot shows a Windows File Explorer window with the following details:

- Address bar: <code>devt > aws-isolates > taxmodel-source > taxmodel</code>
- Search bar: Search taxmodel
- File list table:

Name	Date modified	Type	Size
GINI.aplf	26-04-2023 21:22	Dyalog APL Source	1 KB
MUUTTUJIIIN23.aplf	26-04-2023 21:22	Dyalog APL Source	2 KB
NETTO23mod.aplf	26-04-2023 21:22	Dyalog APL Source	2 KB
NJAKO.aplf	26-04-2023 21:22	Dyalog APL Source	1 KB
PERUSTIEDOT23.aplf	26-04-2023 21:22	Dyalog APL Source	2 KB
TAXGINI.aplf	26-04-2023 21:22	Dyalog APL Source	1 KB
VAKIOT23mod.aplf	26-04-2023 21:22	Dyalog APL Source	3 KB
VEROTUS23.aplf	26-04-2023 21:22	Dyalog APL Source	3 KB
VVERO.aplf	26-04-2023 21:22	Dyalog APL Source	1 KB

The preview pane on the right displays the following APL code:

```
VAKIOT23mod
A Vakioita ja parametreja
A VALTIONVEROTUKSEN TAULUKKO
B←0
R←1000×0 19.9 29.7 49 85.8
D←first_taxrate 19 30.25 34 44
A ELÄKETULON LISÄVERO
ELISR←47000
ELISP←5.85
A YLE-VERO
Y←163
YR←14000
YP←2.5
A MUITA PARAMETREJA
IND←1805
```

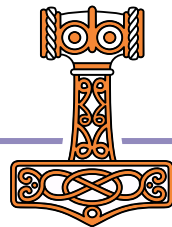
Build Container

```
Dockerfile
FROM dyalog/dyalog:latest
ADD taxmodel.dws      /apps/taxmodel/taxmodel.dws
ADD isolate.dws      /apps/taxmodel/isolate.dws
ADD gross_incomes.dcf /apps/taxmodel/gross_incomes.dcf
ENV MAXWS=2G
ENV isolate=isolate
ENV Port=7052
ENV AutoShut=1
ENV AllowRemote="IP=98.128.165.90"
ENV LOAD="/apps/taxmodel/isolate.dws"
```

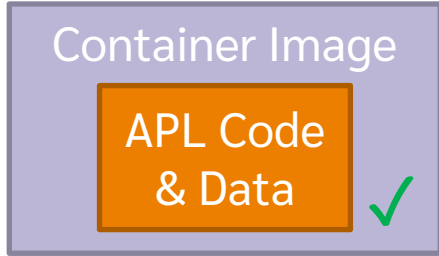
```
build.bat
@ECHO ON
docker context use default
docker build --no-cache -t "taxmodel" .
```

Container Image

APL Code
& Data



Push Container to Elastic Container Registry



Elastic Container Registry - Repositories

eu-west-3.console.aws.amazon.com/ecr/repositories?region=eu-west-3

Apps Link APL Flying & Sailing Car Dyalog Cloud SBO Travel Linux Sport Productivity Ferie 2022

aws Services Search [Alt+S]

IAM

Amazon Elastic Container Registry

Private registry
Public registry
Repositories

Getting started [external link]
Documentation [external link]
Public gallery [external link]

Amazon ECR > Repositories

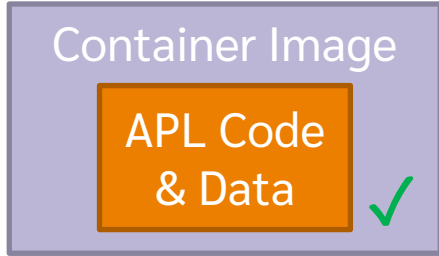
Private Public

Private repositories (1) [refresh] [View push commands] [Delete] [Action]

Find repositories

<input type="checkbox"/>	Repository name ▲	URI	Created at ▼	Tag immutability	Scan frequency	Encryption
<input type="checkbox"/>	taxmodel	352645159704.dkr.ecr.eu-west-3.amazonaws.com/taxmodel	28 April 2023, 13:47:19 (UTC+02)	Disabled	Manual	AES-256

Push Container to Elastic Container Registry



```
push.bat
File Rediger Vis
@ECHO ON
SET AWS_ID=352645159704.dkr.ecr.eu-west-3.amazonaws.com
SET REPO=%AWS_ID%/taxmodel

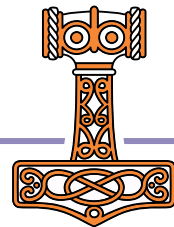
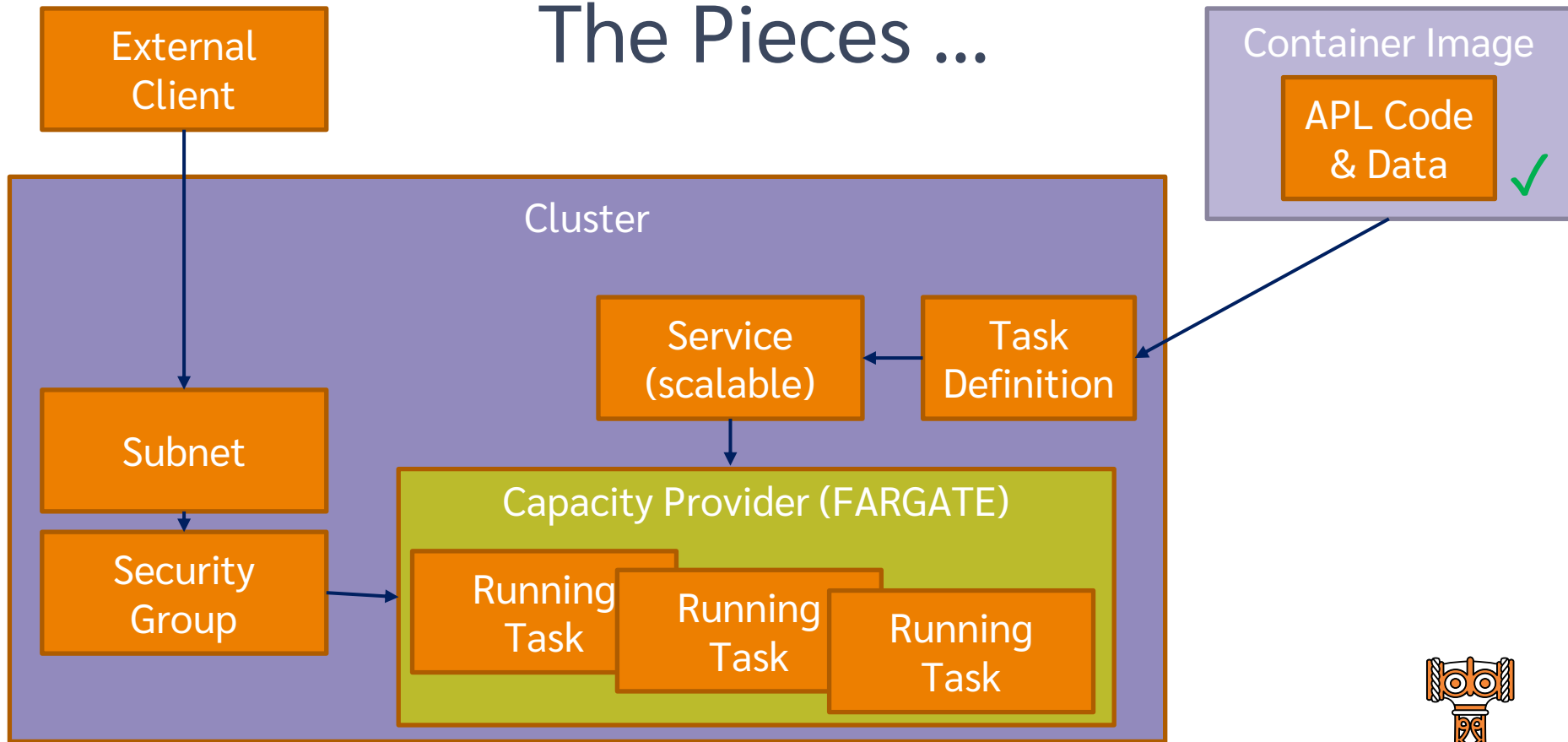
docker context use default
aws ecr get-login-password --region eu-west-3 | docker login --username AWS --password-stdin %AWS_ID%
docker tag taxmodel %REPO%
docker push %REPO%
```

Ln 1, Col 1 100% Windows (CRLF) UTF-8

- Getting started
- Documentation
- Public gallery

<input type="checkbox"/>	Repository name ▲	URI	Created at	Tag immutability	Scan frequency	Encryption
<input type="checkbox"/>	taxmodel	352645159704.dkr.ecr.eu-west-3.amazonaws.com/taxmodel	28 April 2023, 13:47:19 (UTC+02)	Disabled	Manual	AES-2

The Pieces ...



The Pieces ...

Cluster

```
C:\devt\aws-isolates\APLSource\CreateCluster.aplf
```

File Edit View Help

Search...

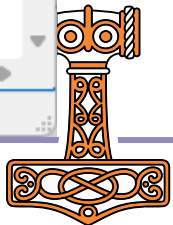

```
[0] r+CreateCluster name;file;cl;folder
[1] A --- Create a Cluster ---
[2]
[3] folder+[]SE.Link.LaunchDir
[4]
[5] cl+[]NS''
[6] cl.capacityProviders+'FARGATE' 'FARGATE_SPOT'
[7] cl.PutJSON file+folder,'/cluster-spec.json'
[8]
[9] r+AwsCmd 'ecs create-cluster --cluster-name ',name,' --output json --cli-input-json file://',file
[10]
[11] []DELETE file
```

Function Pos: 0/12,1

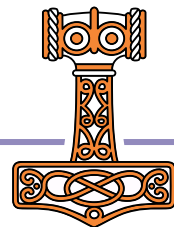
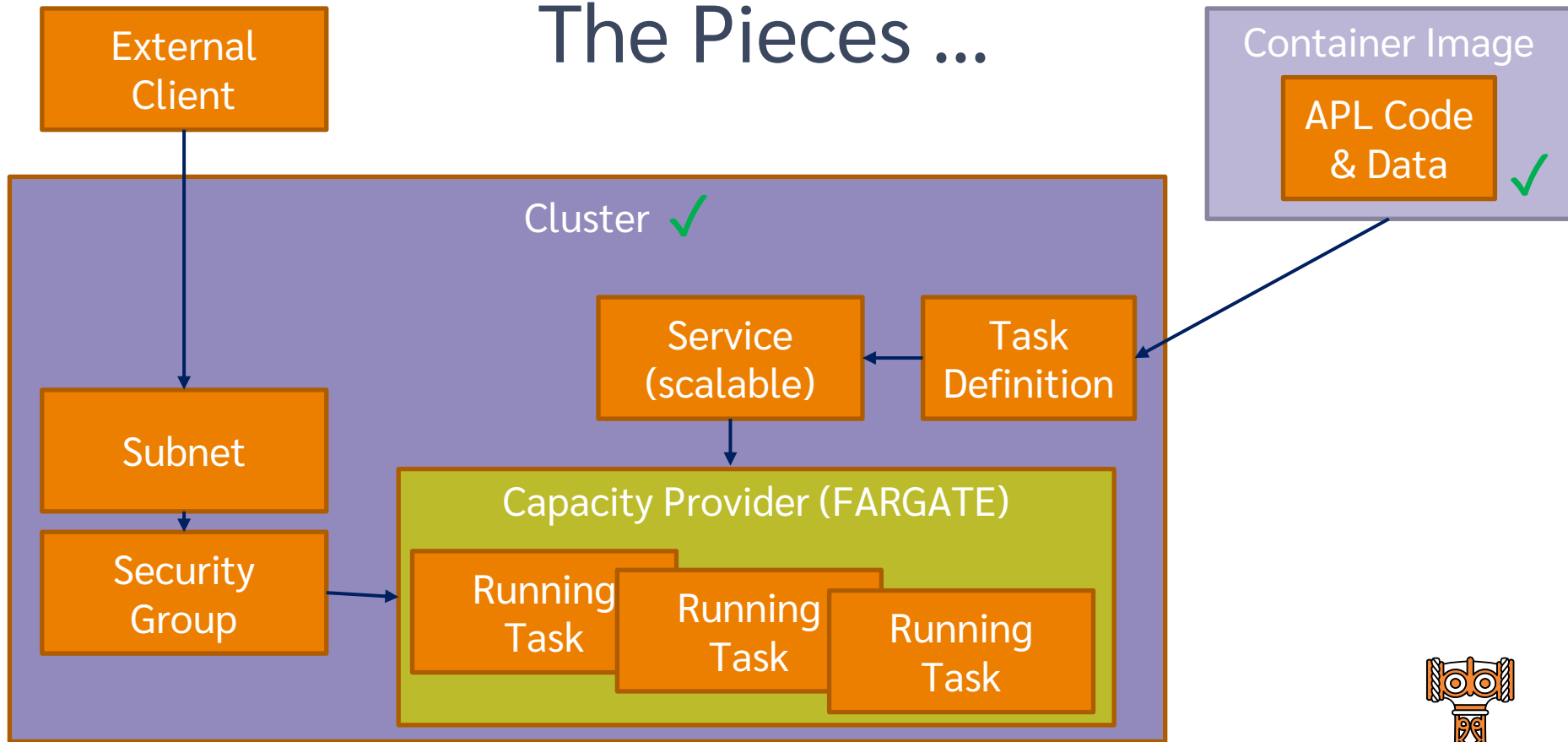
```
cluster-spec.json
```

```
{
  "capacityProviders": [
    "FARGATE",
    "FARGATE_SPOT"
  ]
}
```

Ln 1, Col 1 100% Macintosh (CR) UTF-8



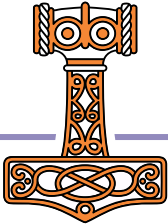
The Pieces ...



```
C:\dev\aws-isolates\APLSource\CreateTask.aplf
File Edit View Help
Search...
[0] r+CreateTask (name container rolearn);td;cd;ports;env;mem;cpu;folder;file;image
[1] A --- Actually "Register" a Task Definition ---
[2]
[3] folder+[]SE.Link.LaunchDir
[4]
[5] cpu+'2048' A 2 vCPUs
[6] mem+'4096' A 4Gb
[7]
[8] A cpu+'512' A 0.5 vCPUs
[9] A mem+'3072' A 3Gb
[10]
[11] container,+ (0=#container)+'/352645159704.dkr.ecr.eu-west-3.amazonaws.com/taxmodel'
[12] rolearn,+ (0=#rolearn)+'/arn:aws:iam::352645159704:role/taxmodel-role'
[13]
[14] (ports+[]NS'' '' ').(containerPort protocol)+(4502 'tcp')(7052 'tcp')(7053 'tcp') A RIDE & Isolate ports
[15] A env+[]NS ''
[16] A env.(name value)+'RIDE_INIT' 'SERVE:*:4502' ; not possible with more than one isolate process
[17] td+[]NS ''
[18] cd+[]NS ''
[19] cd.essential+c'true'
[20] cd.name+name
[21]
[22] cd.image+container
[23] cd.portMappings+ports
[24] A cd.environment+,env
[25] cd.(memory memoryReservation)+2000 100
[26]
[27] td.(family containerDefinitions)+name(,cd)
[28] td.requiresCompatibilities+,c'FARGATE'
[29] td.networkMode+'awsvpc'
[30] td.executionRoleArn+rolearn
[31] td.(cpu memory)+cpu mem
[32]
[33] td PutJSON file+folder,'/td-spec.json'
[34]
[35] r+AwsCmd 'ecs register-task-definition --output json --cli-input-json file://',file
[36] []DELETE file

Modified Function Last saved by: Pos: 24/37,0
```

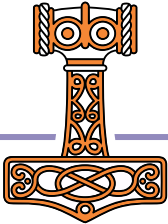
Task Definition



```
C:\dev\aws-isolates\APLSource\CreateTask.aplf
File Edit View Help
Search...
[0] r+CreateTask (name container rolearn);td;cd;ports;env;mem;cpu;folder;file;image
[1] A --- Actually "Register" a Task Definition ---
[2]
[3] folder+SE.Link.LaunchDir
[4]
[5] cpu+'2048' A 2 vCPUs
[6] mem+'4096' A 4Gb
[7]
[8] A cpu+'512' A 0.5 vCPUs
[9] A mem+'3072' A 3Gb
[10]
[11] container,+('0=#container')/'352645159704.dkr.ecr.eu-west-3.amazonaws.com/taxmodel'
[12] rolearn,+('0=#rolearn')/'arn:aws:iam::352645159704:role/taxmodel-role'
[13]
[14] (ports+NS'' '' ').(containerPort protocol)+(4502 'tcp')(7052 'tcp')(7053 'tcp') A RIDE & Isolate ports
[15] A env+NS''
[16] A env.(name value)+'RIDE_INIT' 'SERVE:*:4502' ; not possible with more than one isolate process
[17] td+NS''
[18] cd+NS''
[19] cd.essential+c'true'
[20] cd.name+name
[21]
[22] cd.image+container
[23] cd.portMappings+ports
[24] A cd.environment+,env
[25] cd.(memory memoryReservation)+2000 100
[26]
[27] td.(family containerDefinitions)+name(,cd)
[28] td.requiresCompatibilities+,c'FARGATE'
[29] td.networkMode+'awsvpc'
[30] td.executionRoleArn+rolearn
[31] td.(cpu memory)+cpu mem
[32]
[33] td PutJSON file+folder,'/td-spec.json'
[34]
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[36] DELETE file

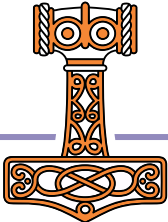
Modified Function Last saved by: Pos: 24/37,0
```

Task Definition



```
C:\dev\aws-isolates\APLSource\CreateTask.aplf
File Edit View Help
Search...
[0] r+CreateTask (name container rolearn);td;cd;ports;env;mem;cpu;folder;file;image
[1] A --- Actually "Register" a Task Definition ---
[2]
[3] folder+[]SE.Link.LaunchDir
[4]
[5] cpu+'2048' A 2 vCPUs
[6] mem+'4096' A 4Gb
[7]
[8] A cpu+'512' A 0.5 vCPUs
[9] A mem+'3072' A 3Gb
[10]
[11] container,+ (0=#container)+'/352645159704.dkr.ecr.eu-west-3.amazonaws.com/taxmodel'
[12] rolearn,+ (0=#rolearn)+'/arn:aws:iam::352645159704:role/taxmodel-role'
[13]
[14] (ports+[]NS'' '' ''').(containerPort protocol)+(4502 'tcp')(7052 'tcp')(7053 'tcp') A RIDE & Isolate ports
[15] A env+[]NS ''
[16] A env.(name value)+'RIDE_INIT' 'SERVE:*:4502' ; not possible with more than one isolate process
[17] td+[]NS ''
[18] cd+[]NS ''
[19] cd.essential+c'true'
[20] cd.name+name
[21]
[22] cd.image+container
[23] cd.portMappings+ports
[24] A cd.environment+,env
[25] cd.(memory memoryReservation)+2000 100
[26]
[27] td.(family containerDefinitions)+name(,cd)
[28] td.requiresCompatibilities+,c'FARGATE'
[29] td.networkMode+'awsvpc'
[30] td.executionRoleArn+rolearn
[31] td.(cpu memory)+cpu mem
[32]
[33] td PutJSON file+folder,'/td-spec.json'
[34]
[35] r+AwsCmd 'ecs register-task-definition --output json --cli-input-json file://',file
[36] []DELETE file
```

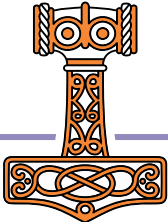
Task Definition




```
C:\devt\aws-isolates\APLSource\CreateTask.aplf
File Edit View Help
Search...
[0] r+CreateTask (name container rolearn);td;cd;ports;env;mem;cpu;folder;file;image
[1] A --- Actually "Register" a Task Definition ---
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[16] A env.(name value)+'RIDE_INIT' 'SERVE:*:4502' ; not possible with more than one isolate process
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[29] td.networkMode+'awsvpc'
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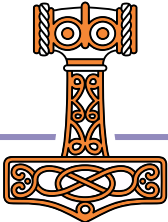
Task Definition



```
C:\dev\aws-isolates\APLSource\CreateTask.aplf
File Edit View Help
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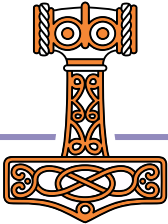
Task Definition



```
C:\dev\aws-isolates\APLSource\CreateTask.aplf
File Edit View Help
Search...
[0] r+CreateTask (name container rolearn);td;cd;ports;env;mem;cpu;folder;file;image
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[11] container,+ (0=#container)+'/352645159704.dkr.ecr.eu-west-3.amazonaws.com/taxmodel'
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[16] A env.(name value)+'RIDE_INIT' 'SERVE:*:4502' ; not possible with more than one isolate process
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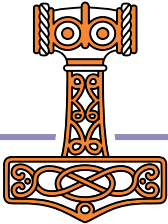
Task Definition



```
C:\dev\aws-isolates\APLSource\CreateTask.aplf
File Edit View Help
Search...
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[3] folder+[]SE.Link.LaunchDir
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[5] cpu+'2048' A 2 vCPUs
[6] mem+'4096' A 4Gb
[7]
[8] A cpu+'512' A 0.5 vCPUs
[9] A mem+'3072' A 3Gb
[10]
[11] container,+ (0=#container)'/352645159704.dkr.ecr.eu-west-3.amazonaws.com/taxmodel'
[12] rolearn,+ (0=#rolearn)'/arn:aws:iam::352645159704:role/taxmodel-role'
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[14] (ports+[]NS'' '' ').(containerPort protocol)+(4502 'tcp')(7052 'tcp')(7053 'tcp') A RIDE & Isolate ports
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[16] A env.(name value)+'RIDE_INIT' 'SERVE:*:4502' ; not possible with more than one isolate process
[17] td+[]NS ''
[18] cd+[]NS ''
[19] cd.essential+c'true'
[20] cd.name+name
[21]
[22] cd.image+container
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[24] A cd.environment+,env
[25] cd.(memory memoryReservation)+2000 100
[26]
[27] td.(family containerDefinitions)+name(,cd)
[28] td.requiresCompatibilities+,c'FARGATE'
[29] td.networkMode+'awsvpc'
[30] td.executionRole+rolearn
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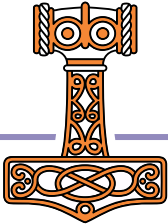
Task Definition

```
td.requiresCompatibilities+,c'FARGATE'
```



```
C:\dev\aws-isolates\APLSource\CreateTask.aplf
File Edit View Help
Search...
[0] r+CreateTask (name container rolearn);td;cd;ports;env;mem;cpu;folder;file;image
[1] A --- Actually "Register" a Task Definition ---
[2]
[3] folder+[]SE.Link.LaunchDir
[4]
[5] cpu+'2048' A 2 vCPUs
[6] mem+'4096' A 4Gb
[7]
[8] A cpu+'512' A 0.5 vCPUs
[9] A mem+'3072' A 3Gb
[10]
[11] container,+ (0=#container)'/352645159704.dkr.ecr.eu-west-3.amazonaws.com/taxmodel'
[12] rolearn,+ (0=#rolearn)'/arn:aws:iam::352645159704:role/taxmodel-role'
[13]
[14] (ports+[]NS'' '' ').(containerPort protocol)+(4502 'tcp')(7052 'tcp')(7053 'tcp') A RIDE & Isolate ports
[15] A env+[]NS ''
[16] A env.(name value)+'RIDE_INIT' 'SERVE:*:4502' ; not possible with more than one isolate process
[17] td+[]NS ''
[18] cd+[]NS ''
[19] cd.essential+c'true'
[20] cd.name+name
[21]
[22] cd.image+container
[23] cd.portMappings+ports
[24] A cd.environment+,env
[25] cd.(memory memoryReservation)+2000 100
[26]
[27] td.(family containerDefinitions)+name(,cd)
[28] td.requiresCompatibilities+,c'FARGATE'
[29] td.networkMode+'awsvpc'
[30] td.executionRoleArn+rolearn
[31] td.(cpu memory)+cpu mem
[32]
[33] td PutJSON file+folder,'/td-spec.json'
[34]
[35] r+AwsCmd 'ecs register-task-definition --output json --cli-input-json file://',file
[36] []DELETE file
```

Task Definition



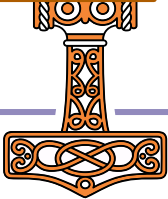
```
C:\dev\aws-isolates\APLSource\CreateTask.aplf
File Edit View Help
Search...
[0] r+CreateTask (name container rolearn);td;cd;ports;env;mem;cpu;folder;file;image
[1] A --- Actually "Register" a Task Definition ---
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[10]
[11] container,+ (0=#container)+'/352645159704.dkr.ecr.eu-west-3.amazonaws.com/taxmodel'
[12] rolearn,+ (0=#rolearn)+'/arn:aws:iam::352645159704:role/taxmodel-role'
[13]
[14] (ports+[]NS'' '' ').(containerPort protocol)+(4502 'tcp')(7052 'tcp')(7053 'tcp') A RIDE & Isolate ports
[15] A env+[]NS ''
[16] A env.(name value)+'RIDE_INIT' 'SERVE:*:4502' ; not possible with more than one isolate process
[17] td+[]NS ''
[18] cd+[]NS ''
[19] cd.essential+c'true'
[20] cd.name+name
[21]
[22] cd.image+container
[23] cd.portMappings+ports
[24] A cd.environment+,env
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[26]
[27] td.(family containerDefinitions)+name(,cd)
[28] td.requiresCompatibilities+,c'FARGATE'
[29] td.networkMode+'awsvpc'
[30] td.executionRoleArn+rolearn
[31] td.(cpu memory)+cpu mem
[32]
[33] td PutJSON file+folder,'/td-spec.json'
[34]
[35] r+AwsCmd 'ecs register-task-definition --output json --cli-input-json file://',file
[36] []DELETE file

Modified Function Last saved by: Pos: 24/37,0
```

Task Definition

Warning: ChatGPT does ***NOT*** know how to do this 😊

But Norbert Jurkiewicz does – Thanks Norbert!



Identity and Access Management (IAM)

Search IAM

- Dashboard
- Access management
 - User groups
 - Users
 - Roles**
 - Policies
 - Identity providers
 - Account settings
- Access reports
 - Access analyzer
 - Archive rules
 - Analyzers
 - Settings
 - Credential report
 - Organization activity
 - Service control policies (SCPs)

IAM > Roles > taxmodel-role

taxmodel-role

Allows ECS to create and manage AWS resources on your behalf.

Summary

Creation date

May 01, 2023, 21:25 (UTC+02:00)

Last activity

6 hours ago

ARN

arn:aws:iam::352645159704:role/taxmodel-role

Maximum session duration

1 hour

- Permissions**
- Trust relationships
- Tags
- Access Advisor
- Revoke sessions

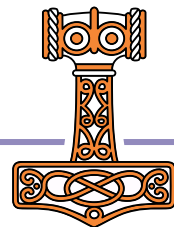
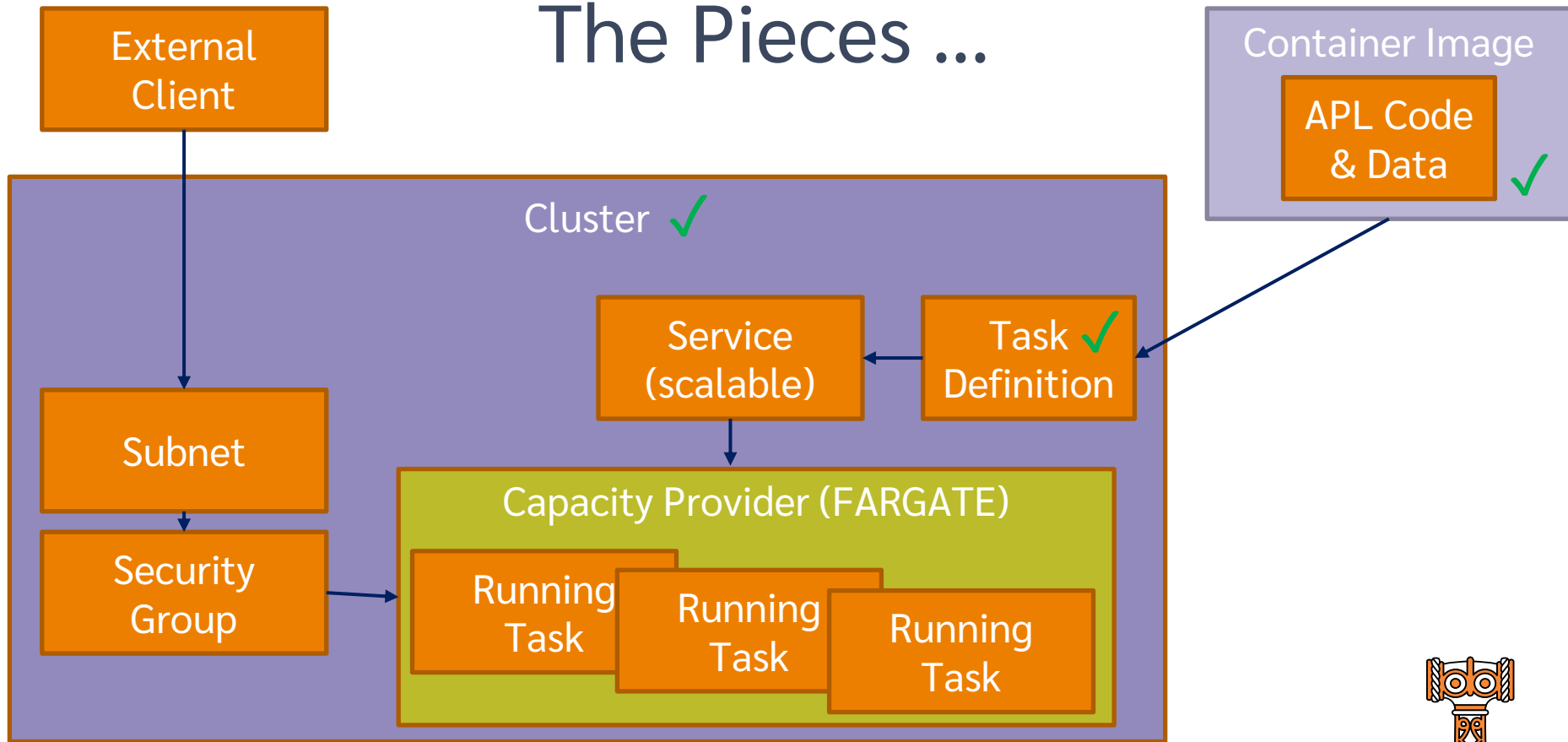
Permissions policies (3) Info

You can attach up to 10 managed policies.

Filter policies by property or policy name and press enter.

<input type="checkbox"/>	Policy name	Type	Descr
<input type="checkbox"/>	AdministratorAccess	AWS managed - job function	Provid
<input type="checkbox"/>	AmazonEC2ContainerServiceRole	AWS managed	Default
<input type="checkbox"/>	AmazonElasticContainerRegistryPublicFullAccess	AWS managed	Provid

The Pieces ...

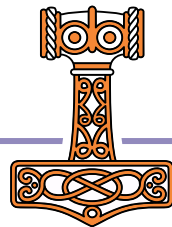


The Pieces ...

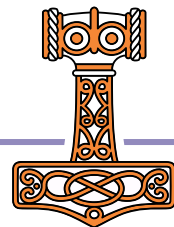
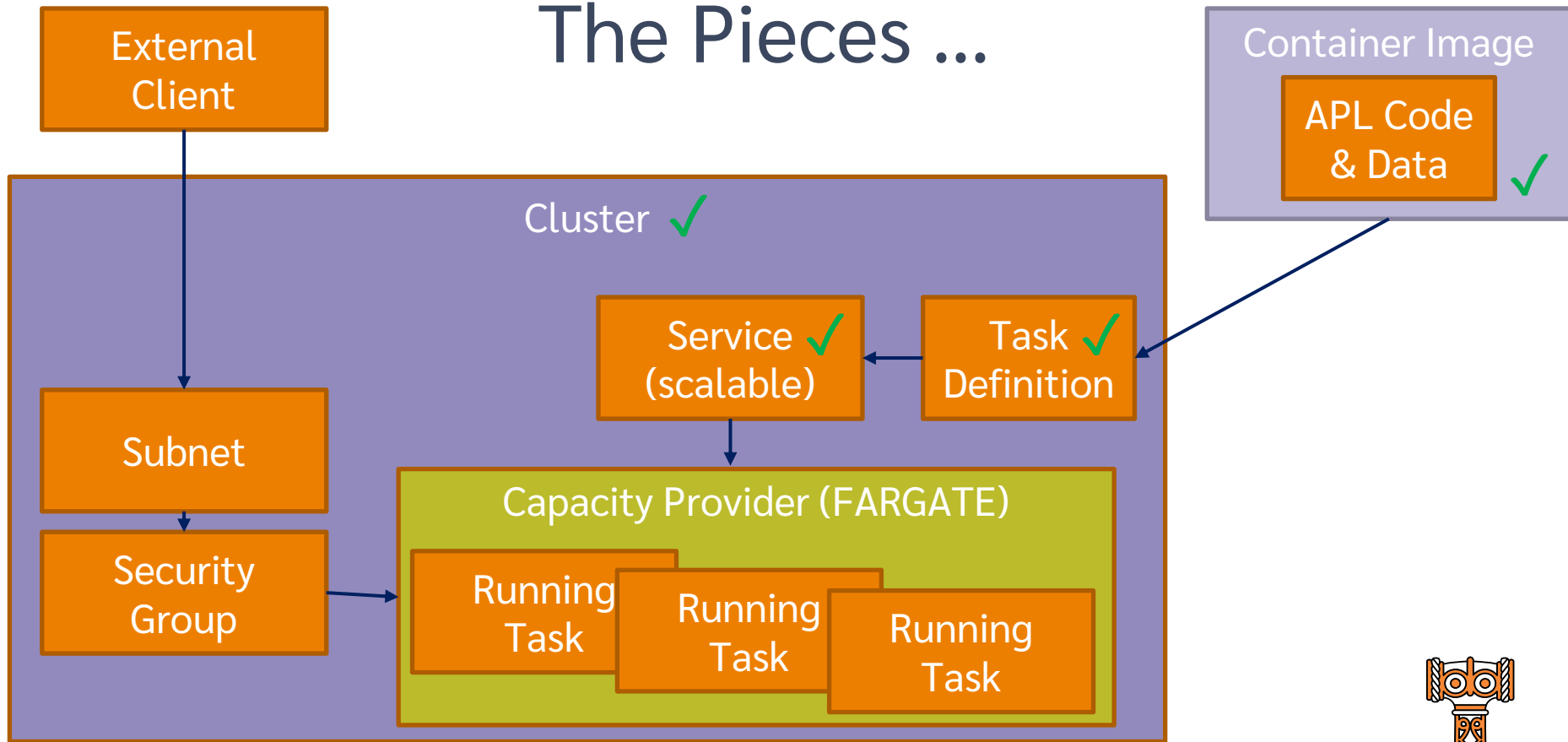
Service
(scalable)

```
▽ r←CreateService(cluster service task);net
[1] A --- Create a Service ---
[2] net←'--network-configuration "awsvpcConfiguration={subnets=[subnet-ccceda5],
    securityGroups=[sg-0c32ce61],assignPublicIp=ENABLED}"' A Don't ask
[3] r←AwsCmd 'ecs create-service --cluster ',cluster,
    ' --service-name ',service,
    ' --task-definition ',task,
    ' --desired-count 0 --launch-type FARGATE ',net
```

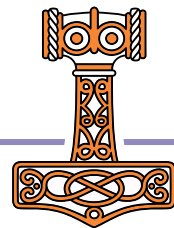
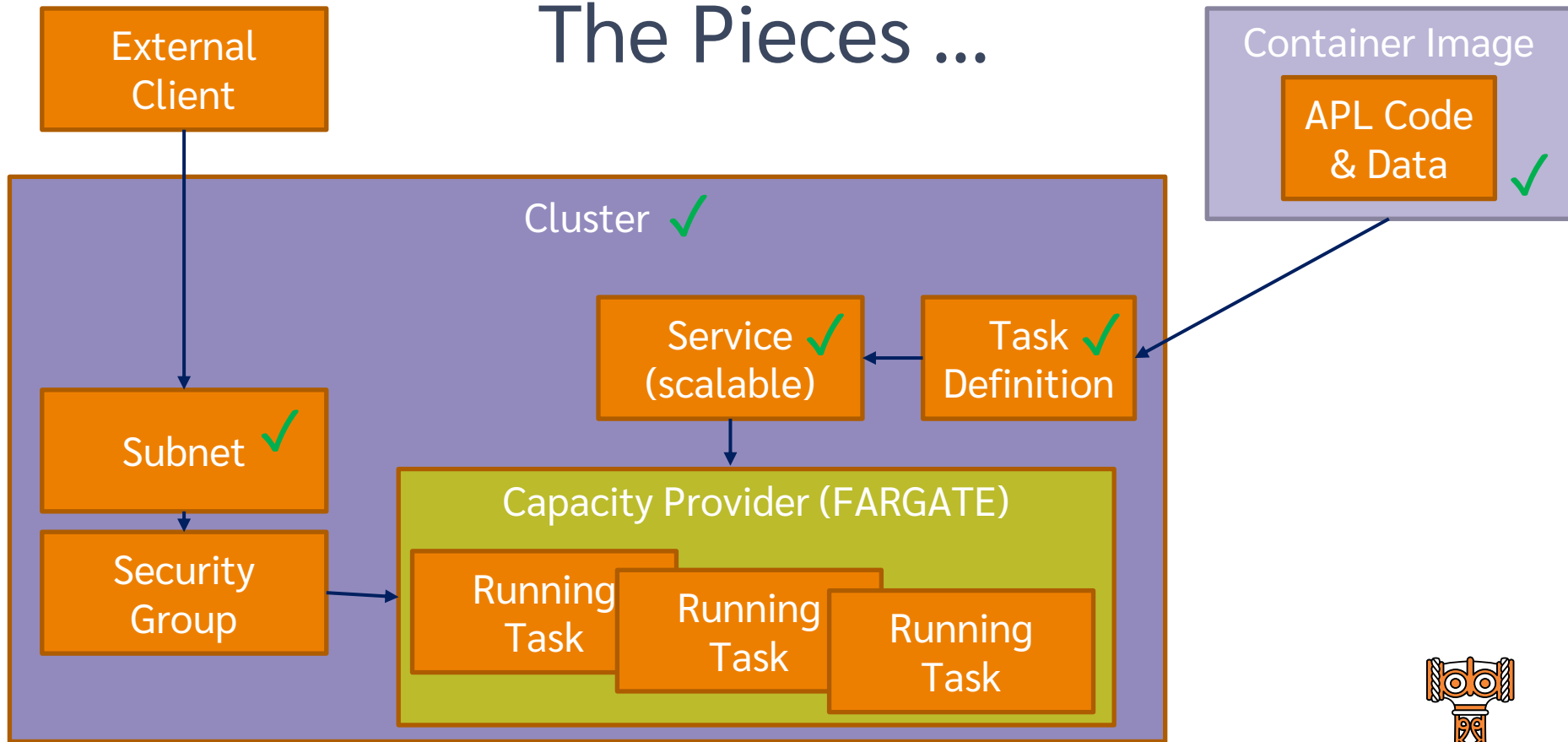
▽



The Pieces ...



The Pieces ...



Edit inbound rules [Info](#)

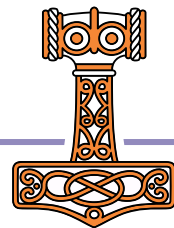
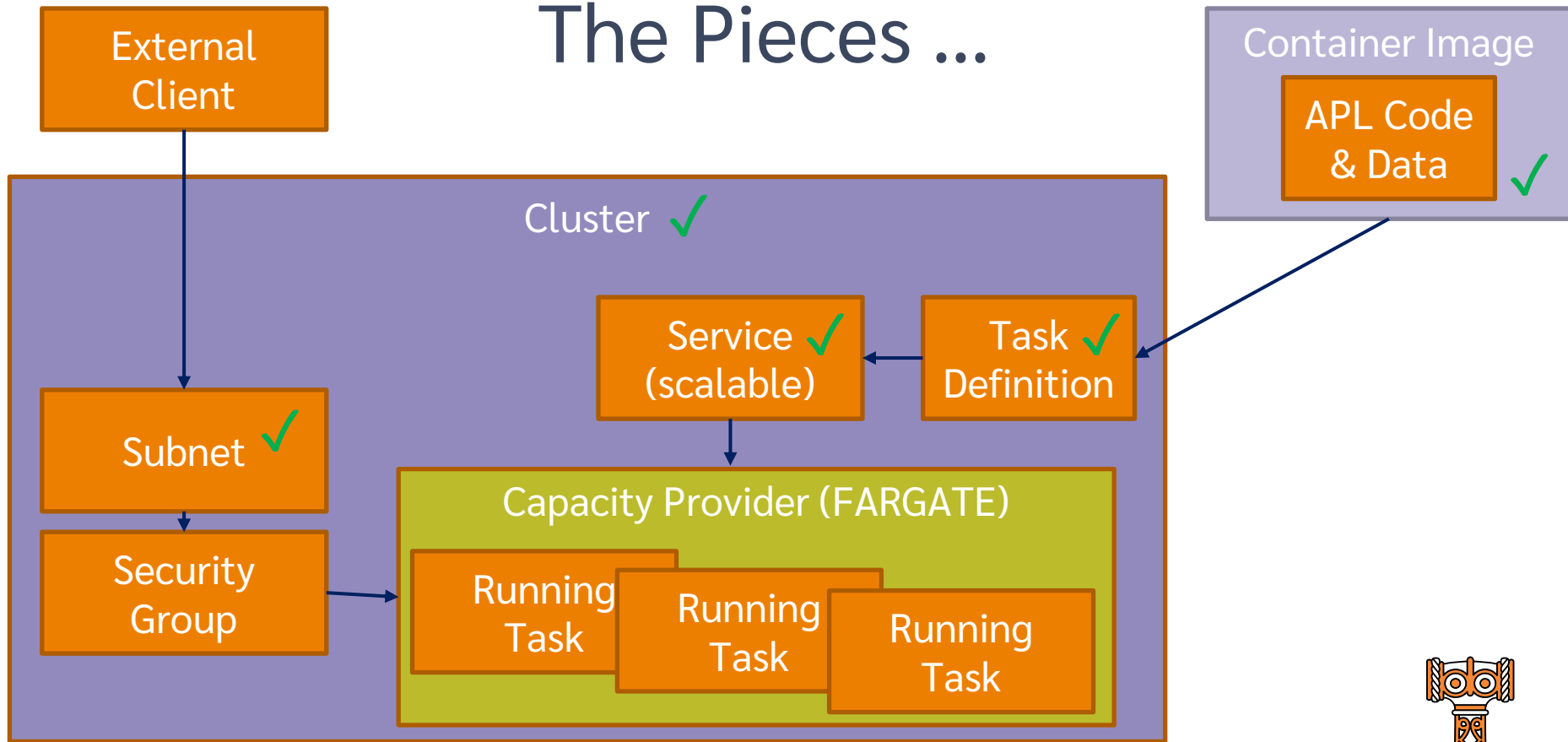
Inbound rules control the incoming traffic that's allowed to reach the instance.

Security group rule ID	Type Info	Protocol Info	Port range Info	Source Info	Description - optional Info	
sg-003c367b068bf5415	Custom TCP	TCP	4502	Custom	0.0.0.0/0	RIDE Delete
sg-04859db9a4a827704	All traffic	All	All	Custom	sg-0c32ce61	Delete
sg-04d3f84bfd84b85	Custom TCP	TCP	7052 - 7055	Custom	0.0.0.0/0	isolate server Delete

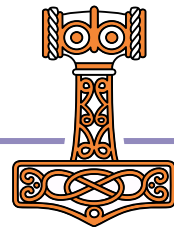
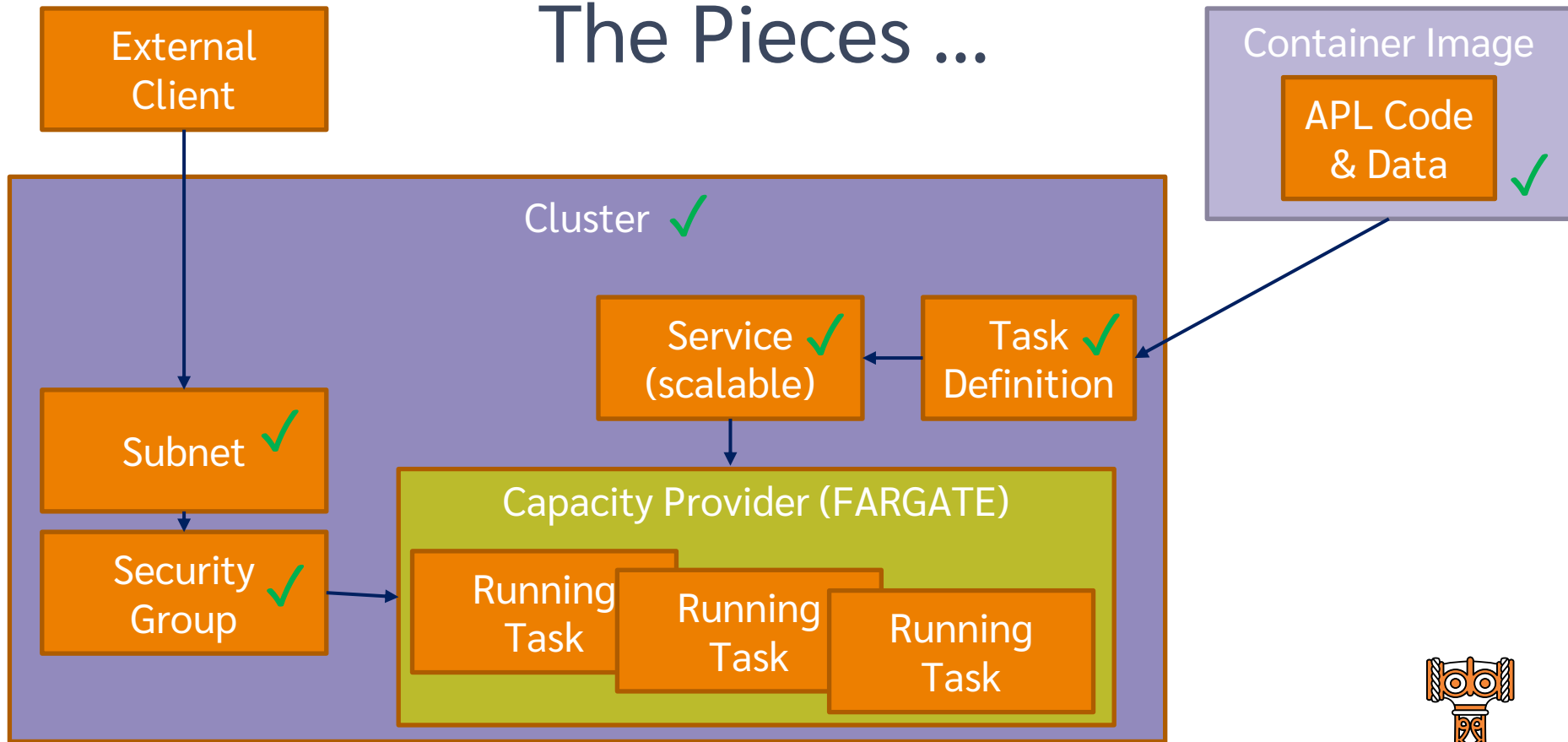
Add rule

Cancel Preview changes Save rules

The Pieces ...

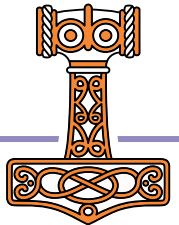
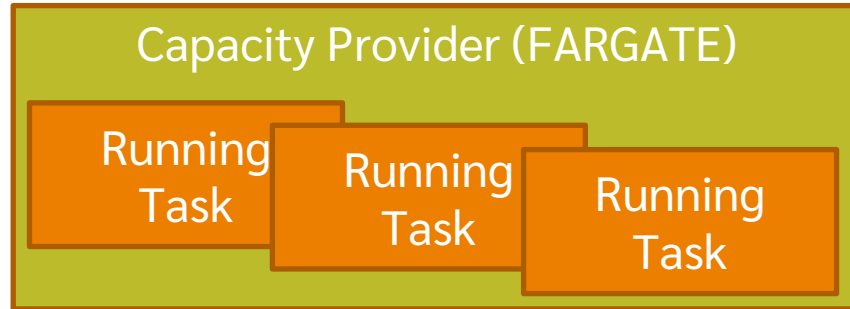


The Pieces ...

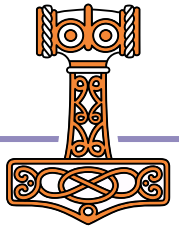


All that remains is to launch the tasks

```
z←AwsCmd 'ecs update-service --cluster ',cluster,' --service ',service,' --desired-count ',n
```



Let's go...



Browser tabs: mkromberg/aws-isolates: Using x +

Address bar: github.com/mkromberg/aws-isolates

Navigation: Apps, Link, APL, Flying & Sailing, Car, Dyalog, Cloud, SBO, Travel, Linux, Sport, Productivity, Ferie 2022

GitHub Header: Search or jump to... Pull requests Issues Codespaces Marketplace Explore

Repository: mkromberg / aws-isolates (Public)

Actions: Pin, Unwatch 1, Fork 0, Star 0

Navigation: Code, Issues, Pull requests, Actions, Projects, Wiki, Security, Insights, Settings

Branch: main | 1 branch | 0 tags

Buttons: Go to file, Add file, Code

File/Folder	Description	Last Commit
mkromberg Final polish on the Ferry		3f98d4c 17 minutes ago 6 commits
APLSource	Final polish on the Ferry	17 minutes ago
aws-cli	A few steps towards launching a service	last week
taxmodel-source	Everything working	6 hours ago
.gitignore	Three working examples	14 hours ago
Dockerfile	Everything working	6 hours ago
LICENSE	Initial commit	2 weeks ago
README.md	Initial commit	2 weeks ago
build.bat	First commit of not quite working code	last week
buildws.apls	First commit of not quite working code	last week
push.bat	Three working examples	14 hours ago
taxmodel.dws	Three working examples	14 hours ago

About

Using Amazon Web Services for parallel computation using Dyalog APL isolates

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- MIT license
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- 1 watching
- 0 forks

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The Pieces ...

