

# Vaccine Refrigerator



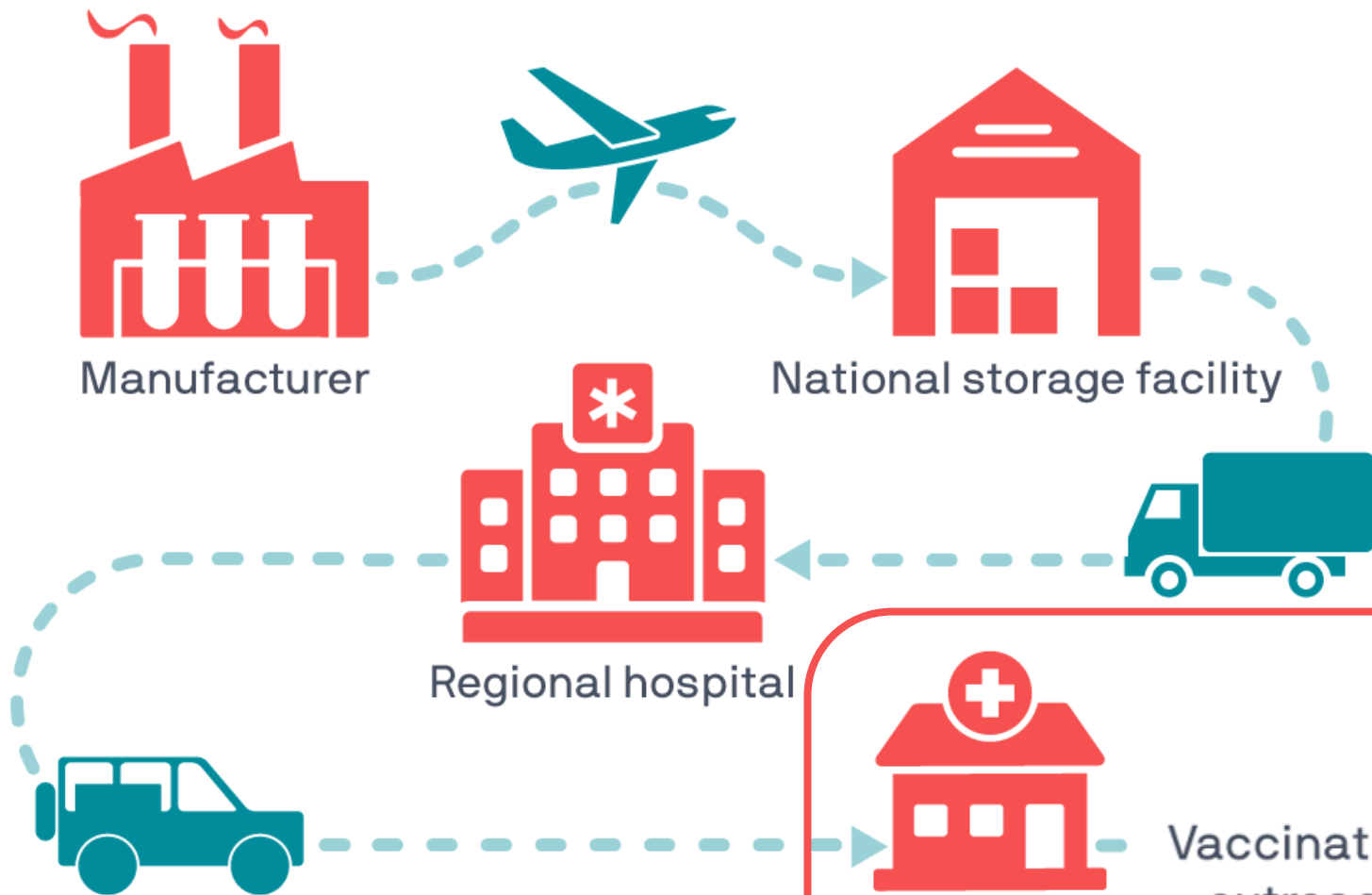






Getting Vaccines to  
where they are needed

# The Vaccine Cold Chain & Storage



**Vaccine Administer Facility:**

Pfizer: 2 to 8 degrees for 5 days

Moderna: 2 to 8 degrees for 30 days

**Transport & Long-term Storage:**

Pfizer: -70 degrees up to 6 months

Moderna: -20 degrees up to 6 months

Health center

Vaccination  
outreach

**Vaccine Recipients**

# Key Components



Home Refrigerator



Digital Min/Max  
Thermometer



Barcode Scanner



Internet Connection Device

# Features



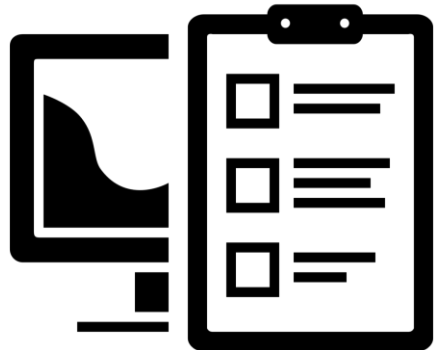
## Normal Temperature Recording

- Twice Daily Routine for 2 to 8 degrees normal temperature range



## Abnormal Temperature Exception Handling

- Alert for abnormal temperature
- Collect temperature & time exposure data

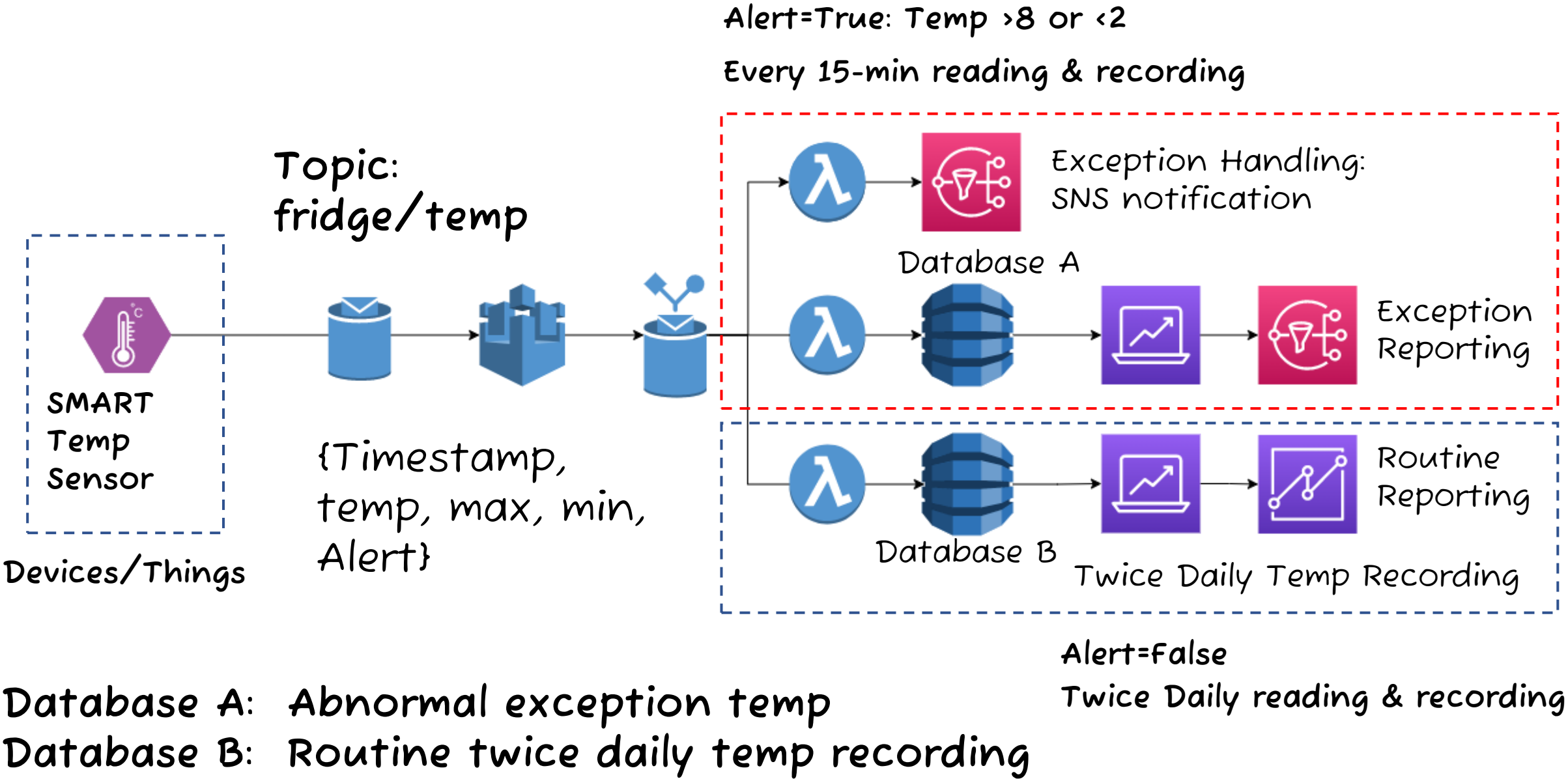


## Inventory Management

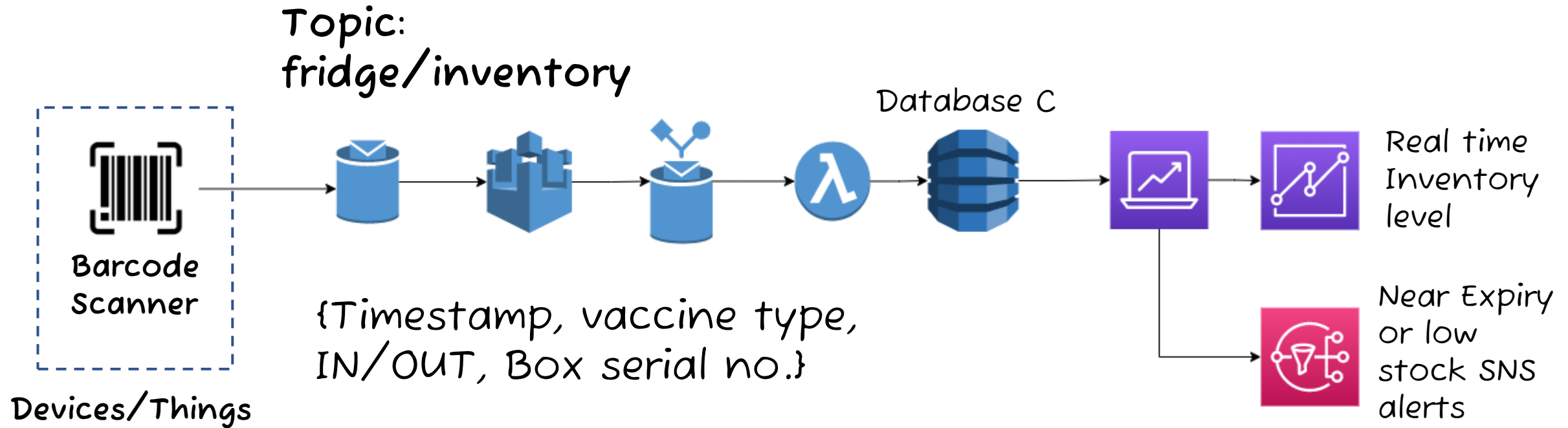
- Real time inventory monitoring
- Low stock & near expiry alerts



# AWS System Architecture: Telemetry

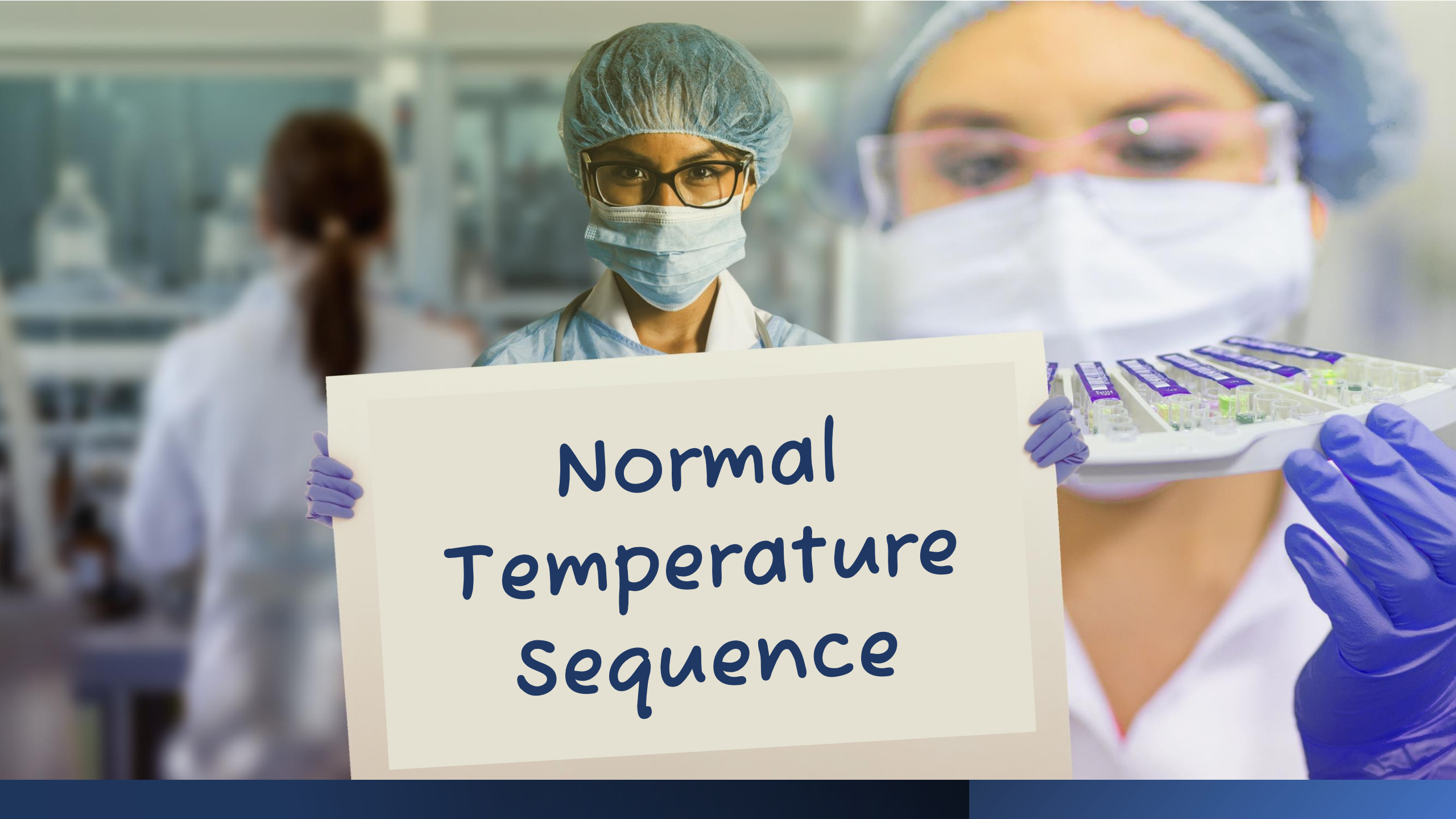


# AWS System Architecture: Inventory Management



Database C: Vaccine Inventory IN/OUT register



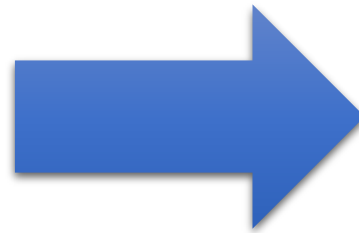


Normal  
Temperature  
Sequence

# Normal Temperature Recording

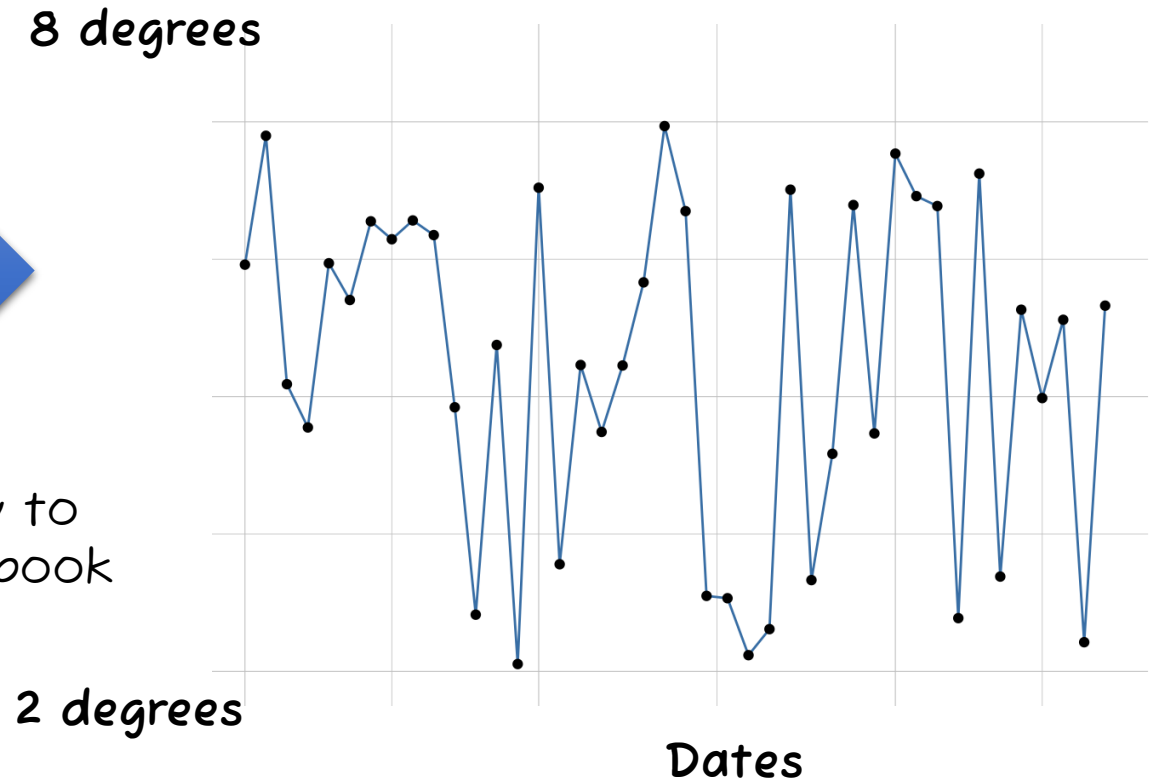
AWS DynamoDB Normal Temp Table  
(extracted as csv file)

timestamp	temp
23/4/2021 0800	3
23/4/2021 2000	4
24/4/2021 0800	4
24/4/2021 2000	5
25/4/2021 0800	6
25/4/2021 2000	3
26/4/2021 0800	4
26/4/2021 2000	4
27/4/2021 0800	5
27/4/2021 2000	6
28/4/2021 0800	3
28/4/2021 2000	7



DynamoDB  
download csv to  
Jupyter Notebook

Twice Daily Temperature  
Recording (Timeseries Plot)



*NB: Sample values*



## AWS Lambda



## Dashboard

Applications

Functions

## ▼ Additional resources

Code signing  
configurations

Layers

## ▼ Related AWS resources

Step Functions state  
machines

## Resources for Asia Pacific (Singapore)

[Create function](#)

Lambda function(s)

9

Code storage

5.7 kB

(0% of 75.0 GB)

Full account concurrency

1000

Unreserved account  
concurrency

1000

## Account-level metrics

The charts below show metrics across **all** your Lambda functions in this AWS Region.

1h

3h

12h

1d

3d

1w

Custom

[Add to dashboard](#)

## Error count and success... ⋮

Count

No unit

1

100

0.5

99.5

0

100

## Throttles ⋮

Count

1

0.5


## Invocations ⋮

Count

2

1





**AB**normal  
Temperature  
Sequence



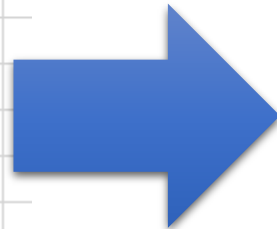
# Abnormal Temperature Recording

AWS DynamoDB Abnormal Temp Table  
(extracted as csv file)

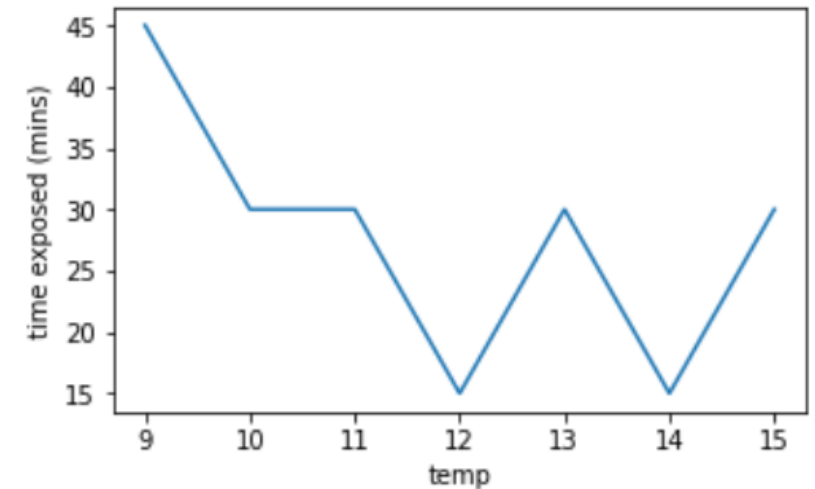
timestamp	temp	max	min	alert
23/4/2021 0800	10	10	3	TRUE
23/4/2021 0815	11	11	3	TRUE
23/4/2021 0830	12	12	3	TRUE
23/4/2021 0845	13	13	3	TRUE
23/4/2021 0900	14	14	3	TRUE
23/4/2021 0915	15	15	3	TRUE
23/4/2021 0930	15	18	3	TRUE
23/4/2021 0945	13	18	3	TRUE
23/4/2021 1000	11	18	3	TRUE
23/4/2021 1015	10	18	3	TRUE
23/4/2021 1030	8	18	3	TRUE
23/4/2021 1045	8	18	3	TRUE
23/4/2021 1100	8	18	3	TRUE

DynamoDB  
download csv to  
Jupyter Notebook

Aggregated Range of  
Temperatures & Time exposed



time exposed (mins)	
temp	
9	45
10	30
11	30
12	15
13	30
14	15
15	30



Maximum temperature limited of 8 degrees has been breached  
Maximum temperature recorded is 18

*NB: Sample values*

## AWS Lambda

[Dashboard](#)[Applications](#)**Functions**

## ▼ Additional resources

[Code signing configurations](#)[Layers](#)

## ▼ Related AWS resources

[Step Functions state machines](#)[Lambda](#) > [Functions](#)

## Functions (9)

Last fetched 1 minute ago




Actions ▼

**Create function**

&lt; 1 &gt;



<input type="checkbox"/>	Function name ▲	Description	Package type ▼	Runtime ▼	Code size
<input type="checkbox"/>	<a href="#">AlertTempSender</a>	-	Zip	Python 3.8	486.0 byte
<input type="checkbox"/>	<a href="#">DynamoDBLambdaTest</a>	-	Zip	Python 3.8	512.0 byte
<input type="checkbox"/>	<a href="#">MockABTempSensor</a>	-	Zip	Python 3.8	490.0 byte
<input type="checkbox"/>	<a href="#">MockBCScanner</a>	-	Zip	Python 3.8	483.0 byte
					520.0

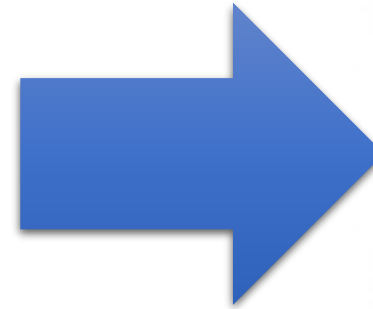


# Inventory Management Sequence

# Stock IN



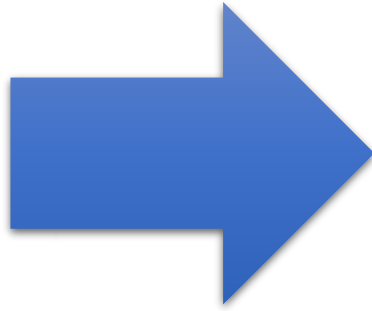
"IN" Scanner



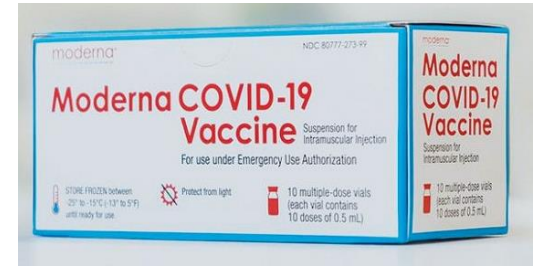
All Vaccine Stock scanned in & data published to AWS IoT core as topic: fridge/inventory



# Stock OUT



"OUT" Scanner



All Vaccine Stock scanned out & data published to AWS IoT core as topic: fridge/inventory

# Inventory Data Visualisation

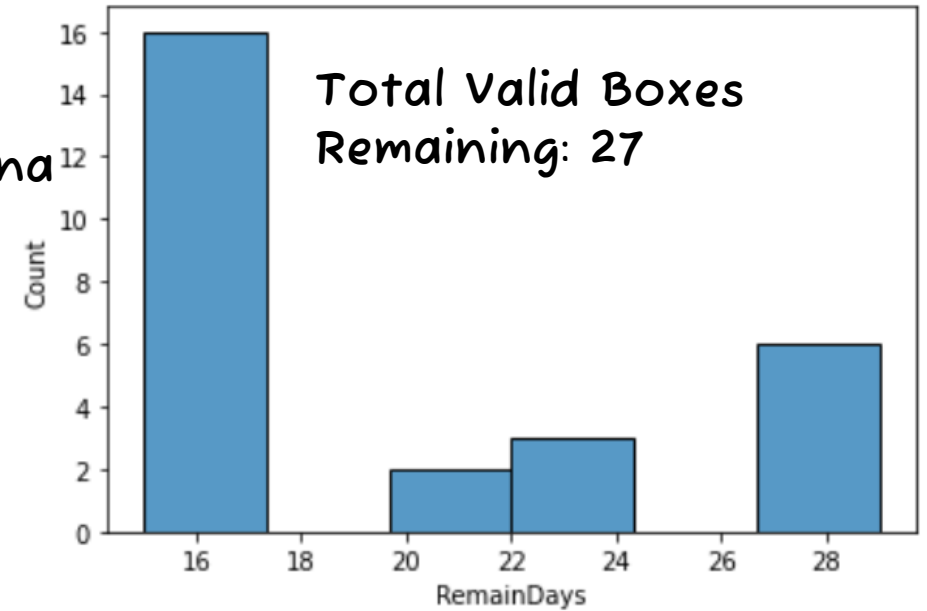
AWS DynamoDB Inventory Table  
(extracted as csv file)

timestamp	type	status	box
23/4/2021	moderna	in	1000
23/4/2021	moderna	in	1001
23/4/2021	moderna	in	1002
23/4/2021	moderna	in	1003
23/4/2021	moderna	in	1004
23/4/2021	moderna	in	1005
23/4/2021	moderna	in	1006
23/4/2021	moderna	in	1007
23/4/2021	moderna	in	1008
23/4/2021	moderna	in	1009
23/4/2021	moderna	in	1010
23/4/2021	moderna	in	1011
23/4/2021	moderna	in	1012
23/4/2021	moderna	in	1013
23/4/2021	moderna	in	1014
23/4/2021	moderna	in	1015
23/4/2021	moderna	in	1016
23/4/2021	moderna	in	1017

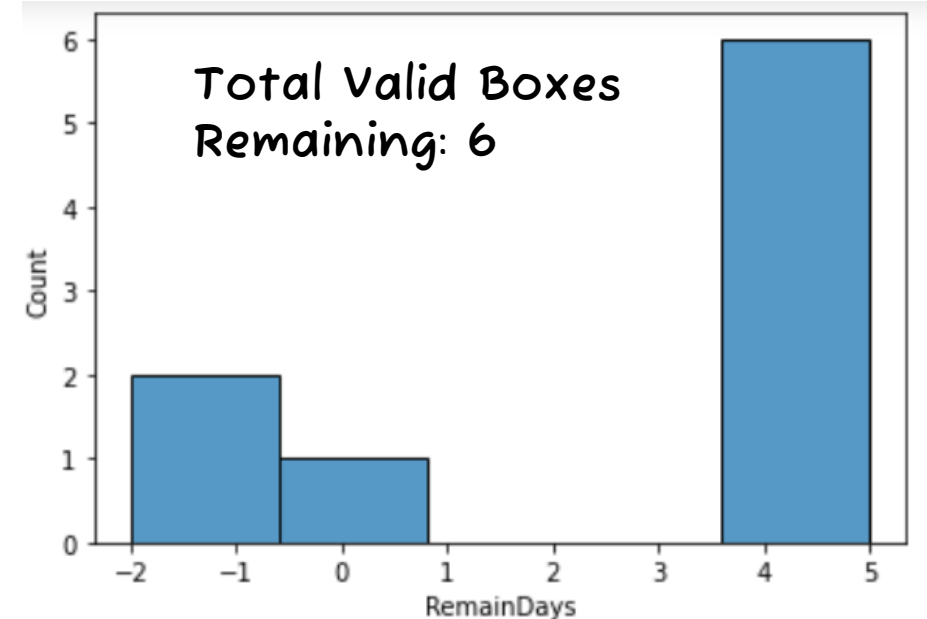
DynamoDB  
download to csv to  
Jupyter Notebook



Moderna



Pfizer



*NB: Sample values*

Real Time Inventory Level Histogram  
(Remaining Days vs Count of Boxes)

## AWS Lambda

[Dashboard](#)[Applications](#)[Functions](#)

## ▼ Additional resources

[Code signing configurations](#)[Layers](#)

## ▼ Related AWS resources

[Step Functions state machines](#)[Lambda](#) > [Functions](#)

## Functions (9)

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[Create function](#)

1











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					520.0



Wrap Up



# Cost & Function Comparison: Brand X professional medical Fridge

Function	Brand X Medical Fridge	Home Fridge IOT Solution
Temperature Monitoring		
Abnormal Temperature Alert		
Inventory Management		
Cloud Based Monitoring	 On site only	 Anywhere
Cost	US\$2,300	10 to 20% of Brand X cost

# Physical stock-taking



for example, monthly routine to ensure computer database is “synchronised” with actual contents of fridge



**Download  
Available Github**

Thanks for Watching!

