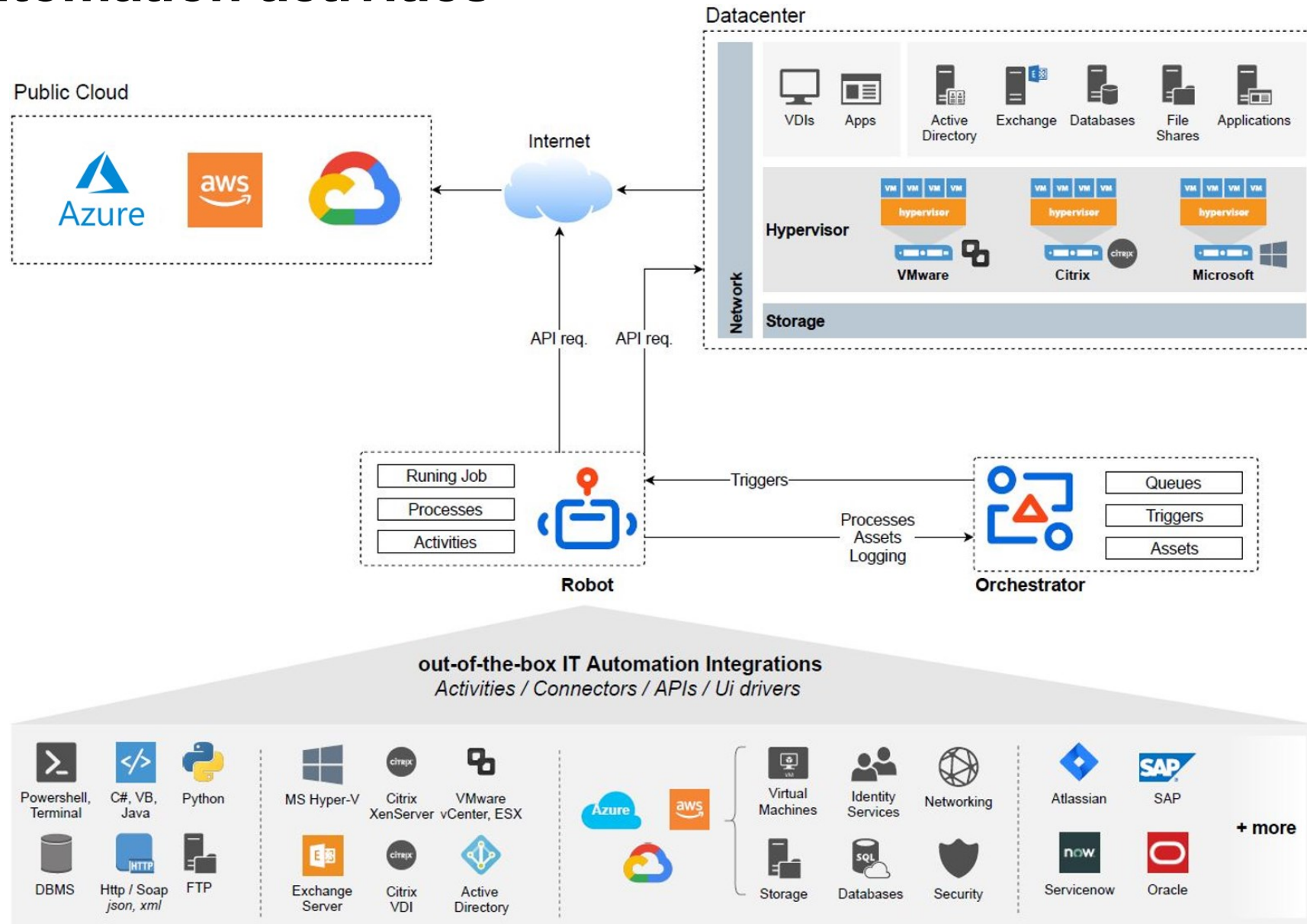


# Robots Autoscaling IT Automation

Andrei Oros

# Empower RPA Workflows with IT Automation activities



# Empower RPA Workflows with IT Automation activities



## Implementation

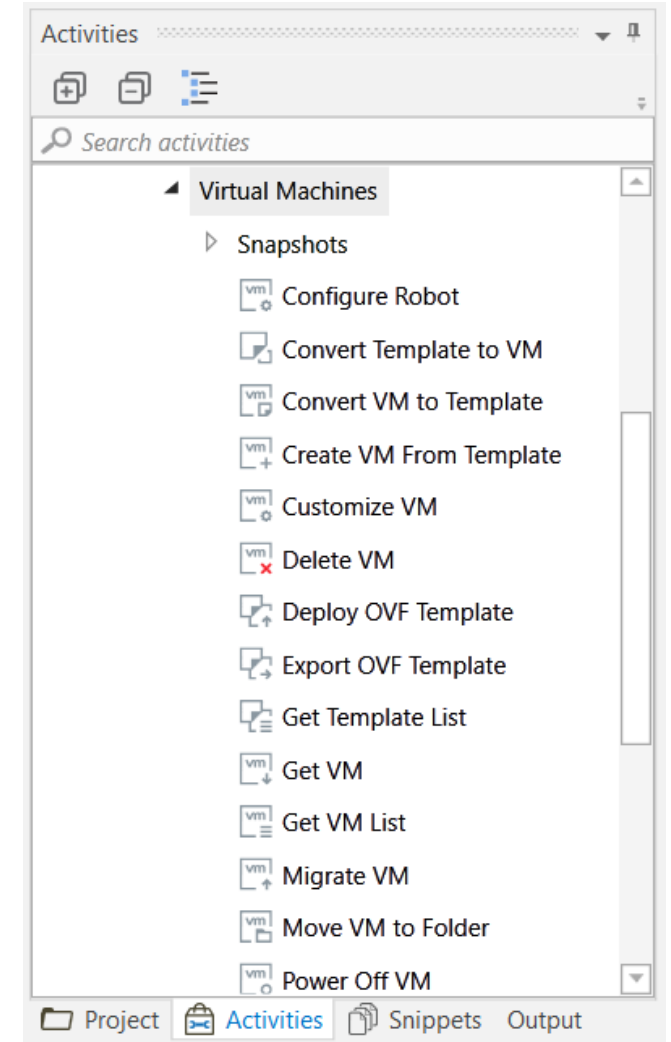
Background running activities built on top of the official SDKs from *Microsoft, Amazon, Citrix, VMware, ..*



## Security and Compliance

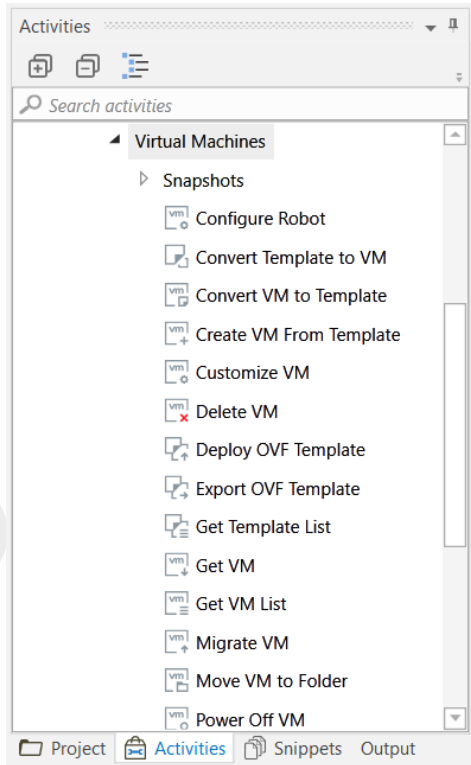
Developed by UiPath

Published on the official feed (LTS)

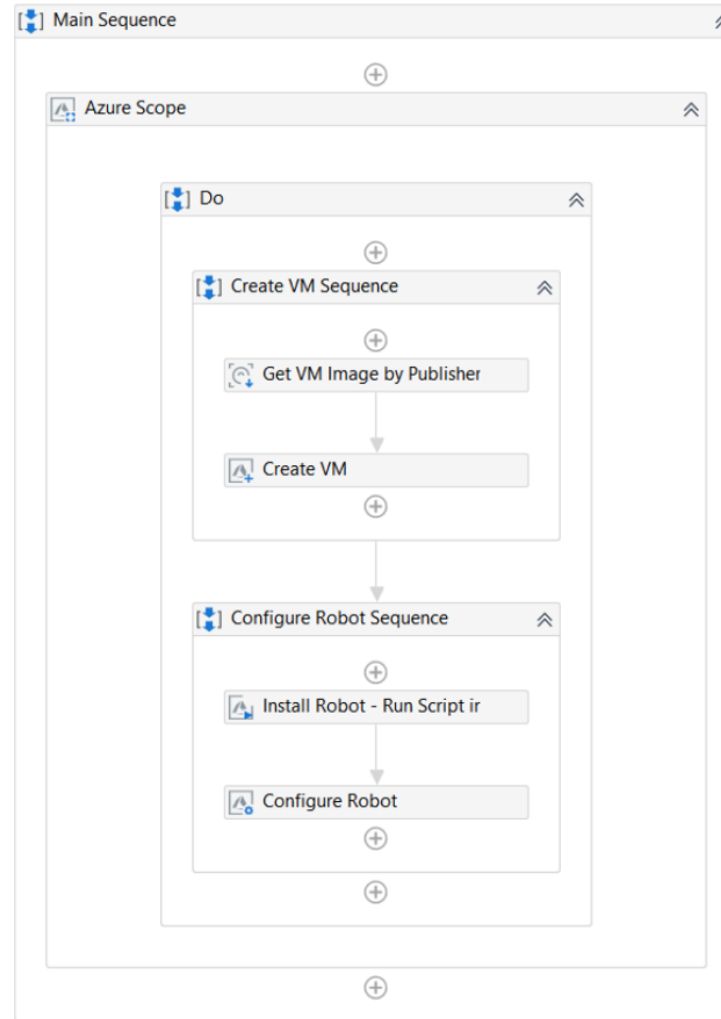




# DevOps. Infrastructure as Workflow / Diagram



Free from Official Feed (LTS)  
Background Running (via SDKs)



## Easy

create automations with out-of-the-box drag & drop official UiPath IT Automation activities

## Vendor agnostic

Azure, AWS, Google Cloud  
VMware, Citrix, Hyper-V

## Transparent

easy to understand & inspect  
business logic



# Robots Autoscaling

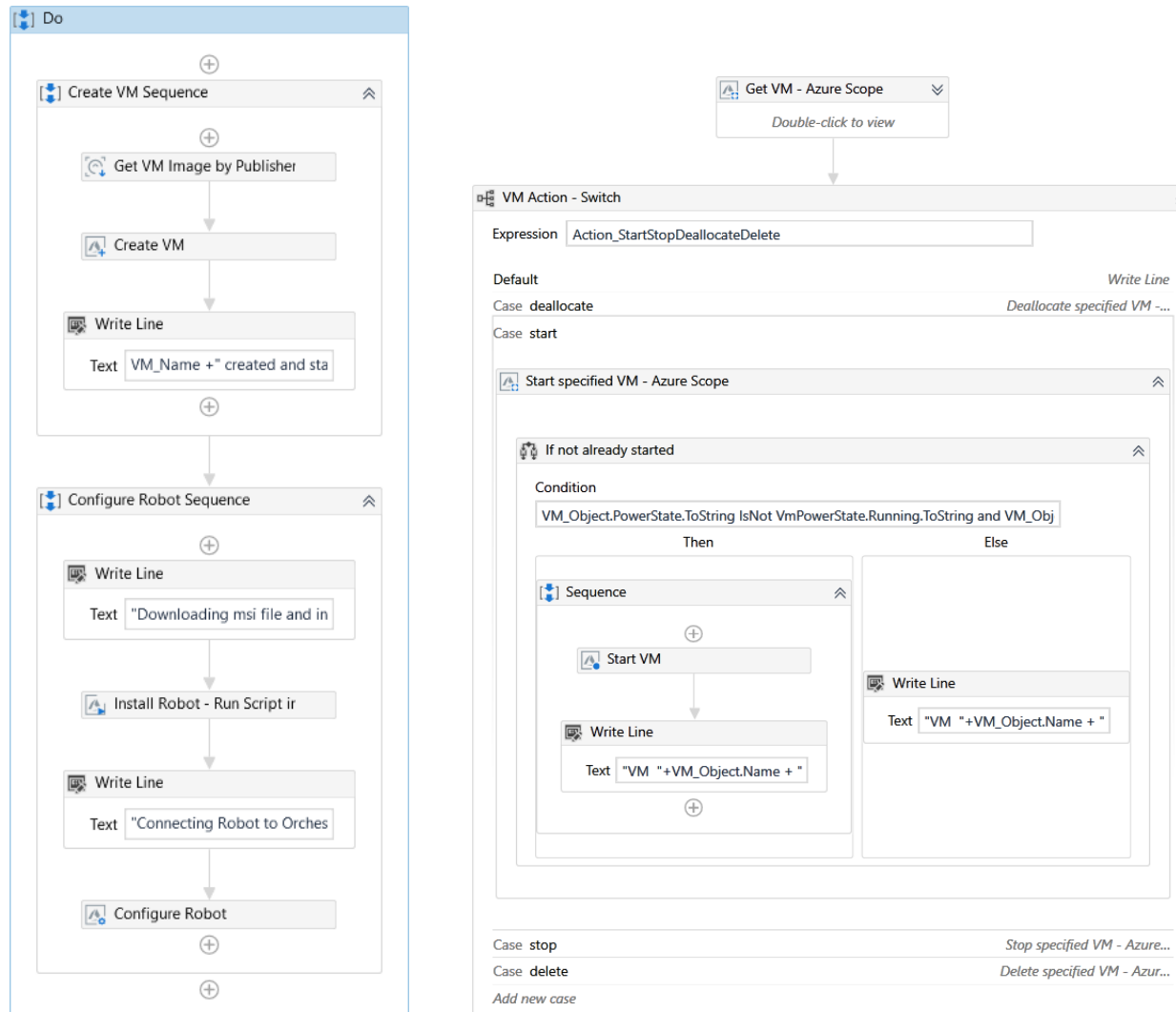
## Tech & components



# Works everywhere



# Powered by UiPath IT Automation workflows



## Transparent

easy to understand & inspect  
workflow business logic

## Flexible

easy to update scaling logic with  
out-of-the-box drag & drop  
UiPath IT Automation activities
















## Vendor agnostic

Azure, AWS, VMware, Citrix  
and more.



# IT Automations workflows **Trusted by UiPath**

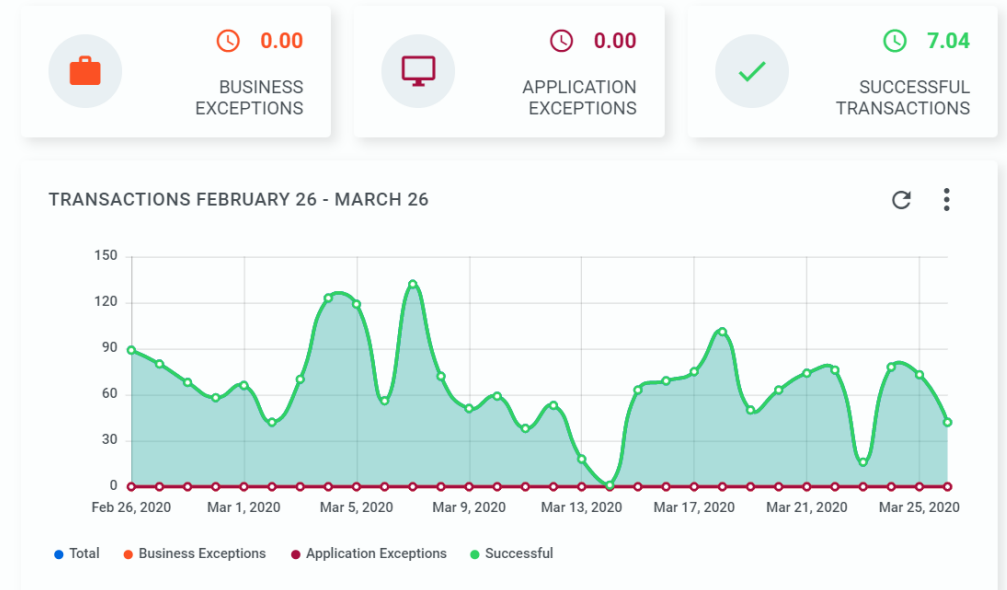
## Cost Control

<input type="checkbox"/> NAME ^	PROCESS ⇅
<input type="checkbox"/>  Azure (POC rg sergiu) policy based VMs start/deallocate	AzureVMsOnDemandAvailability_IT-Ops-Cloud
<input type="checkbox"/>  Azure (QA QA-Orchestrator-Cluj-RG) policy based VMs start/...	AzureVMsOnDemandAvailability_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC +2) VMs Daily PowerOn	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC +2) VMs Nightly PowerOff	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC +5:30) VMs Daily PowerOn	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC +5:30) VMs Nightly PowerOff	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC +9) VMs Daily PowerOn	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC +9) VMs Nightly PowerOff	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC -5) VMs Daily PowerOn	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC -5) VMs Nightly PowerOff	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC -8) VMs Daily PowerOn	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure (UTC -8) VMs Nightly PowerOff	AzureVMsPowerOff_IT-Ops-Cloud
<input type="checkbox"/>  Azure Security Alerts - add rule to block queued attacker IP	AzureVMsAttackersBlock_AddSecurityRuleTo...
<input type="checkbox"/>  Azure Security Alerts - NICs NSG policy - create NSG for NIC i...	AzureCreateNSGforNIC_IT-Ops-Cloud
<input type="checkbox"/>  Azure Security Alerts - queue VM Attackers for blocking in V...	AzureVMsAttackersBlock_IT-Ops-Cloud

## Azure Security (brute force attacks on VMs)

**15000+ attacks**  
processed automatically in the last 6 months

Azure\_SecurityCenterAlerts\_VMAccounts Chart

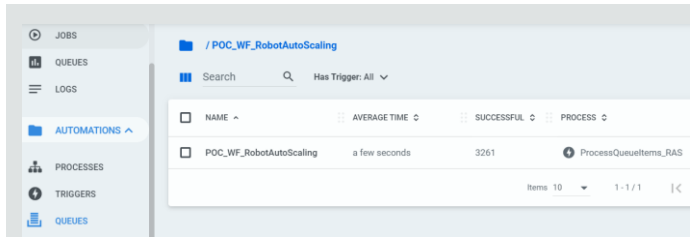


<https://connect.uipath.com/marketplace/components/it-automation-for-public-private-and-hybrid-clouds>



# Robot Autoscaling - Solution Components

## Management Orchestrator



1+ Robots (for HA)

Assets // db conn, infra auth, ..

Queue // webhook events

Autoscale Process Package

Trigger // on new queue item added

## Webhook Receiver

```
namespace UiPath.WorkflowSolutions.RobotAutoScaling.Function
{
    0 references
    public static class ReceiveWebhooks
    {
        [FunctionName("ReceiveWebhooks")]
        0 references
        public static async Task<ActionResult> Run([HttpTrigger(AuthorizationLevel.

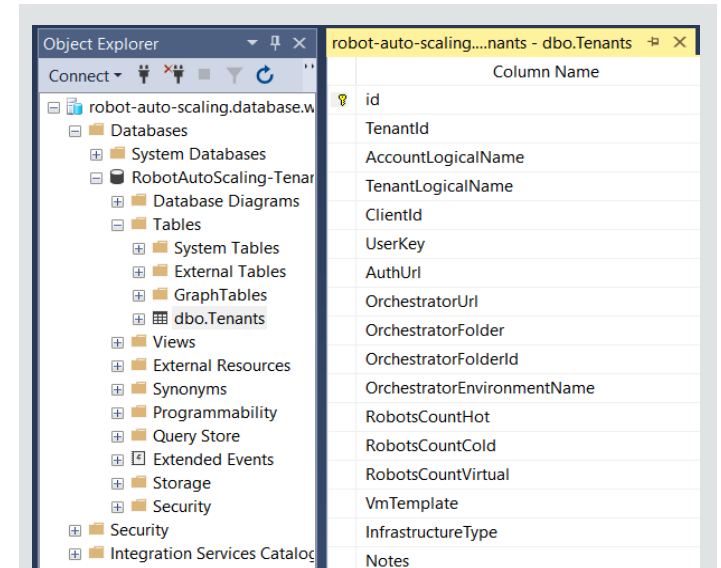
// admin tenant info
18 references
public static class Constants...

1 reference
public static class OrchestratorHelper
{
    1 reference
    public static async Task<string> Authenticate()...

1 reference
    public static async Task<IRestResponse> AddNewQueueItem(string requestBody)
}
}
```

Events sent via webhooks by the managed clients are added in the *Management OR. Queue*

## Clients Database



Orchestrator API: key, secret, tid, fid, ..  
Infra type: Azure / AWS / VMware / ..  
Scaling rules: cold / hot Robot no.

## Client Tenants

Orchestrator API

Folders (classic) &  
Environments

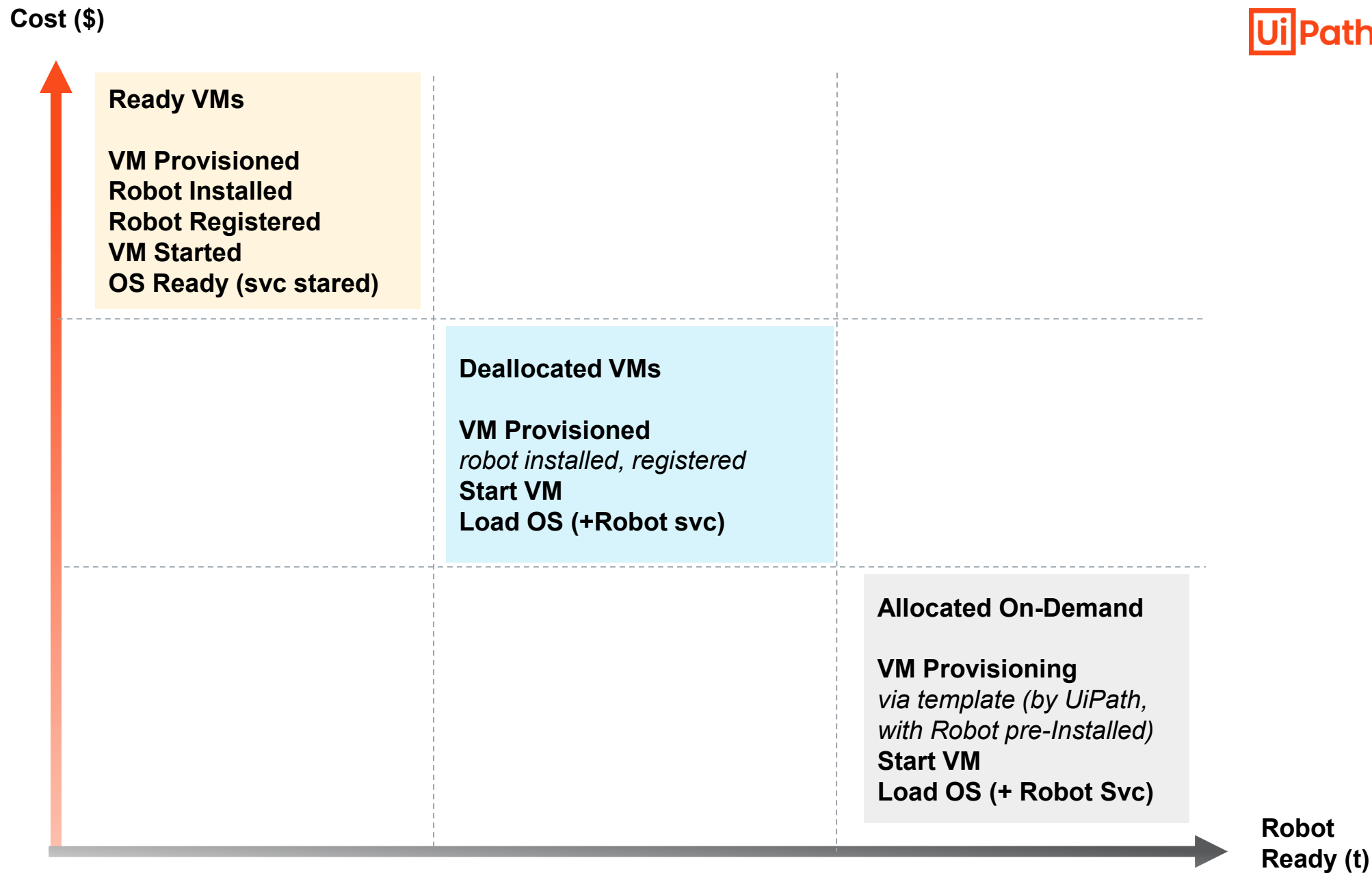
Robots (unattended)

Webhooks

# Robots Autoscaling

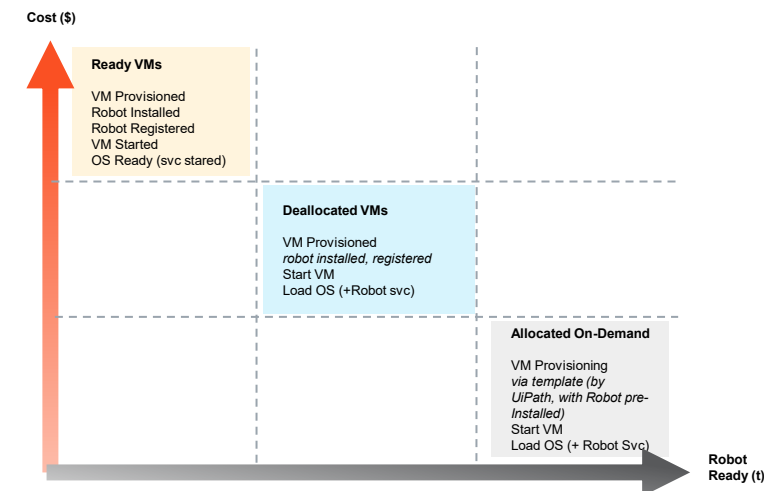
## Scaling Strategies





# Autoscaling. Cost vs Availability

Robot Type	VM / Server state	T(min) to Ready	Cost (\$) VM / month
 Hot	<b>Ready VMs</b> VM is provisioned and running, robot configured and available for Jobs	0	<b>High \$160+</b> compute allocation
 Cold	<b>Deallocated VMs</b> VM is created / exists + robot configured, but it is deallocated (only storage costs)	~2-3	<b>Low \$1.54</b> HDD standard S4  <b>Medium \$2.4</b> SSD standard E4
 Virtual	<b>Allocated On-Demand VMs</b> VM will be created on-demand from specified image + robot configuration	~10	\$0



**Scaling Strategy = F(x,y,..)**

Pending Jobs

Robots Available  
Robots Disconnected  
Robots Busy

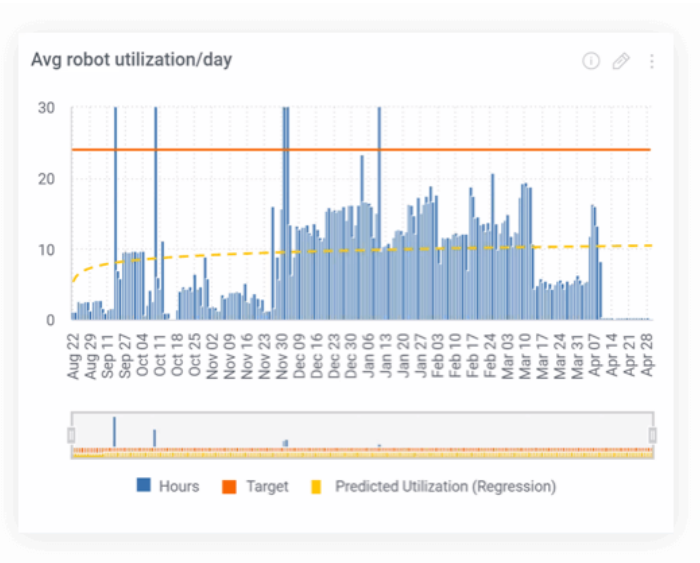
Hot Robots  
Cold Robots  
Virtual Robots

\* Azure (pay-as-you-go) ref. VM: D2v3 + 32Gb Standard S4 hdd / E4 ssd

# Easy Customization - dynamic scaling strategies

**Couple with Robots usage**  
eg. Insights / analyze Job requests

Adjust **hot** / **cold** Robots variables for the identified intervals.



Cost (\$)

**Ready VMs**

VM Provisioned  
Robot Installed  
Robot Registered  
VM Started  
OS Ready (svc started)

**Deallocated VMs**

VM Provisioned  
*robot installed, registered*  
Start VM  
Load OS (+Robot svc)

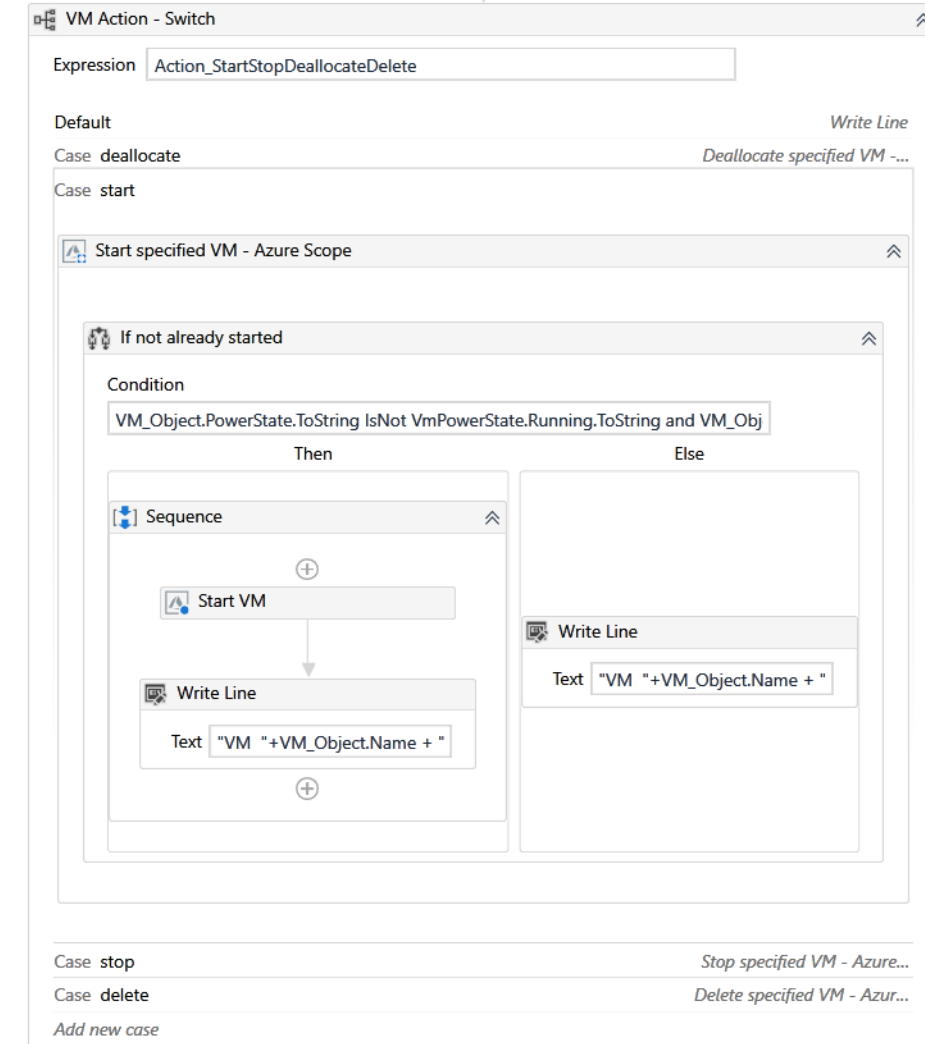
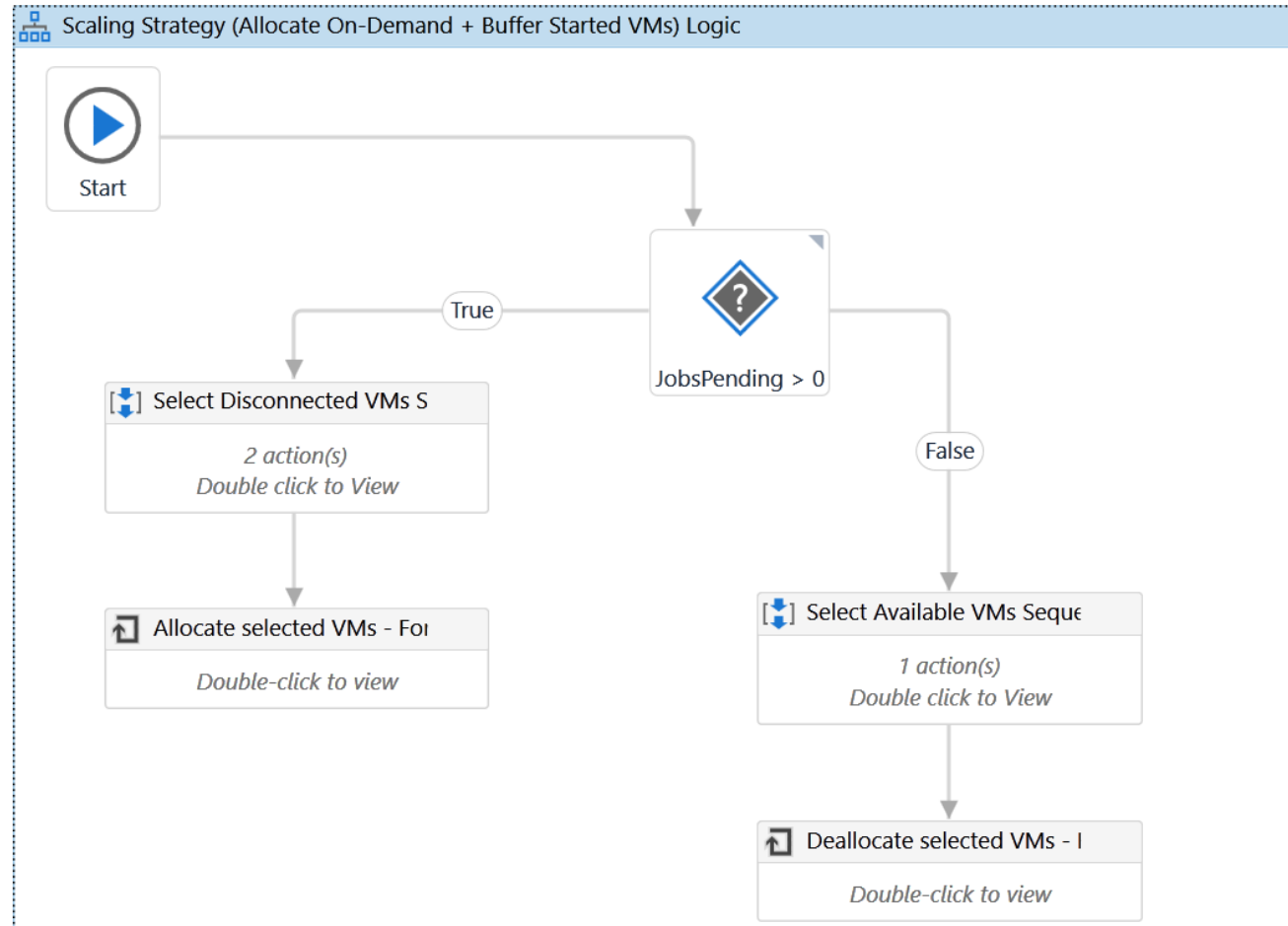
**Allocated On-Demand**

VM Provisioning  
*via template (by UiPath,  
with Robot pre-Installed)*  
Start VM  
Load OS (+ Robot Svc)

Robot  
Ready (t)



# Easy Customization change the process workflows





# Robots Autoscaling


## Process flow



# DB Clients Configs

RobotsCold	50
RobotsHot	10
Infrastructure	
Environment	RAS
Folder	Default
client_(x)	

RobotsCold	10
RobotsHot	2
Infrastructure	
Environment	E2
Folder	F2
client_1	

RobotsCold	80
RobotsHot	5
Infrastructure	
Environment	E1
Folder	F1
client_1	

# Management Orchestrator

## Queue. New Webhook Events

AUTOMATIONS	STATUS	REFERENCE	STARTED	ENDED
PROCESSES				
TRIGGERS				
QUEUES				
ASSETS				
STORAGE BUCKETS				
ACTIONS				
	0 rows selected			
	Successful	job.completed_204_19619154	11 minutes ago	11 minutes ago
	Successful	job.created_204_19618580	11 minutes ago	11 minutes ago
	Successful	job.created_9351_94536657	13 minutes ago	13 minutes ago
	Successful	job.completed_204_19616011	40 minutes ago	40 minutes ago
	Successful	job.created_204_19615964	40 minutes ago	40 minutes ago

## Jobs triggered by New Items

4.1	get event data for 1 <sup>st</sup> new q. item
4.2	update all associated q. items
4.3	get the client info from the database
4.4	get the client state: jobs, robots, ..
4.5	select machines to start/stop & apply

MONITORING	PROCESS	ROBOT	ENVIRONM.	STATE	STA.	ENDED
ROBOTS						
JOB						
	ProcessQueueItems_RAS	AdminRobot1	RAS	Successful	a minute ago	a few seconds ago
	ProcessQueueItems_RAS	AdminRobot1	RAS	Successful	3 minutes a...	3 minutes ago

# Webhook Events Receiver Service





Add Event to Queue

tenant Id	folder Id
[ ... ]	job.created


client\_1 jobs

PROCESS	ROBOT	MACHINE	ENVIRONMENT	STATE
Fake Work	T204F5031-R2	T204F5031-R2	RAS	Pending
Fake Work	T204F5031-R3	T204F5031-R3	RAS	Pending
Fake Work	Pending allocation		RAS	Pending


client\_1 machines

M1	M2	M3	M(n)
			


The screenshot shows the SQL Server Enterprise Manager interface. The left pane displays the 'Server Enterprise1' tree with 'Databases' expanded, showing 'Adventureworks2008' and 'Adventureworks2008tempdb'. The right pane shows the 'Adventureworks2008' database properties, including 'Collation: Latin1\_General\_CI\_AS\_KS\_WS' and 'Character set: Latin1\_General\_CI\_AS'. The 'Security' folder is highlighted in the left pane.

RobotsCold	<b>50</b>
RobotsHot	<b>10</b>
Infrastructure	
Environment	<b>RAS</b>
Folder	<b>Default</b>

**client\_(x)**

RobotsCold	10
RobotsHot	2
Infrastructure	
Environment	E2
Folder	F2

client\_1

RobotsCold	80
RobotsHot	5
Infrastructure	
Environment	E1
Folder	F1

client\_1

# Management Orchestrator

The screenshot displays the Management Orchestrator interface. At the top, a table lists processes with columns for NAME, PROCESS, and ENVIRONMENT. The first entry is 'ProcessQueueItems' in the 'RAS' environment. A red arrow points from this entry to a red circle with the number '1'. Below this, a sequence of steps is shown, each in a white box with a red circle containing a number:

- 1 Jobs started by scheduled trigger
- 2 get the client info from the database
- 3 get the client state: jobs, robots, ..
- 4 select machines to start/stop & apply

At the bottom, a 'MONITORING' sidebar is visible on the left, and a table shows the execution history of the 'ProcessQueueItems\_RAS' process. The table has columns for PROCESS, ROBOT, ENVIRONM..., STATE, STA..., and ENDED. Two entries are shown, both with a 'Successful' state.

PROCESS	ROBOT	ENVIRONM...	STATE	STA...	ENDED
ProcessQueueItems_RAS	AdminRobot1	RAS	Successful	a minute ago	a few seconds ago
ProcessQueueItems_RAS	AdminRobot1	RAS	Successful	3 minutes a...	3 minutes ago



2

3

4

The screenshot shows the 'MONITORING' section of the interface. On the left, there is a sidebar with 'ROBOTS' and 'JOBS' options. The main area displays a table of robot jobs. The table has the following columns: PROCESS, ROBOT, ENVIRONM..., STATE, STA..., and ENDED. Two rows are visible, both showing 'ProcessQueueItems\_RAS' as the process, 'AdminRobot1' as the robot, and 'RAS' as the environment. Both rows have a 'Successful' status and show timestamps.

PROCESS	ROBOT	ENVIRONM...	STATE	STA...	ENDED
ProcessQueueItems_RAS	AdminRobot1	RAS	Successful	a minute ago	a few seconds ago
ProcessQueueItems_RAS	AdminRobot1	RAS	Successful	3 minutes a...	3 minutes ago

client 1 machines

client\_1 jobs

The diagram illustrates a client machine architecture. On the left, a box labeled 'client 1 machines' contains four vertical panels. The first panel, labeled 'M1' with a blue triangle icon, contains six small robot icons. The second panel, labeled 'M2' with an orange square icon, contains three robot icons. The third panel, labeled 'M3' with a black circle icon, contains two robot icons. The fourth panel, labeled 'M(n)' with a green square icon, contains one robot icon. To the right of the machines is a box labeled 'client\_1 jobs' containing one robot icon. An orange arrow points from the bottom towards the machines.

cli

MONITORING

ROBOTS

JOBS

QUEUES

LOGS

AUTOMATIONS

PROCESSES

TRIGGERS

/ POC\_DemoAWS\_WF\_RobotAutoScaling

Search

User: All

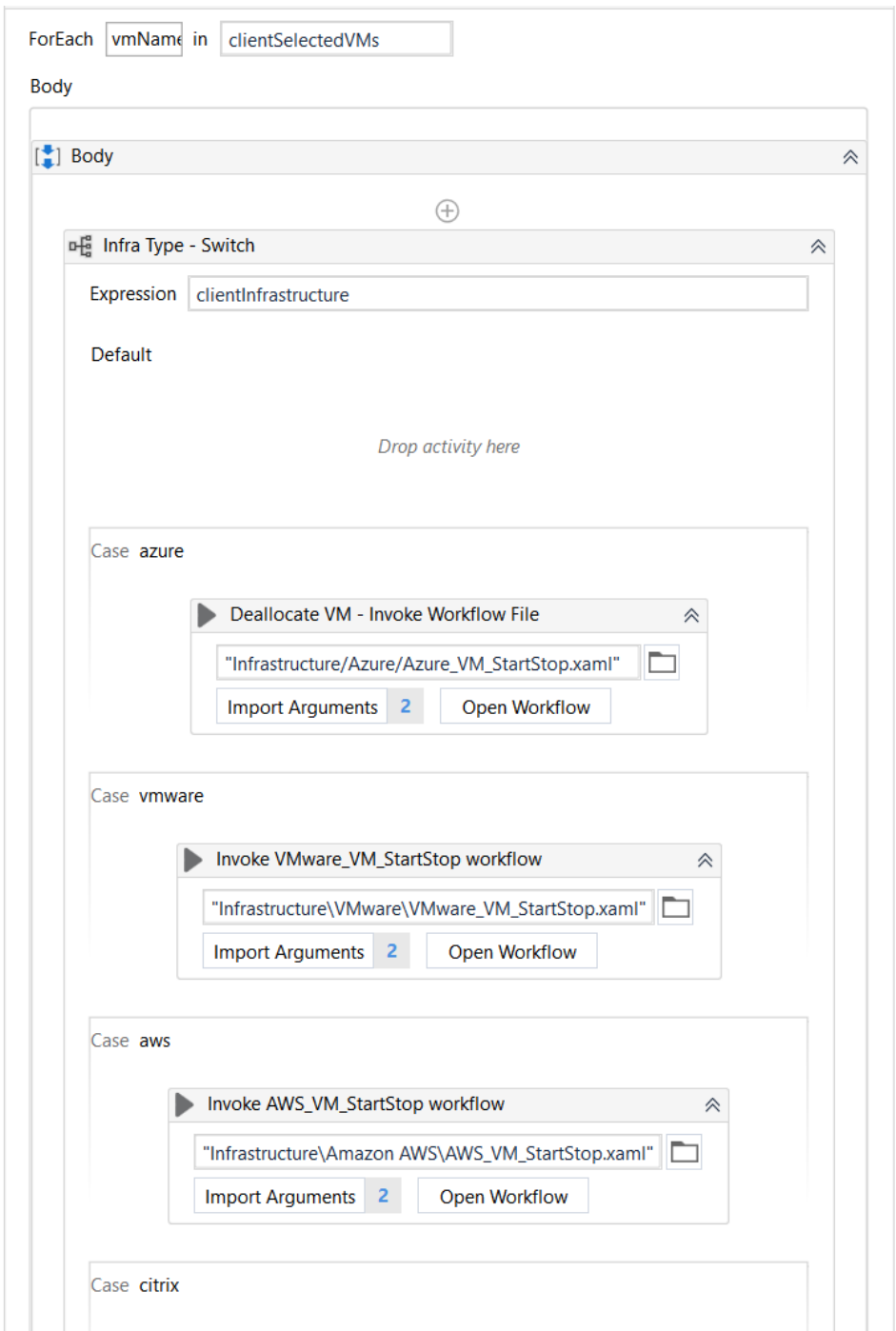
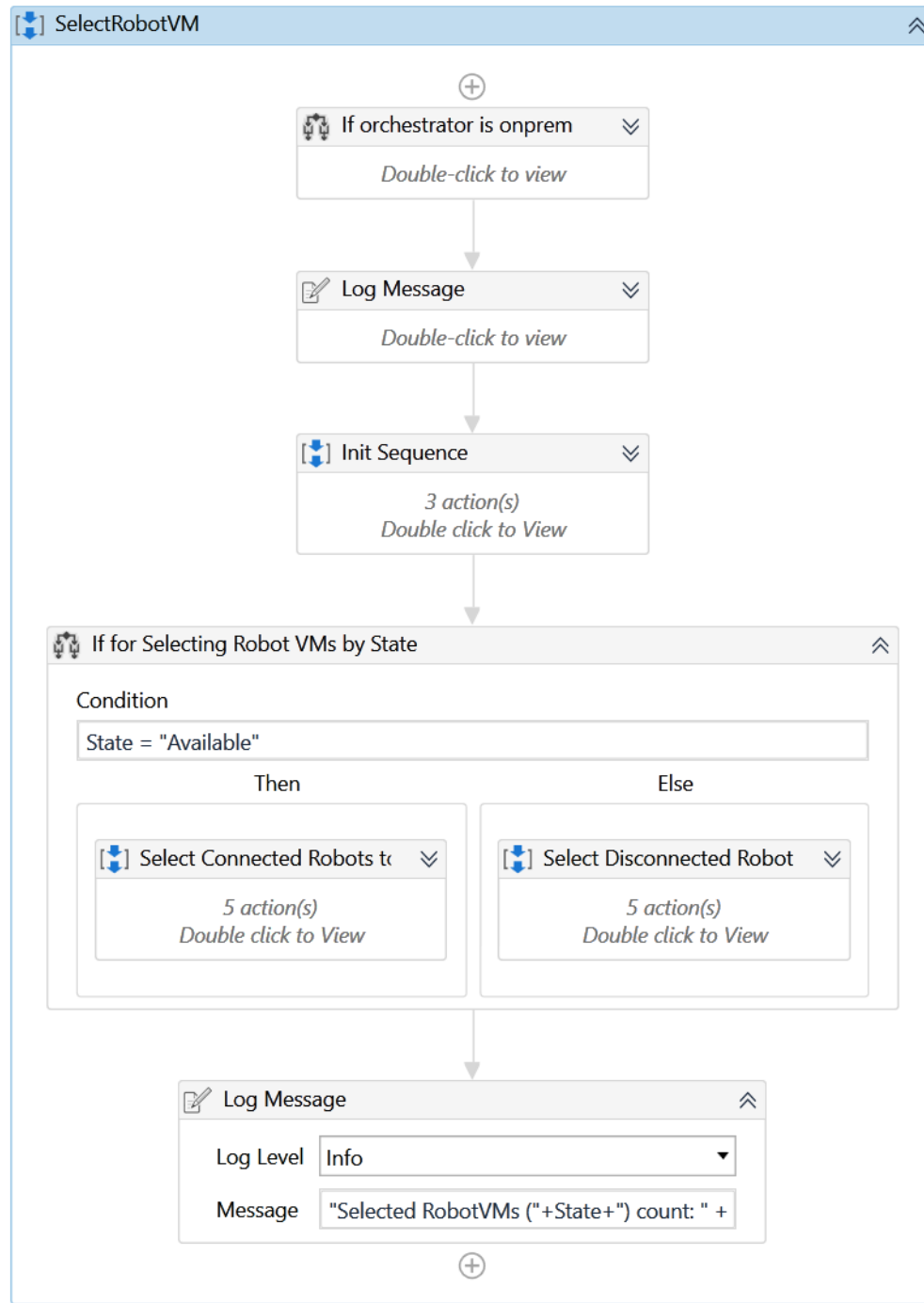
State: All

Priority: All

Source: All

<input type="checkbox"/>	PROCESS	ROBOT	MACHINE	ENVIRONMENT	STATE
<input type="checkbox"/>	Fake Work	T204F5031-R2	T204F5031-R2	RAS	... Pending
<input type="checkbox"/>	Fake Work	T204F5031-R3	T204F5031-R3	RAS	... Pending
<input type="checkbox"/>	Fake Work	Pending allocation		RAS	... Pending

Items 10





# RPA Autoscaling Customer Story

**Business Problem.** Client is a leading Tax provider that faces dynamic workload related to customer workload during busy tax seasons. This resulted in excess spending on infrastructure and personnel.

## Challenge

- Deadline events cause 500-1000% workload demand increases on a daily cycle
- Tax busy seasons, specifically tax end requests, caused spikes in RPA Jobs (dynamic workload)
- Very inefficient while done manually: increased costs with IT Infrastructure and administration
- Scaling needs increase from 10 machines to 300 machines dynamically, each with 10-20 high density robots (avg 1500 robots during the day and 150 robots at night) running 24 / 7
- Incurred high maintenance costs, high administration costs to accommodate dynamic workload in real-time
- Higher Risk from missed SLAs - client potential liability for millions of dollars towards customers and legal commitments

## Solution

**UiPath provided an autoscaling solution that ..**

- Responds in real-time to dynamic workloads by allocating / deallocating robot machines to meet the incoming RPA Jobs requests
- Works with all types of infrastructures (cloud, on-premises, hybrid)
- Empowers the client to easily and on the fly adjust the autoscaling strategy to balance *Cost Savings* vs *Highly-Available Job Execution*

## Expected Outcomes



**Optimized RPA & Business Operations**  
reduced costs with IT Infrastructure & labor



**Flexible deployment**  
support for custom RPA setup  
(high density robots, environments, Azure cloud + VMware on-premises)



**Green Computing**  
energy savings with compute from running a more efficient RPA operation



**SLAs risk management**  
help meet customer & contractual SLAs in a highly regulated tax environment

## Anticipated Savings

**62%**

average expected reduction in annual infrastructure costs

**73%**

average expected reduction in annual labor costs

**64%**

average expected overall reduction in total costs

# Robots Autoscaling

## Easy to get started



# Robot Autoscaling



SOLUTION



Project source files



Step by step configuration guide



Autoscaling recommendations



Free to download and customize



## Management Orchestrator Config

Processes, Assets, Robot,  
Queue + Trigger



## Webhooks Receiver Service Setup

E.g. function in Azure / AWS



## Deploy Database & Add Clients

DB create, Clients config

# Robot Autoscaling e.g. for 3 client tenants (+ folders)

The screenshot displays a multi-monitor environment used for managing robot autoscaling across different cloud providers and the UiPath Orchestrator.

**Top Left Monitor (XenCenter):** Shows a virtual machine named 'robot' with a folder structure containing 'robot autoscaling in Pool', 'CoE - Robot 01', and 'CoE - Robot 02'.

**Bottom Left Monitor (AWS Console):** Displays the 'Instances | EC2 Management Console' for the 'eu-central-1' region. It shows a table of instances:

Name	Instance ID	Instance Type	Availability Zone	Instance State
T204F5031-R2	i-093cfa10cadb49ca9	t2.small	eu-central-1b	stopped
T204F5031-R3	i-0b5fe6745611984fa	t2.small	eu-central-1b	stopped
T204F5031-R1	i-0bc18ae77416c8966	t2.small	eu-central-1b	stopped

**Bottom Left Monitor (Microsoft Azure):** Shows the 'Virtual machines - Microsoft Azure' portal. It displays a table of virtual machines:

Name	Status	Resource group	Location
T204F4576-R1	Stopped (deallocated)	DevTest_WF_RobotAut...	West Europe
T204F4576-R2	Stopped (deallocated)	DevTest_WF_RobotAut...	West Europe
T204F4576-R3	Stopped (deallocated)	DevTest_WF_RobotAut...	West Europe

**Right Monitor (UiPath Orchestrator):** Displays the 'Jobs - Folder Overview' for the folder '/ POC\_Demo\_WF\_RobotAutoScaling'. It shows a table of jobs:

PROCESS	ROBOT	USER	MACHIN...	ENVIRON...	T...	STATE	P...	STARTED	ENDED	SO...
Fake Work	Pending allocat...	Pending allocat...	RAS	...	...	Pending	→	Norr		Manual
Fake Work	Pending allocat...	Pending allocat...	RAS	...	...	Pending	→	Norr		Manual
Fake Work	Pending allocat...	Pending allocat...	RAS	...	...	Pending	→	Norr		Manual

The bottom right monitor shows the 'Jobs - Folder Overview' for the folder '/ POC\_WF\_RobotAutoScaling'. It shows a table of jobs:

PROCESS	ROBOT	USER	MACHIN...	ENVIRON...	T...	STATE	P...	STARTED	ENDED	SO...
ProcessQ...	AdminRobotOn...	unicom\andrei...	COE-ROB...	RAS	Una...	Running	→	Norr a few second...		ProcessQ...
ProcessQ...	AdminRobotOn...	unicom\andrei...	COE-ROB...	RAS	Una...	Succe...	→	Norr a few second...	a few second...	ProcessQ...
ProcessQ...	AdminRobotOn...	unicom\andrei...	COE-ROB...	RAS	Una...	Succe...	→	Norr 11 minutes ago	10 minutes ago	ProcessQ...
ProcessQ...	AdminRobotOn...	unicom\andrei...	COE-ROB...	RAS	Una...	Succe...	→	Norr 10 minutes ago	10 minutes ago	ProcessQ...
ProcessQ...	AdminRobotOn...	unicom\andrei...	COE-ROB...	RAS	Una...	Succe...	→	Norr 12 minutes ago	12 minutes ago	ProcessQ...

# About UiPath





# A Leader in the 2020 Gartner Magic Quadrant for Robotic Process Automation

For the second consecutive year, UiPath is placed highest for its ability to execute

*“In the second year of this Magic Quadrant, the bar has been raised for market viability, relevance, growth, revenue and how vendors set the vision for their RPA offerings in a fluid market.”\**

\* Source: Gartner, “Magic Quadrant for Robotic Process Automation,” Saikat Ray, Arthur Villa, Cathy Tornbohm, Naved Rashid, Melanie Alexander, July 27, 2020

Magic Quadrant for Robotic Process Automation



Source: Gartner (July 2020)

This graphic was published by Gartner, Inc. as part of a larger research document and should be evaluated in the context of the entire document. The Gartner document is available upon request from UiPath. Gartner does not endorse any vendor, product or service depicted in its research publications, and does not advise technology users to select only those vendors with the highest ratings or other designation. Gartner research publications consist of the opinions of Gartner's research organization and should not be construed as statements of fact. Gartner disclaims all warranties, expressed or implied, with respect to this research, including any warranties of merchantability or fitness for a particular purpose.

# A Forrester Wave Leader

Highest Scores in Current Offering, and Highest Possible Scores in Strategy and Market Presence

*“References report that UiPath will go the extra mile to meet a client's need and cite the transparent and innovation culture as a plus.*

*They also applaud the low cost of getting started, the well-organized partner channel, overall product stability, and strong security.”*

Source: ForresterWave™:RoboticProcessAutomation,Q42019

FIGURE 1 Forrester Wave™: Robotic Process Automation, Q4 2019

## THE FORRESTER WAVE™

Robotic Process Automation

Q4 2019



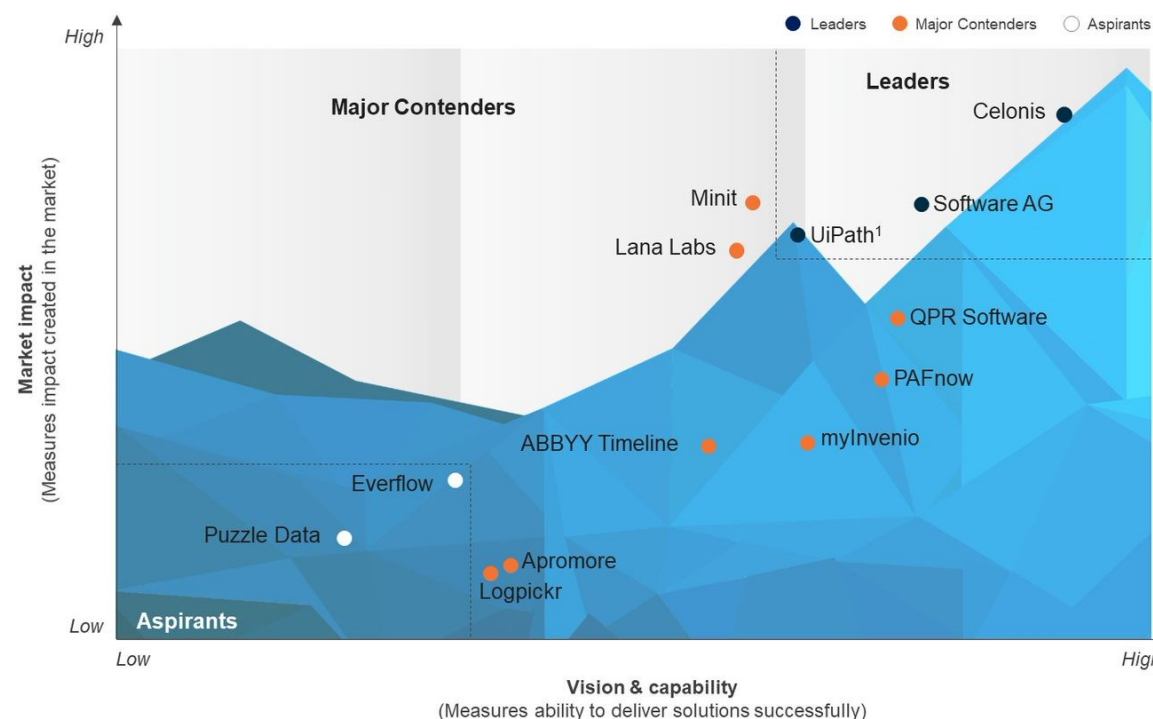
# A Process Mining Leader

Everest Group PEAK Matrix® for  
Process Mining Technology  
Vendors 2020



*"[...] its product development strategy is now more focused toward helping enterprises discover automation use cases and accelerate their automation journeys."*

Everest Group®  
PEAK  
MATRIX™ Everest Group Process Mining Products PEAK Matrix® Assessment 2020



<sup>1</sup> UiPath Process Mining (formerly ProcessGold)

# Business Partner Ecosystem Spans Globally and Locally

Global	Americas	Japan	EMEA	India	Asia Pacific
      	    	    	    	    	    

**600+ business partners** that help with the implementation of RPA

# Thank you

[andrei.oros@uipath.com](mailto:andrei.oros@uipath.com)

