Driving IBM Z Workload Scheduler with REST API

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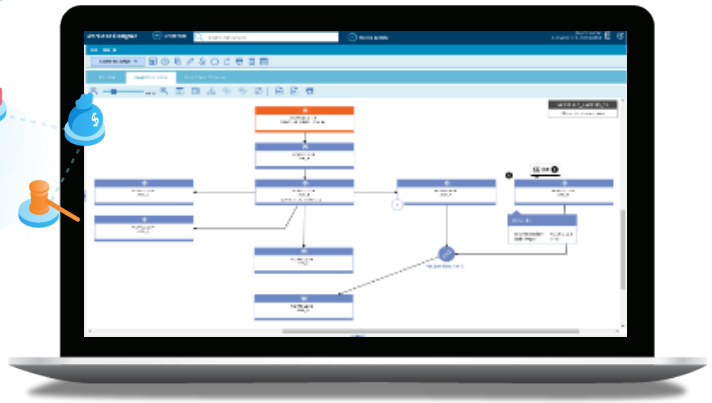
November 2020
Session 3AF

Agenda

- IBM ZWS brief overview
- REST API introduction
- IBM ZWS REST API
- Customer scenarios
- Demo

IBM Z Workload Scheduler – a digital transformation booster

Automate & De-Risk

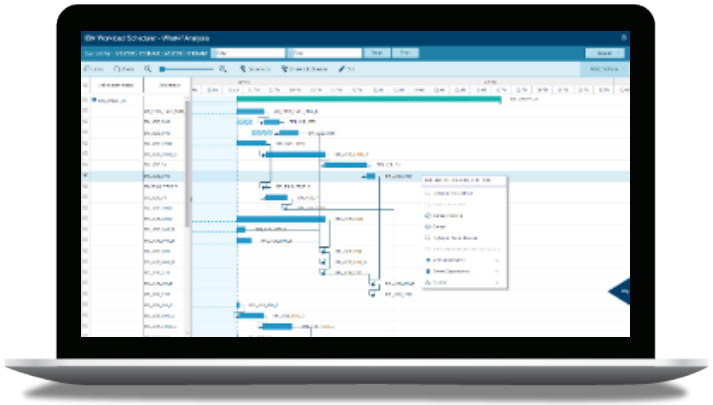


- ✓ Any kind of **unattended** process
- ✓ **Millions** of jobs per day

Monitor

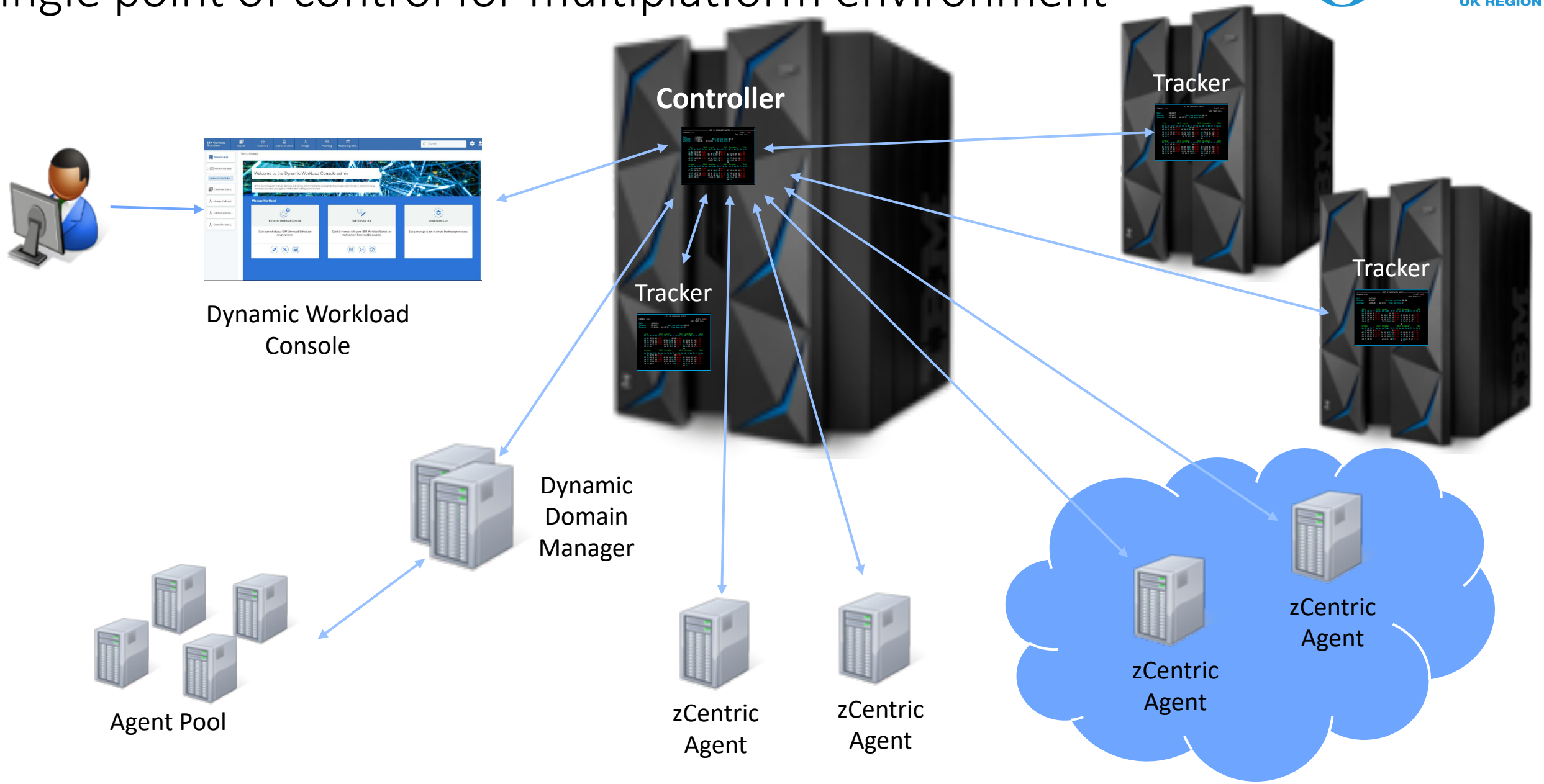
- ✓ Unified management platform for **advance monitoring and recovery** across all data centers

Govern



- ✓ Centralized point for regulation **compliance**
- ✓ **Predicts** impacts of failures on business deadlines with analytics

Single point of control for multiplatform environment

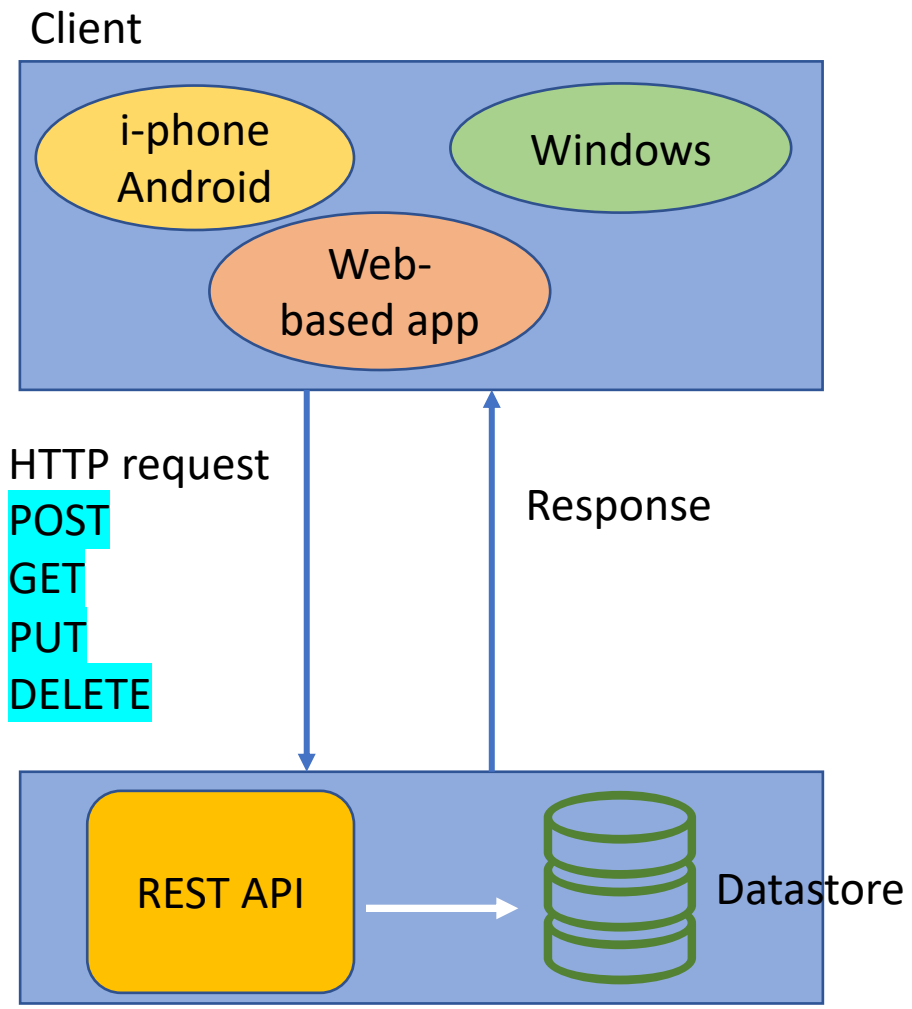


REST API – Representational State Transfer

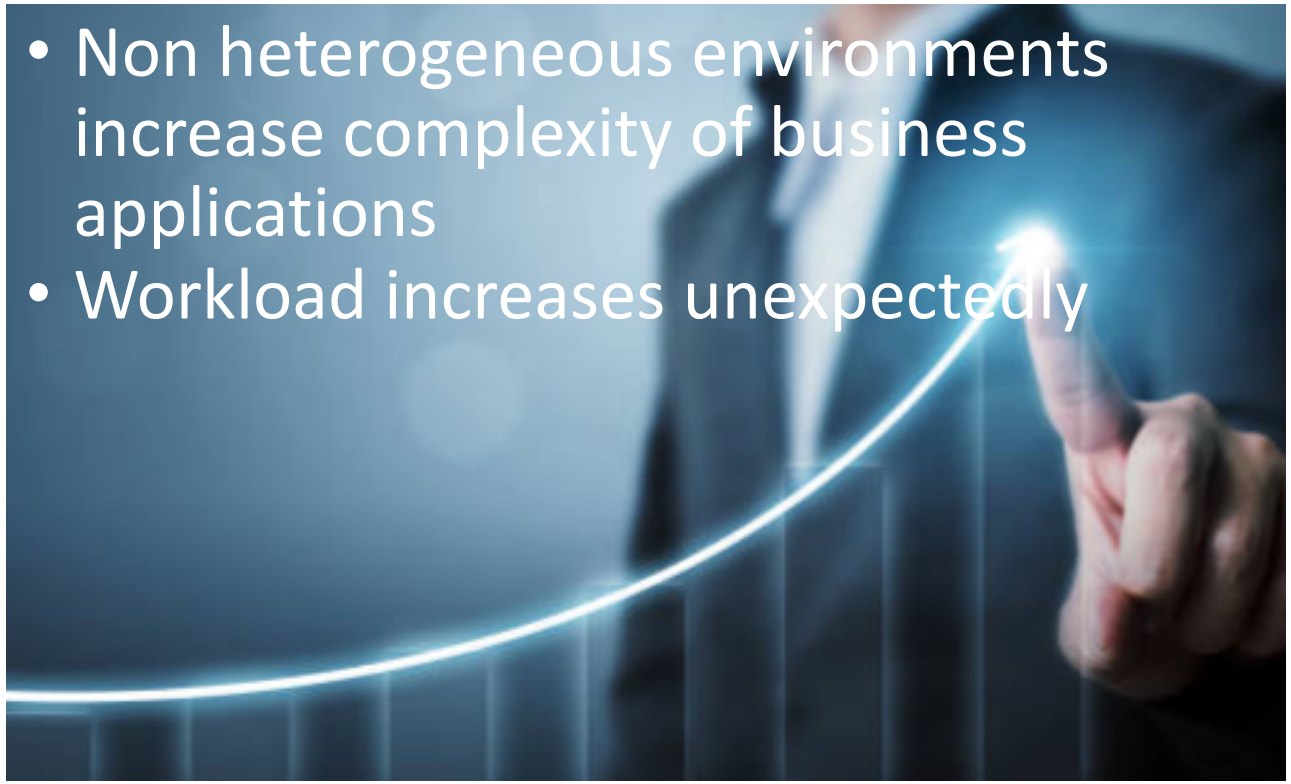
A REST API ‘is a architectural style’ based on web standard and HTTP protocol, that represents the state of a resource at a certain time

- Everything is a resource.
- Resources are identified by global id (URI URL) and have different representation: text , json, xml

A REST server provides access to the resource and a REST client accesses and modifies the resource



IBM ZWS manages and reduce risks in digital transformation

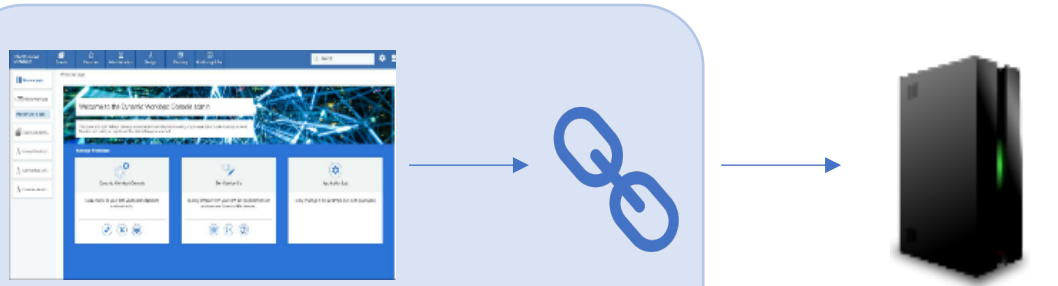


IBM ZWS exposes multiple interfaces to manage business applications from different platforms and with different types of knowledge

- **REST API**
- Zowe Command Line (Session Zowe™ Overview and IBM Z Workload Scheduler Zowe extensions - 4AC)
- **IZWS Dashboard**
- **Workload Automation Programming Language**

REST API - a digital glue in IBM ZWS

REST API for IBM ZWS needs the zOS Connector to the Controller



- Simple web-based API
- Leverage HTTP HTTPS protocol
- Can be called from anywhere in a hybrid environment
- No complex programming

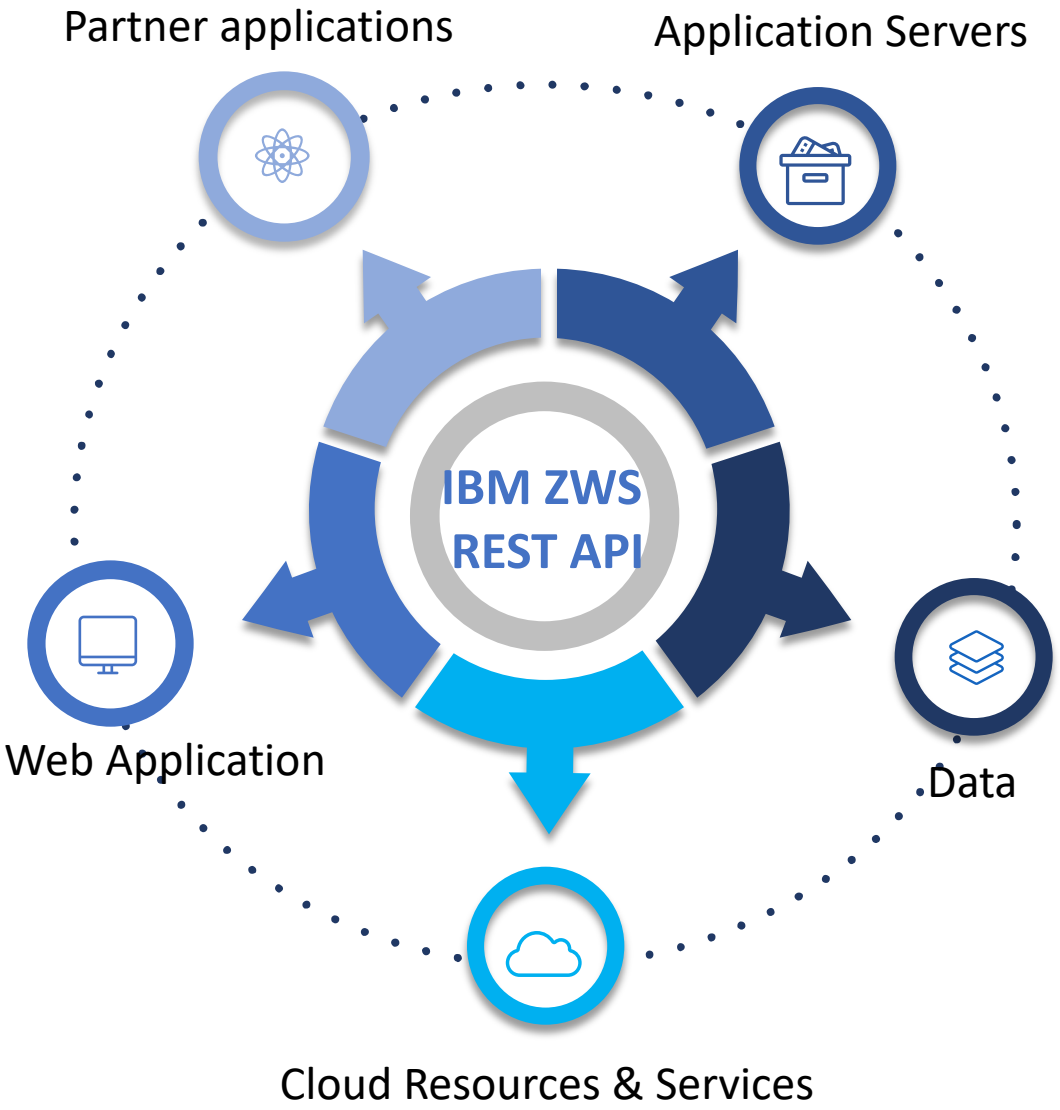
Acting on IBM ZWS

- Run individual jobs or jobstreams
- Create jobstreams dynamically
- Submit workload at absolute or relative times
- Manipulate active planned workload
- Design or manipulate a resource in the DB

Third party application acting towards IBM ZWS

- Third party business process information can be embedded within the Dynamic Workload Console Dashboard using their own APIs
- IBM ZWS can run application processes as jobs using their REST APIs

Get the best of IZWS REST API



IBM ZWS provides a set of fully functional REST APIs
The REST APIs are based on the same APIs used by the product user interface and provide full access to all the IBM Z Workload Scheduler features.

Workload definitions and planned resources can be manipulated using the IBM ZWS REST API.
Third party application information can be embedded within the Dynamic Workload Console using their own REST APIs

Customer scenarios using REST API

A Nordic Bank

Challenge

The customer supports the automation of customers' core financial processes such as Purchase to Pay, Order to Cash and Accounting to Reporting.

- The customer has the need to integrate their ordering system within IBM ZWS, to automatically add applications and jobs instances.

Solution

The customer is leveraging REST API for IBM ZWS as the fastest and easiest way to accomplish a third-party application integration with IZWS.

- The usage of WAPL REST API, allows them to fully integrate with most of the properties of application/job instances in IBM ZWS plan.

Benefit

IBM ZWS is the single point of entry to integrate and orchestrate Customer's business applications. This generates cost and process efficiency benefits.

A Turk Bank

Challenge

Increase efficiency of IT organization without extensive training

Solution

The Customer leveraged IBM Z Workload Scheduler (IZWS) REST API in the homegrown Web UI leveraged by developers for other internal purposes to make easy to “submit a job request” providing minimal information.

IZWS REST API were leveraged to add on-demand job to the plan, submit the job added and to retrieve job status.

Benefit

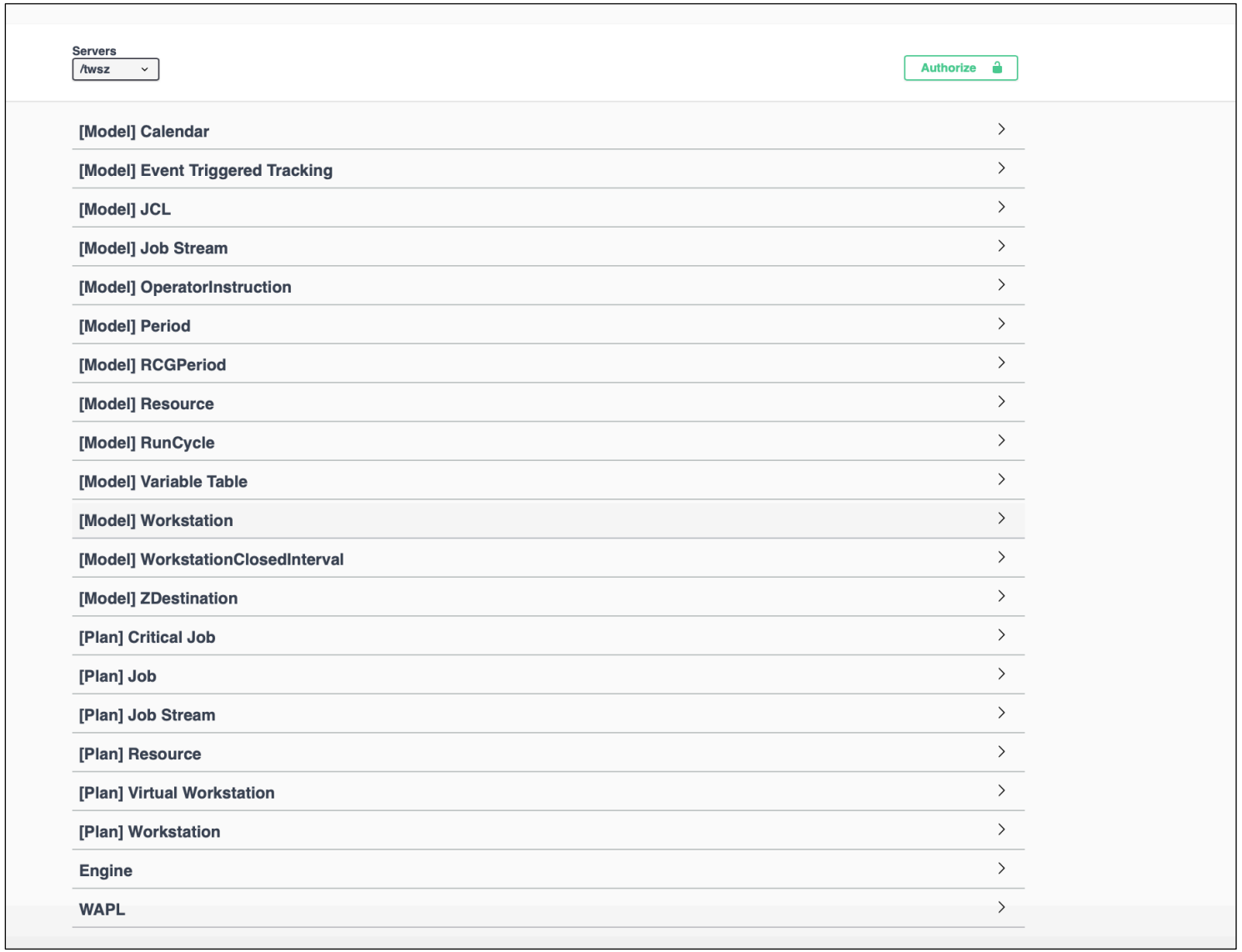
Open scheduling to other teams, with no scheduling skills, in the enterprise :

- Reduce workload on Scheduling team for repetitive task
- Keep under control what is allowed to the end user (through a tailored Web interface and internal check

IBM ZWS REST API

IBM ZWS REST API Swagger

Swagger https://IP ADDRESS:PORT/twsz/



3D rules that allows to

- Document
- Design
- Develop

REST API for IBM ZWS

REST API for modelling

REST API allows to run multiple actions on the DB resources

- Add
- Modify
- Delete
- Query list of resources
- Fetch a resource

Use	Action	HTTP	Body/Filter	Response
Create a new resource	**Add**	POST	Resource name to be created + some attributes	Resource ID
Update an existing resource	**Update**	PUT	Resource ID + attributes to be updated	Resource ID
Delete a resource	**Delete**	DELETE	Resource ID	
Retrieve a list of resources	**Query**	POST	Can be filtered with attributes	List of resources (ID & name)
Fetch a resource with all attributes	**Fetch**	GET	Resource ID	Resource with all the attributes

DB Resources

JobStream

Job

Workstation

Calendar

Period

Resource

Variable Table

Run Cycle Group

Event Triggering

Operator Instruction

REST API for plan

REST API allows to run multiple actions on the Plan resources

- Add
- Modify
- Retrieve list of resources
- Fetch a resource

Use	Action	HTTP	Body/Filter	Response
Create a new resource	**Add**	POST	Resource name to be created + some attributes	Resource ID
Update an existing resource	**Update**	PUT	Resource ID + attributes to be updated	Resource ID or No content (for example releasing a job)
Retrieve a list of resources	**Query**	POST	Can be filtered with attributes	List of resources (ID & name)
Fetch a resource with all attributes	**Fetch**	GET	Resource ID	Resource with all the attributes

Plan Resources

Critical Job (list, info about risk level and list of predecessors on the critical network)

Job (list, submit, update properties, HOLD, NPO, release, set dependencies)

JobStream

Joblog

Dependency (successor, predecessor, resource, not completed predecessor)

Resource

Workstation

IBM ZWS REST API documentation for the DB

[Model] Workstation

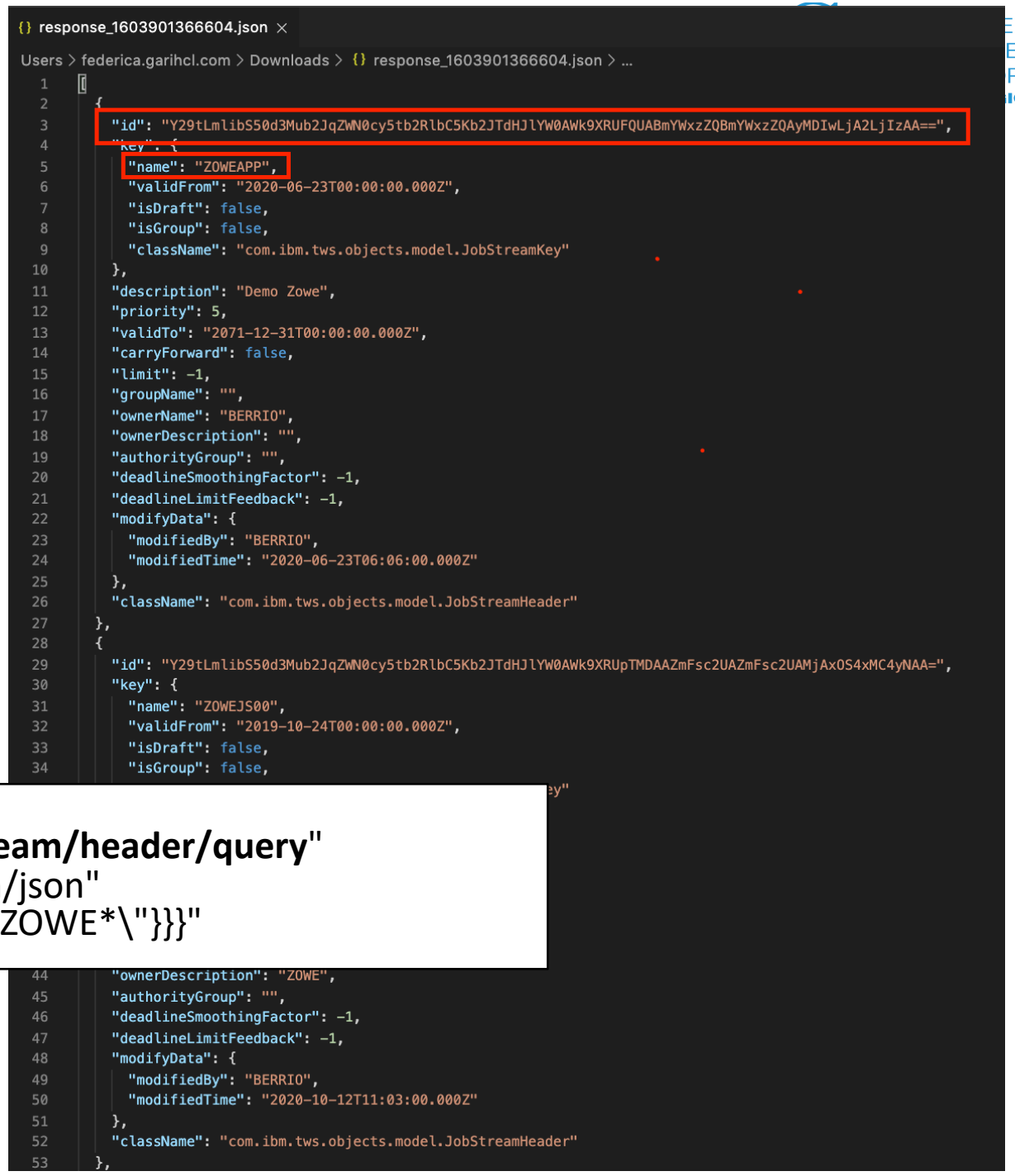
GET	/v1/{engine}/model/workstation	GET operation for Workstation using a TWSKey	getWorkstationByName
POST	/v1/{engine}/model/workstation	ADD operation for Workstation	addWorkstation
DELETE	/v1/{engine}/model/workstation	DELETE operation for Workstation using a TWSKey	removeWorkstationByName
GET	/v1/{engine}/model/workstation/{workstationId}	GET operation for Workstation using a TWSId	getWorkstationById
PUT	/v1/{engine}/model/workstation/{workstationId}	UPDAT	
DELETE	/v1/{engine}/model/workstation/{workstationId}	DELE	
PUT	/v1/{engine}/model/workstation/{workstationId}/acti		
PUT	/v1/{engine}/model/workstation/{workstationId}/acti		
PUT	/v1/{engine}/model/workstation/action/lock	LOCK operati	
PUT	/v1/{engine}/model/workstation/action/unlock	UNLOCK	
POST	/v1/{engine}/model/workstation/header/query	QUERY ope	
POST	/v1/{engine}/model/workstation/header/query_next	QU	

[Model] Job Stream

GET	/v1/{engine}/model/jobstream	GET operation for JobStream using a TWSKey	getJobStreamByKey
POST	/v1/{engine}/model/jobstream	ADD operation for JobStream	addJobStream
DELETE	/v1/{engine}/model/jobstream	DELETE operation for JobStream using a TWSKey	removeJobStreamByKey
GET	/v1/{engine}/model/jobstream/{jobstreamId}	GET operation for JobStream using a TWSId	getJobStreamById
PUT	/v1/{engine}/model/jobstream/{jobstreamId}	UPDATE operation for JobStream using a TWSId	updateJobStream
DELETE	/v1/{engine}/model/jobstream/{jobstreamId}	DELETE operation for JobStream using a TWSId	removeJobStreamById
PUT	/v1/{engine}/model/jobstream/{jobstreamId}/action/lock	LOCK operation for JobStream using a TWSId	lockJobStreamById
PUT	/v1/{engine}/model/jobstream/{jobstreamId}/action/unlock	UNLOCK operation for JobStream using a TWSId	unlockJobStreamById
PUT	/v1/{engine}/model/jobstream/action/lock	LOCK operation for JobStream using a TWSKey	lockJobStreamByKey
PUT	/v1/{engine}/model/jobstream/action/unlock	UNLOCK operation for JobStream using a TWSKey	unlockJobStreamByKey
POST	/v1/{engine}/model/jobstream/header/query	QUERY operation for JobStream	queryJobStreamHeader
POST	/v1/{engine}/model/jobstream/header/query_next	QUERY operation for JobStream	queryNextJobStreamHeader

IBM ZWS DB REST API- query a JobStream

QUERY (POST) on JobStream in the DB.
Filter is on JobStreamName (starting ZOWE)




```
curl -X POST
"https://10.14.36.57:9443/twsz/v1/cwsusr/model/jobstream/header/query"
-H "accept: application/json" -H "Content-Type: application/json"
-d "{\"filters\":{\"jobstreamFilter\":{\"jobStreamName\":\"ZOWE*\"}}}"
```

IBM ZWS REST API documentation for the Current Plan

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[Plan] Job Stream

GET	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId}	Get Job Stream In Plan	getJobStreamInPlan
PUT	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId}	Update JobStream In Plan properties	updateJobStreamInstance
PUT	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId}/action/cancel	Cancel JobStream In Plan	canc
PUT	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId}/action/cancel_pending	Cancel Pending JobStream In Plan	cancelPe nce
PUT	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId}/action/complete	Complete a jobstream in plan	comple
PUT	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId} /action/disable_jobs_monitoring	Disable monitoring of jobs in JobStream by external applications	disable reamIns
PUT	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId} /action/enable_jobs_monitoring	Enable monitoring of jobs in JobStream by external applications	enableM eamInst
PUT	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId}/action/hold	Hold a jobstream in plan	holdJo
PUT	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId}/action /update_jobstream_dependencies	UPDATE a jobstream dependencies in plan	updateJobStreamDepend encies
PUT	/v1/{engine}/plan/{planId}/jobstream/{jobstreamId}/action/wait	Wait a jobstream in plan	setToWaitJobStreamInstance
POST	/v1/{engine}/plan/{planId}/jobstream/action/add_jobstream	Add operation for Jobstream in plan	addJobStreamInstance
POST	/v1/{engine}/plan/{planId}/jobstream/action /edit_add_jobstream	Ed in t	
POST	/v1/{engine}/plan/{planId}/jobstream/action/submit_jo		
POST	/v1/{engine}/plan/{planId}/jobstream/query	Query operat	
POST	/v1/{engine}/plan/{planId}/jobstream/query_next	Query	

[Plan] Workstation

GET	/v1/{engine}/plan/{planId}/workstation/{workstationId}	Get Workstation In Plan	getWorkstationInPlan
PUT	/v1/{engine}/plan/{planId}/workstation/{workstationId}/action/link	Link workstation In Plan	linkWorkstation
PUT	/v1/{engine}/plan/{planId}/workstation/{workstationId}/action/status	Set virtual workstation status	setWorkstationStatus
PUT	/v1/{engine}/plan/{planId}/workstation/{workstationId}/action/unlink	Unlink workstation In Plan	unlinkWorkstation
PUT	/v1/{engine}/plan/{planId}/workstation/{workstationId}/action/update	Set workstation instance	setWorkstationInstance
POST	/v1/{engine}/plan/{planId}/workstation/query	Query operation for Workstation in plan	queryWorkstationInPlan
POST	/v1/{engine}/plan/{planId}/workstation/query_next	Query operation for Workstation in Plan	queryNextWorkstationInPlan

[Plan] Critical Job

POST	/v1/{engine}/plan/{planId}/criticaljob/{criticalJobId} /query_predecessors_chain	Predecessors for Critical Job in plan	queryPredecessorsCh ain
POST	/v1/{engine}/plan/{planId}/criticaljob/query	Query operation for Critical Job in Plan	queryCriticalJobInPlan
POST	/v1/{engine}/plan/{planId}/criticaljob/query_next	Query operation for Critical Job in Plan	queryNextCriticalJobInPlan
POST	/v1/{engine}/plan/{planId}/criticaljob /query_next_predecessors_chain	Next predecessors for Critical Job in plan	queryNextPredecessorsCha in
POST	/v1/{engine}/plan/{planId}/criticaljob/summary_info	Summary info for Critical Job in plan	querySummaryInfo

IBM ZWS CP REST API – Add a JobStream in the CP

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ADD (POST) a JobStream (JS1) in the CP

```
curl -X POST
"https://10.14.36.57:9443/twsz/v1/cwsusr/plan/current/jobstream/action/add_jobstream"
-H "accept: application/json" -H "Content-Type: application/json"
-d "{\"name\":\"JS1\"}"
```

response_1603976079452.json

Users > federica.garihcl.com > Downloads > {} response_1603976079452.json > ...

```
1  [
2    "Y29tLmlibS50d3Mub2JqZWN0cy5wbGFuLkpvYlN0cmVhbUluUGxhbgBKUzEAMjAyMC4xMC4yOS4xMi41NAA="
3  ]
```

Query (POST) a JobStream (JS1) in the CP

```
curl -X POST
"https://10.14.36.57:9443/twsz/v1/cwsusr/plan/current/jobstream/query"
-H "accept: application/json" -H "Content-Type: application/json”
 -d "{\"filters\":{\"jobStreamInPlanFilter\":{\"jobStreamName\":\"JS1*\"}}}"
```

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```
1   [
2     {
3       "id": "Y29tLmlibS50d3Mub2JqZWN0cy5wbGFuLkpvYlN0cmVhbUluUGxhbgBKUzEAMjAyMC4xMC4yOS4wMC4xNQA=",
4       "description": "",
5       "key": {
6         "name": "JS1",
7         "startTime": "2020-10-29T00:15:00.000Z"
8       },
48      "status": {
49        "commonStatus": "SUCCESSFUL",
50        "internalStatus": "COMPLETE",
51        "canceled": false
52      },
```

IBM ZWS CP REST API – Query info on Critical Job

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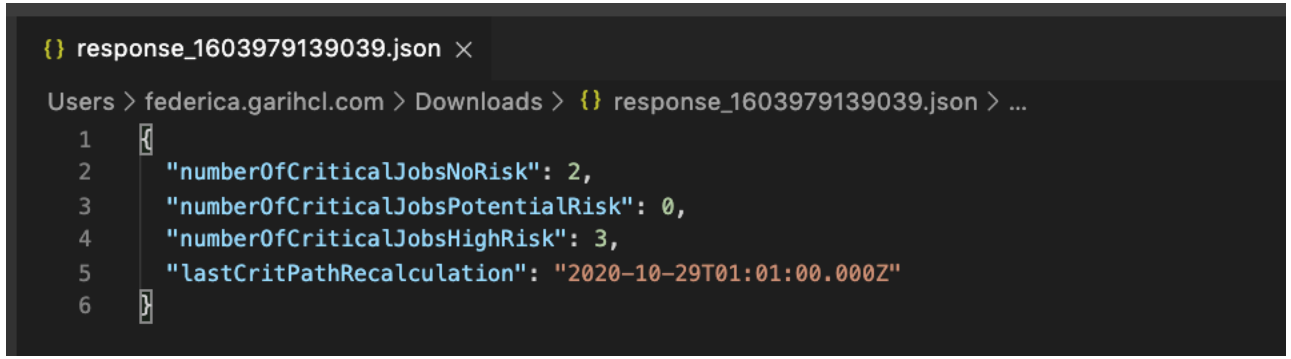
Query POST of Critical Job information

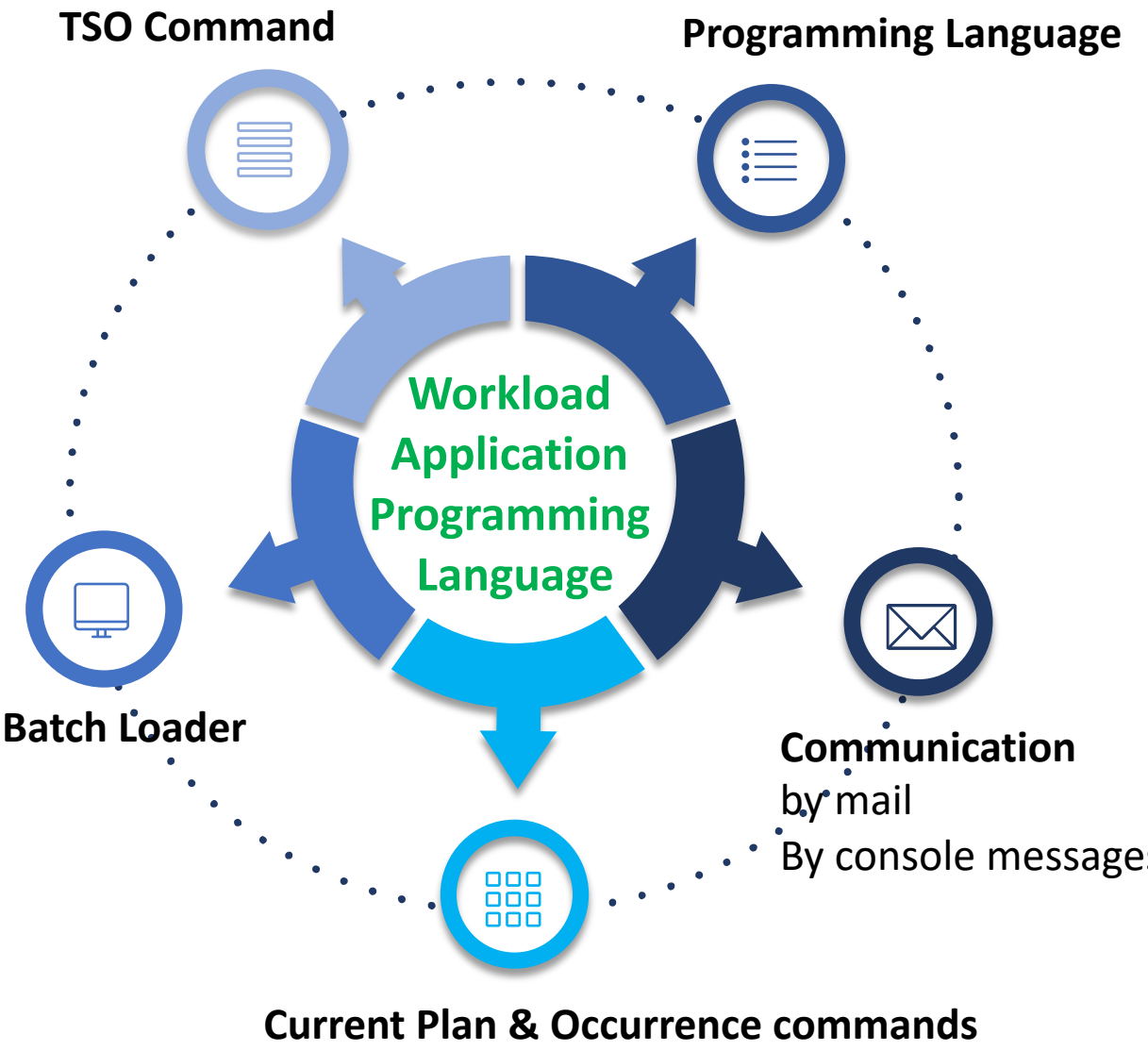
```
curl -X POST
"https://10.14.36.57:9443/twsz/v1/cwsusr/plan/current/criticaljob/summary_info"
-H "accept: application/json" -H "Content-Type: application/json"
```



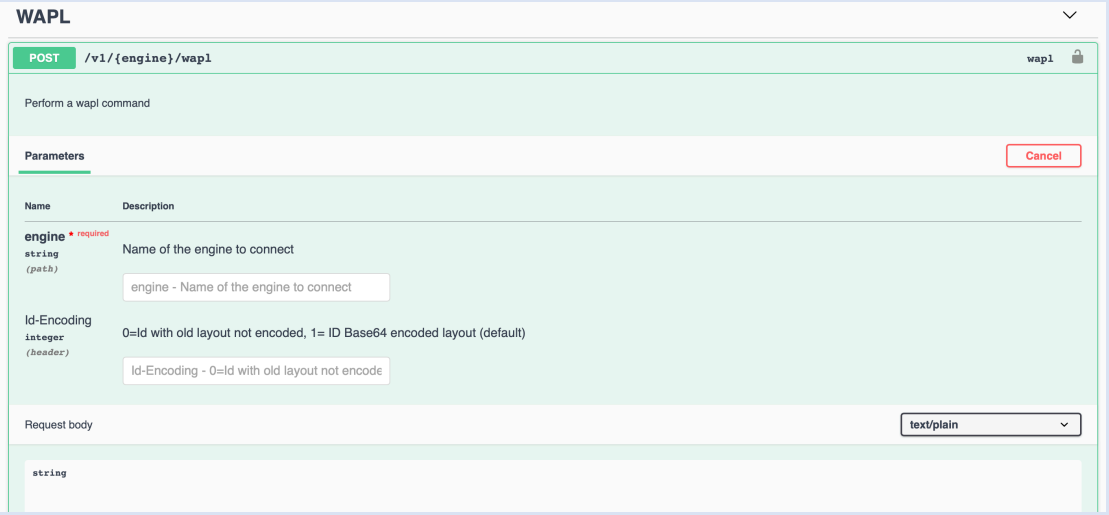
REST API for Workload Automation Programming Language

WAPL a batch utility that allows

- simple commands
- complex programming
- communication with the world outside IBM ZWS

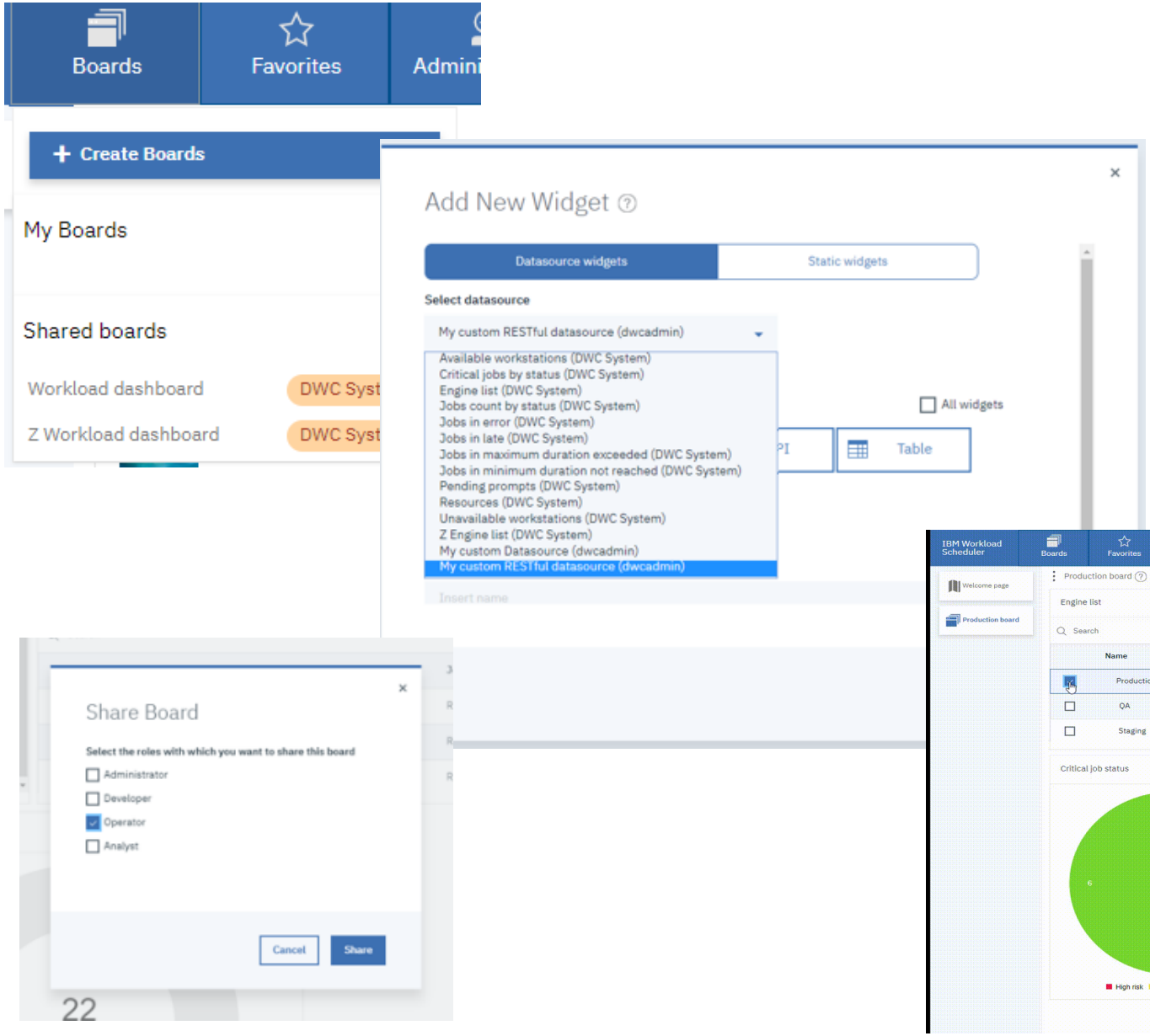


WAPL is available over REST API



Dynamic Workload Console Dashboard

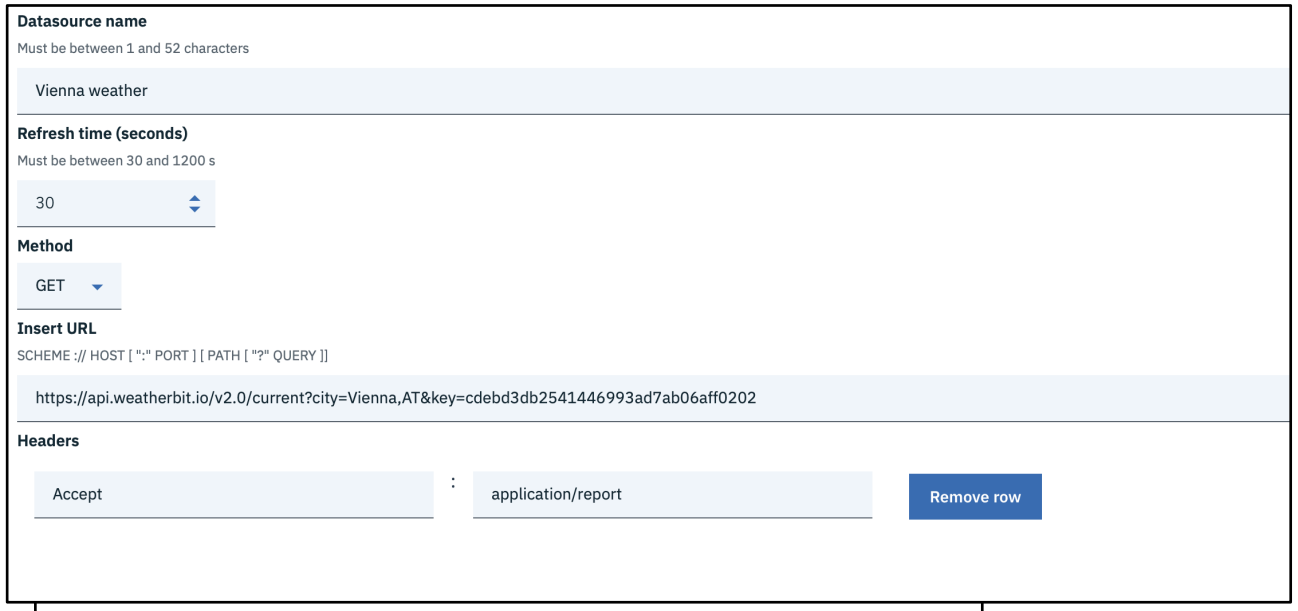
Create your own dashboard



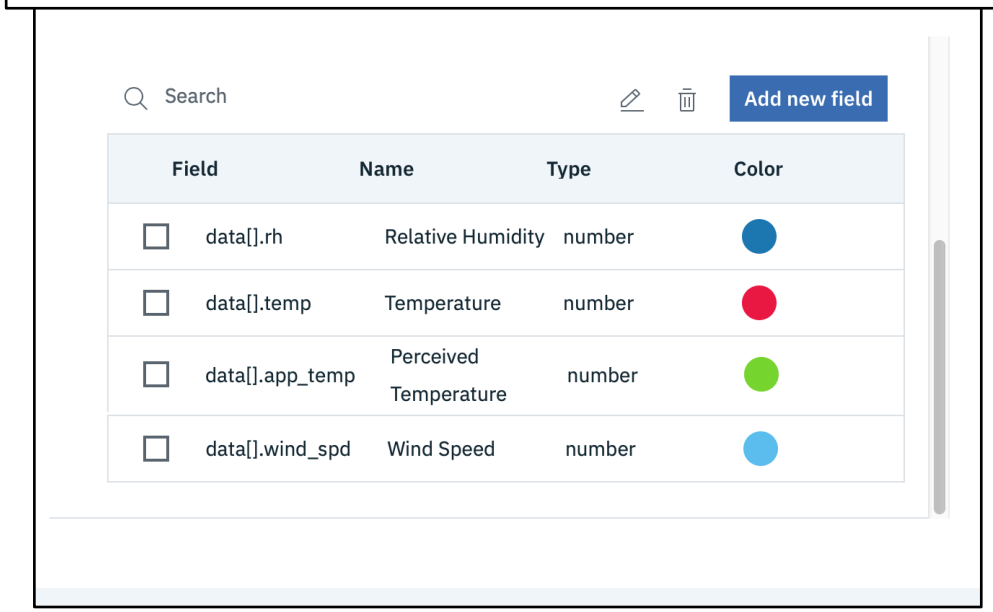
Dashboard can be easily customized

- REST API widget to include IBM ZWS or external application data
- Widget based on IBM ZWS queries
- Static widget to include web page

Customizable Dashbord

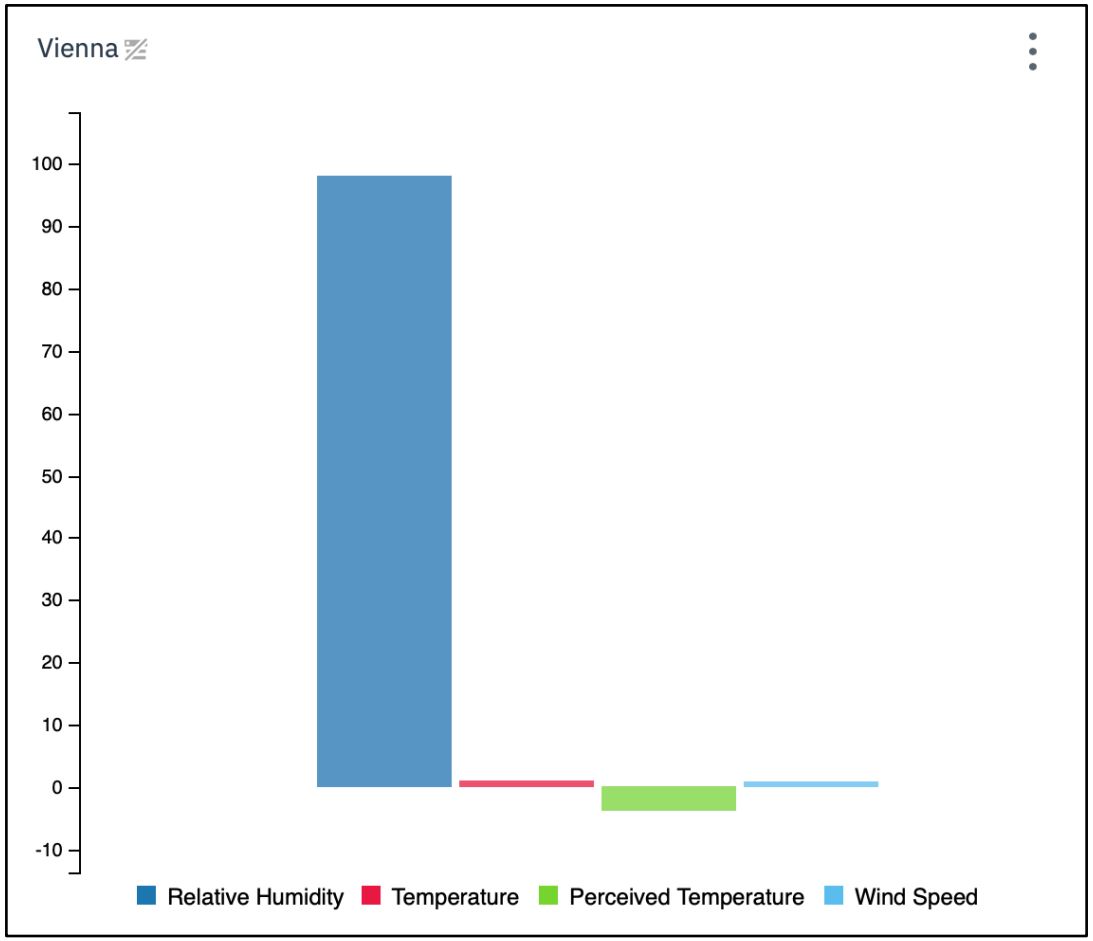


datasource



Widget properties

Widget



Some REST API examples

REST API - Demo

- Submit application with first operation in HOLD (WAPL REST API). Job release by its ID.
- Submit a job into IZWS plan (WAPL REST API), without application defined in the DB

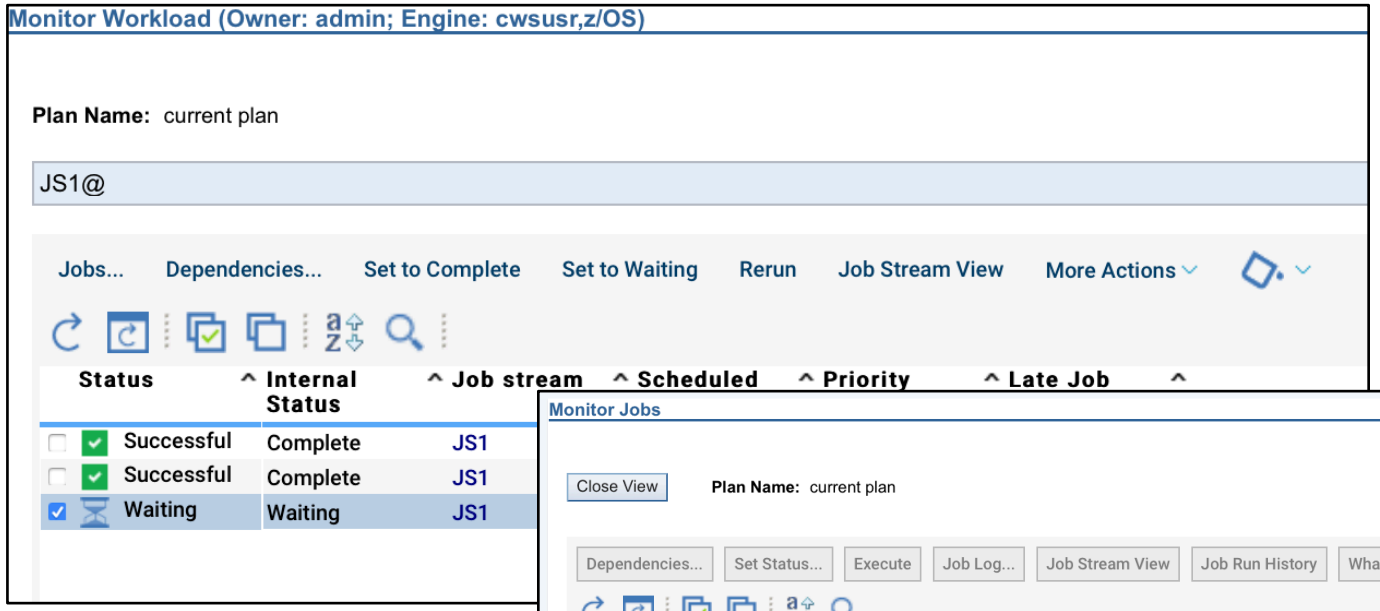
JobStream submission with first operation in HOLD

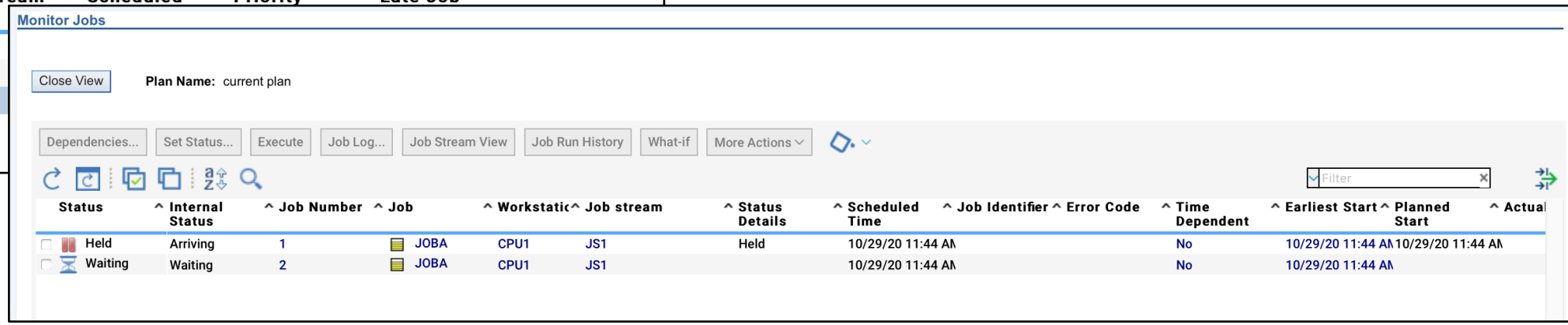
Request body

text/plain

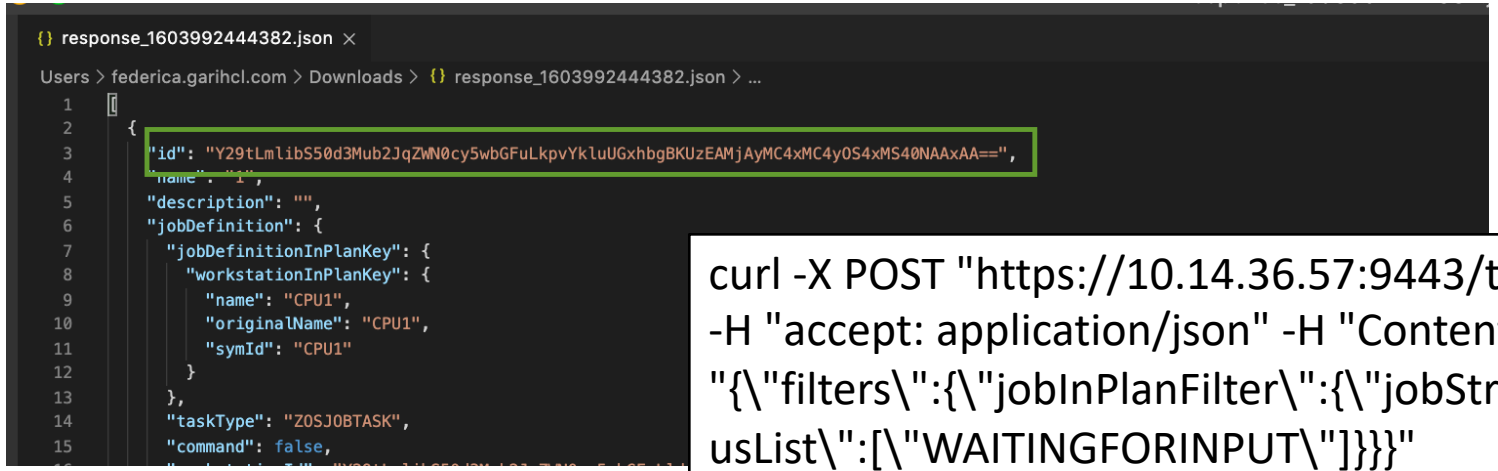
```
OPTIONS SERVER(Y)
ADD ADID(JS1) HOLD(START)
EXECUTE
```

```
curl -X POST "https://10.14.36.57:9443/twsz/v1/cwsusr/wapl" -H
"accept: text/plain" -H "Content-Type: text/plain"
-d "OPTIONS SERVER(Y)ADD ADID(JS1) HOLD(START)EXECUTE"
```





Release of job in HOLD

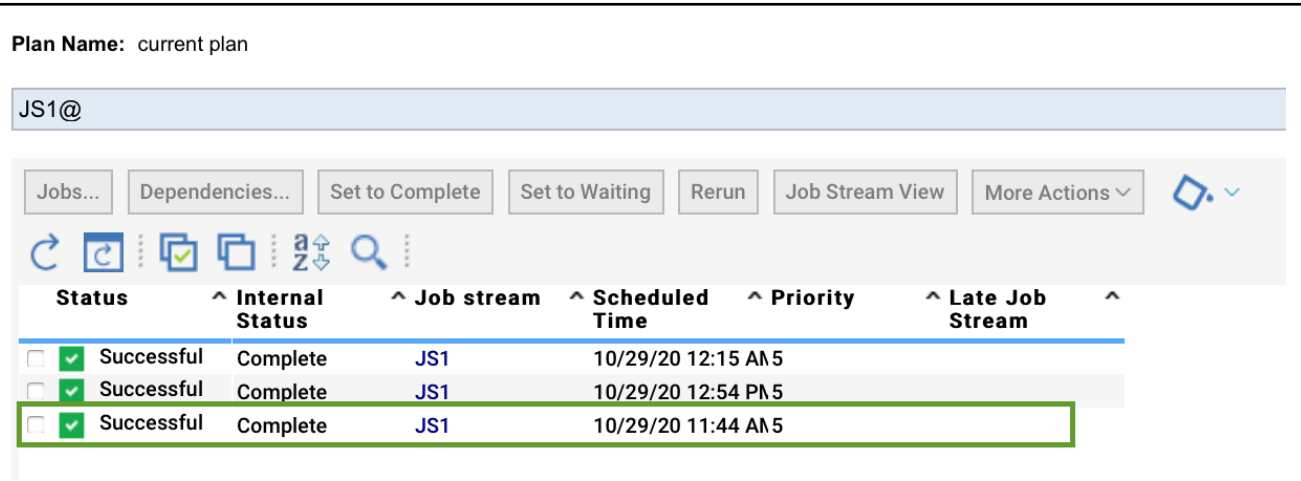


Get JobID with POST method

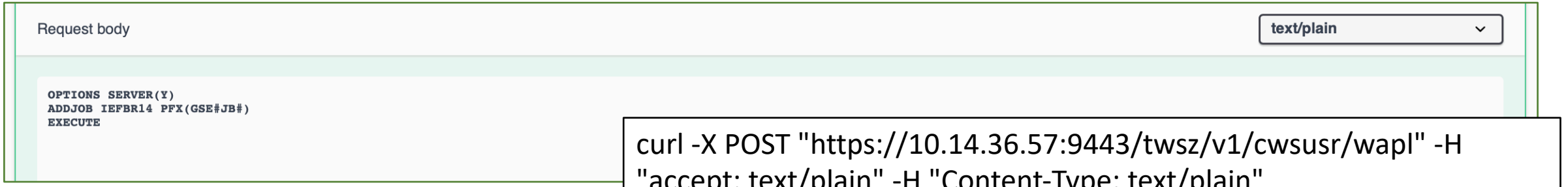
```
curl -X POST "https://10.14.36.57:9443/twsz/v1/cwsusr/plan/current/job/query"
-H "accept: application/json" -H "Content-Type: application/json" -d
"{\"filters\":{\"jobInPlanFilter\":{\"jobStreamName\":\"JS1\",\"task\":\"JOBA\",\"internalStat
usList\":[\"WAITINGFORINPUT\"]}}}"
```

Release JOB by its ID

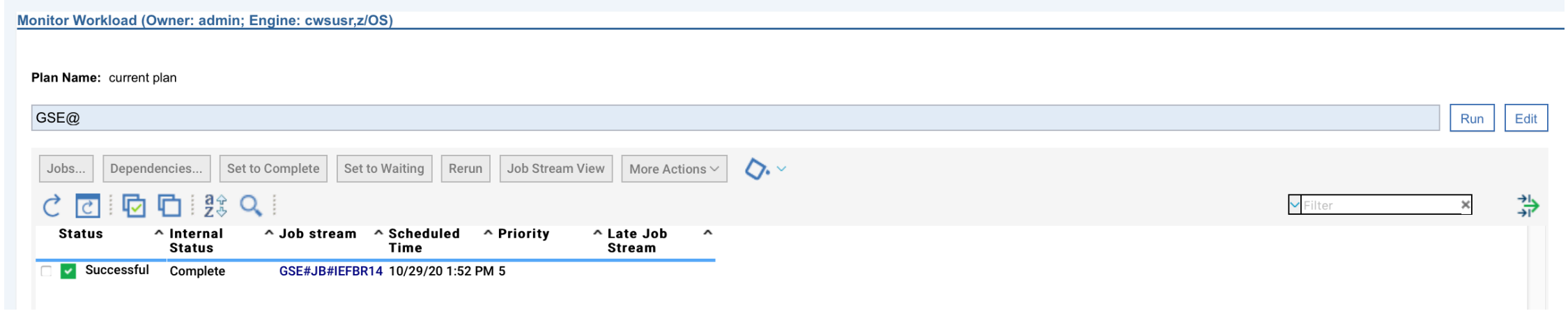
```
curl -X PUT
"https://10.14.36.57:9443/twsz/v1/cwsusr/plan/current/job/Y29tLmlibS50d3Mub2JqZWN0cy5wbGFuLkpvYkluUGxhbgBK
UzEAMjAyMC4xMC4yOS4xMS40NAAxAA%3D%3D/action/release" -H "accept: */*"
```



Submit a job into IZWS plan (WAPL REST API), creating a dynamic application




```
curl -X POST "https://10.14.36.57:9443/twsz/v1/cwsusr/wapl" -H
"accept: text/plain" -H "Content-Type: text/plain"
-d "OPTIONS SERVER(Y)ADDJOB IEFBR14 PFX(GSE#JB#)EXECUTE"
```



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1 to 4 = "Too Short" 5 = "OK" 6-9 = "Too Long"

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3. Did this presention meet your requirements?

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1 2 3 4 5 6 7 8 9

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NHS CHARITIES TOGETHER