Final Project

Azure Batch

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Deep Azure

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The problem…

- You are receiving a steady flow of X12 EDI files that need to be transformed to XML format for further processing.

- Once a week a client sends you a LARGE number of X12 files (40 000), which overwhelms your X12 to XML conversion infrastructure.

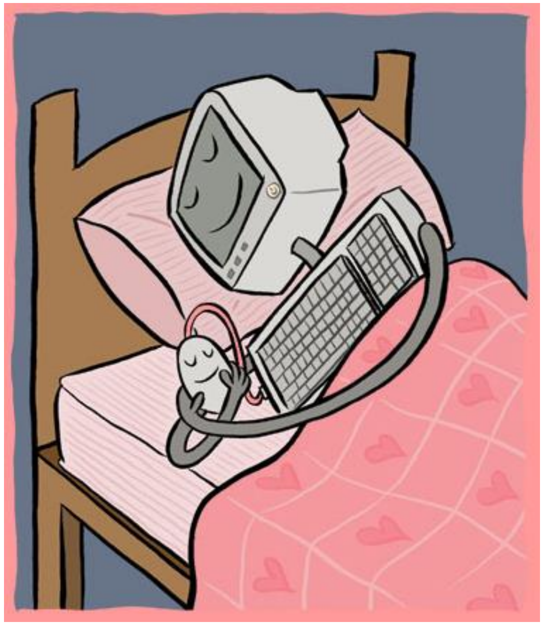
- How would you solve such problem?

The traditional solution

- Your infrastructure needs to be large enough to handle the highest workload possible.
  - Analysis and architecture;
  - Hardware purchase (RFP, PO, …);
  - Computer room infrastructure (floor space, power, UPS, …)
  - Network infrastructure;
  - Systems installation and configuration;
  - Software installation and configuration;
  - Support all this!

The traditional solution - 2

- Most of the time, that infrastructure would sit there doing nothing, since the large bursts of files are infrequent.



- This implies costs and waste of resources.

The Azure Batch solution

- Azure Batch is a platform created to run parallel, high-performance computing.

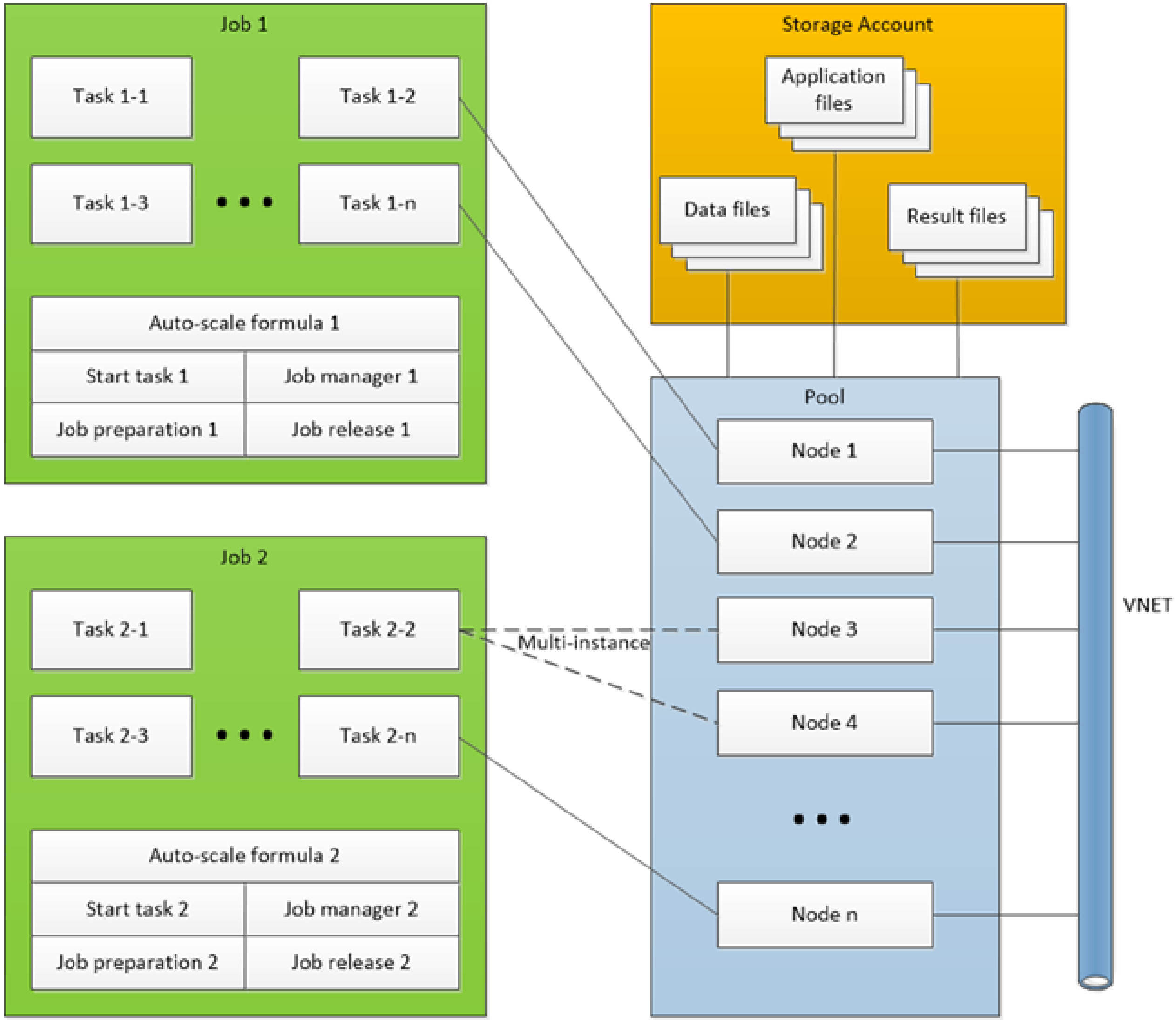
- It also offers auto-scaling of compute resources, to meet varying demands.

- This reduces costs and resources waste.

Azure Batch examples

- Batch processing
  - Invoices, billing
  - Inventory updates
  - Payroll
  - Financial reports
- High-performance computing applications
  - Computational Fluid Dynamic (CFD)
  - Deep Learning
  - Molecular Dynamics
  - Video processing

Azure Batch - Resources



Azure Batch - Jobs

- Application are broken down in to jobs.
- Jobs are collections of tasks and define on which compute node pool(s) they will run.
- Jobs also define
  - Tasks priority and constraints.
  - The auto-scaling formula (based on the number of queue tasks, completion rate, time, resources, other metrics).

Azure Batch - Tasks

- Tasks are units of computation.
- Each task can be executed on one or more compute nodes.
- They define:
  - What command to execute.
  - What files are required (application and data).
  - Environment variables.
  - Constraints.
  - Application packages or container images to use.
- Tasks can have dependencies between one another.
- The output of a task can be the input of another.

Azure Batch – Compute nodes

- Compute nodes are virtual machines (Windows or Linux) or cloud service VMs (Windows only).
- Provide CPU, memory and disks resources.
- Are all identical within a unique pool. Create other pools is different nodes are required.
- Can be :
  - accessed like a regular VM (RDP or SSH).
  - based on standard or custom images.
  - dedicated (more expansive but never pre-empted) or low-priority (less expansive, uses surplus capacity).
  - added to the pool (scaling up), or removed from the pool (scaling down), depending on the auto-scaling formula, defined at the job level.
  - created for each job, and deleted as soon as it is complete, or be created ahead of time, thus reducing the start time, but increasing costs.

Azure Batch - Files

- Types: application, data files (input) and result files (output).
- They are stored in a storage account blob.
- Application files are downloaded on compute nodes and executed.
- Data files are downloaded and processed by the application.
- Result files are uploaded back to the storage account.
- Files associated to a compute node are lost when the node is destroyed.

Azure Batch - Applications

- They can be managed via packages.
- Can have many versions of an application used at the same time.
- Can be defined at the job, or task level.
- Job level: deployed to all nodes in the pool.
- Task level: only on nodes that are defined to run that particular package.

Azure Batch - Network

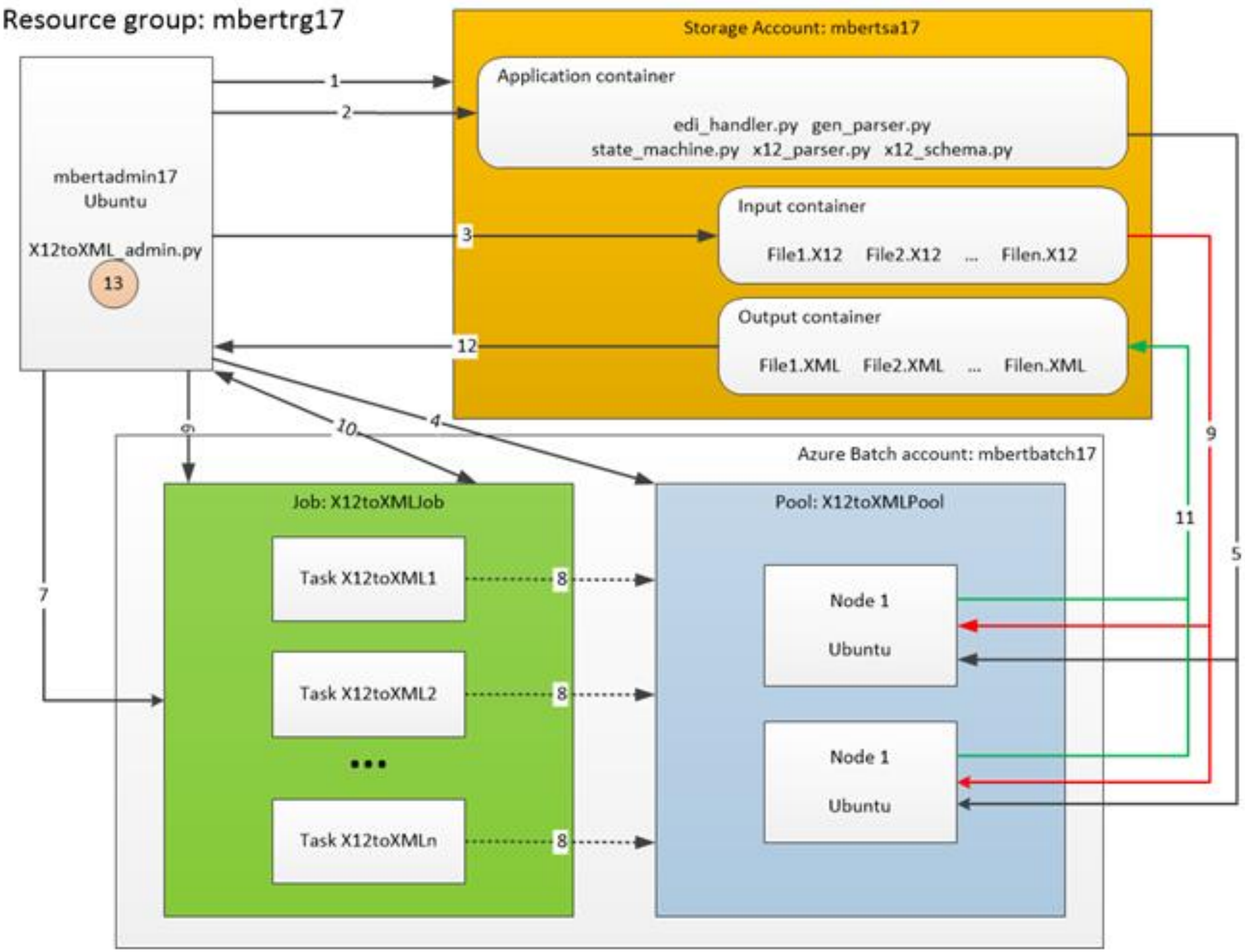
- All nodes must be in the same region, in the same batch account, under the same subscription.

- Network Security Groups must allow communications between batch services and the nodes.

Azure Batch - API

- Communicate with Azure Batch services.
- Create and manage nodes.
- Schedule jobs and tasks.
- Can be used via CLI, REST, .NET, Python, Node.js or Java.

X12 to XML conversion - Infrastructure


Resource group: mbertrg17
mbertadmin17
Ubuntu
X12toXML_admin.py
13
Storage Account: mbertsa17
Application container
edi_handler.py gen_parser.py
state_machine.py x12_parser.py x12_schema.py
Input container
File1.X12 File2.X12 ... Filen.X12
Output container
File1.XML File2.XML ... Filen.XML
Azure Batch account: mbertbatch17
Job: X12toXMLJob
Task X12toXML1
Task X12toXML2
•••
Task X12toXMLn
Pool: X12toXMLPool
Node 1
Ubuntu
Node 1
Ubuntu
1
2
3
4
5
6
7
8
8
8
9
10
11
12

X12 to XML conversion – Infrastructure - 2

- An administration VM (Linux based) runs a Python script to administer Batch.
- This Python script uses the Azure Batch API to communicate with Batch and the storage account.
- The administration script creates required components and prepares files for processing using Batch.
- It also cleans up when the processing is done, to keep costs to a minimum.

X12 to XML conversion - Executing

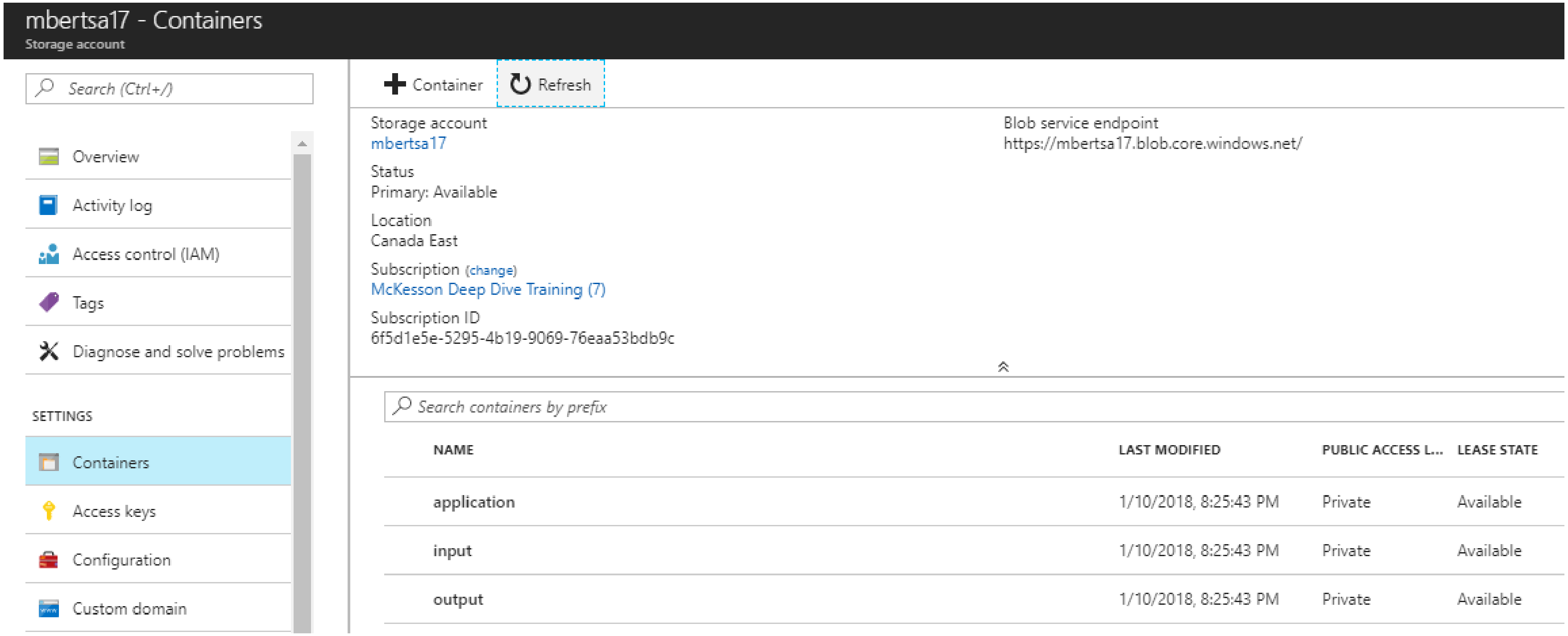
- A Linux bash script creates the required components on Azure, using Azure CLI commands.
- It creates:
  - The resource group.
  - A storage account.
  - A batch account.
  - The administration VM, with associated external IP and network components.
  - It configures the administration VM to run the conversion script.
- It uploads the application and data files to the administration VM.

X12 to XML conversion – Executing - 2

- The Python administration script performs:
  - Create 3 containers in the storage account:
    - “application”: contains all the scripts that will perform the transformation.
    - “input”: will contain all the X12 format data files.
    - “output”: will contain the XML transformed files.
  - Upload the application and input files in the appropriate containers.
  - Create a pool that will contain compute nodes.
  - Create a job which will contain the tasks.
  - Create tasks inside the job. One task is created per input file. Each task uploads the converted file to the “output” storage container.
  - Waits for all tasks to complete.
  - Download the output files from the output container.
  - Delete the storage containers.
  - Delete the job.
  - Delete the pool.

X12 to XML conversion – Portal

- While files are converted, it is possible to view the status of Batch resources via the Azure Portal. This view shows the Storage Account containers:



mbertsa17 - Containers

Storage account

Storage account
mbertsa17

Blob service endpoint
https://mbertsa17.blob.core.windows.net/

Status
Primary: Available

Location
Canada East

Subscription (change)
McKesson Deep Dive Training (7)

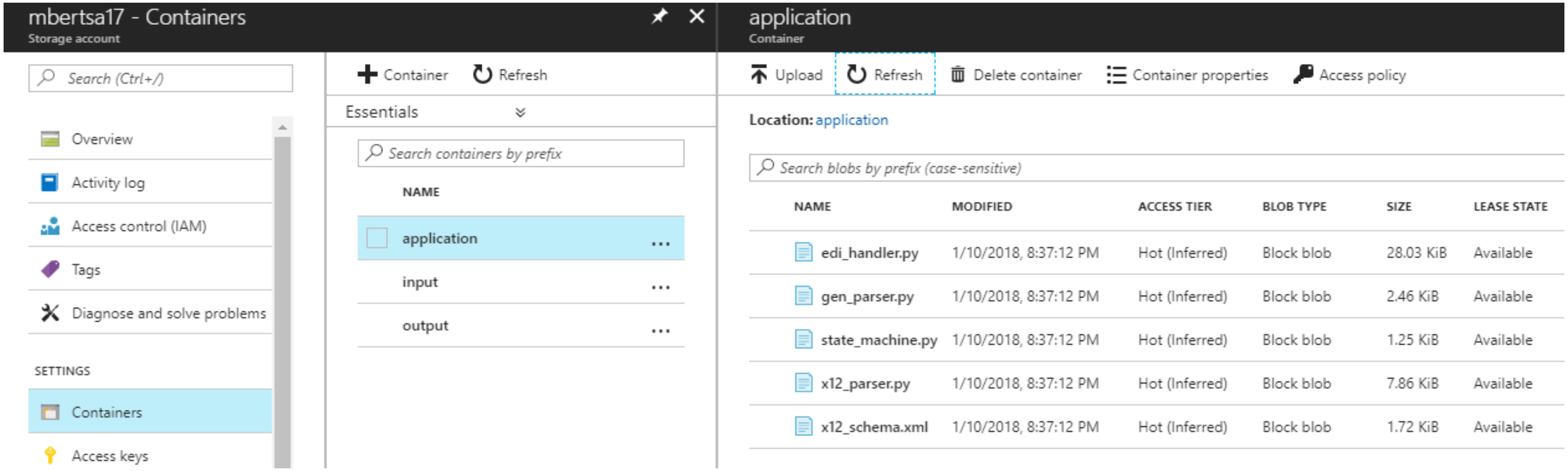
Subscription ID
6f5d1e5e-5295-4b19-9069-76eaa53bdb9c

Search containers by prefix

NAME	LAST MODIFIED	PUBLIC ACCESS L...	LEASE STATE
application	1/10/2018, 8:25:43 PM	Private	Available
input	1/10/2018, 8:25:43 PM	Private	Available
output	1/10/2018, 8:25:43 PM	Private	Available

X12 to XML conversion – Portal - 2

- The application container contains the scripts:



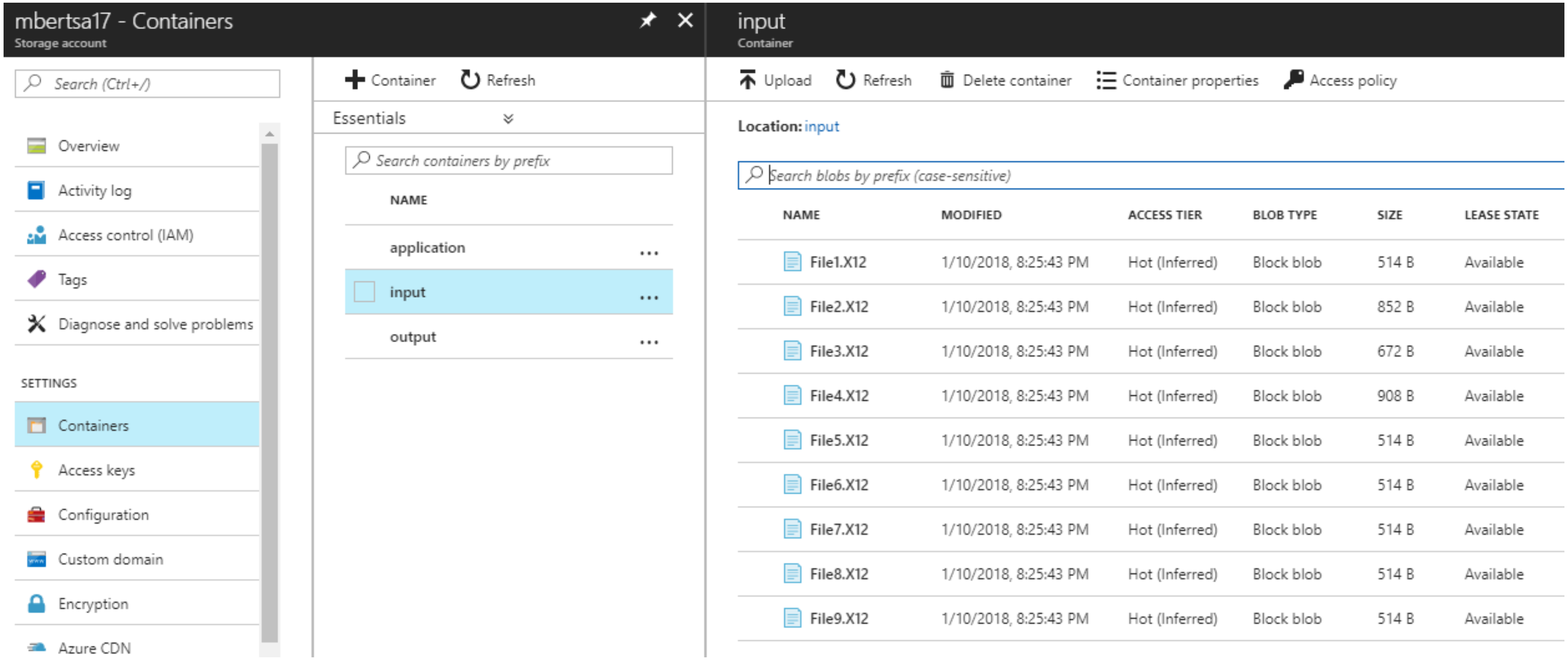
NAME
application
input
output

Location: application

NAME	MODIFIED	ACCESS TIER	BLOB TYPE	SIZE	LEASE STATE
edi_handler.py	1/10/2018, 8:37:12 PM	Hot (Inferred)	Block blob	28.03 KiB	Available
gen_parser.py	1/10/2018, 8:37:12 PM	Hot (Inferred)	Block blob	2.46 KiB	Available
state_machine.py	1/10/2018, 8:37:12 PM	Hot (Inferred)	Block blob	1.25 KiB	Available
x12_parser.py	1/10/2018, 8:37:12 PM	Hot (Inferred)	Block blob	7.86 KiB	Available
x12_schema.xml	1/10/2018, 8:37:12 PM	Hot (Inferred)	Block blob	1.72 KiB	Available

X12 to XML conversion – Portal - 3

- The input container contains the X12 files:



mbertsa17 - Containers
Storage account

Search (Ctrl+/)

- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

SETTINGS

- Containers
- Access keys
- Configuration
- Custom domain
- Encryption
- Azure CDN

+ Container ↻ Refresh

Essentials

Search containers by prefix

NAME
application
input
output

input
Container

Upload ↻ Refresh Delete container Container properties Access policy

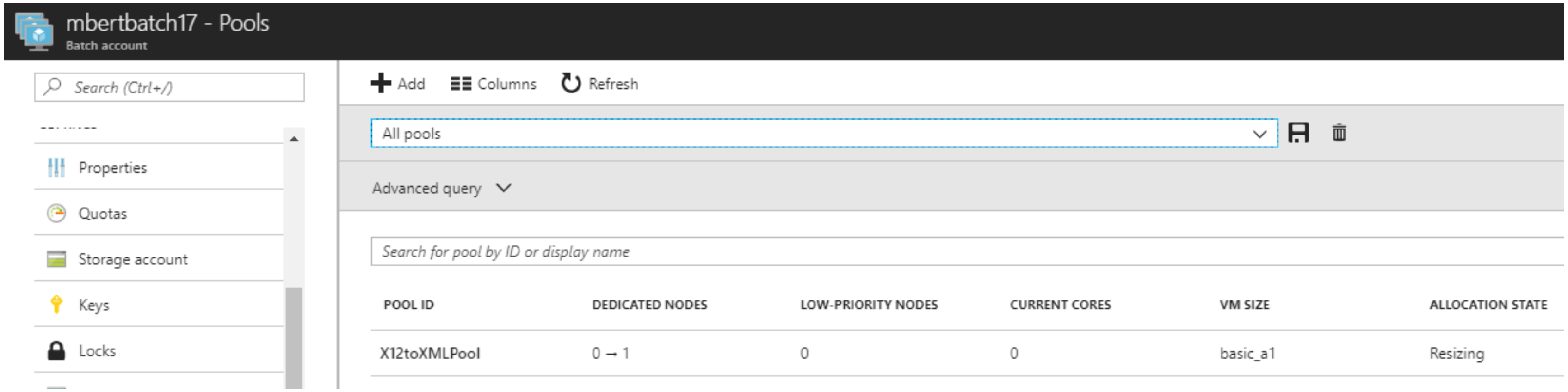
Location: input

Search blobs by prefix (case-sensitive)

NAME	MODIFIED	ACCESS TIER	BLOB TYPE	SIZE	LEASE STATE
File1.X12	1/10/2018, 8:25:43 PM	Hot (Inferred)	Block blob	514 B	Available
File2.X12	1/10/2018, 8:25:43 PM	Hot (Inferred)	Block blob	852 B	Available
File3.X12	1/10/2018, 8:25:43 PM	Hot (Inferred)	Block blob	672 B	Available
File4.X12	1/10/2018, 8:25:43 PM	Hot (Inferred)	Block blob	908 B	Available
File5.X12	1/10/2018, 8:25:43 PM	Hot (Inferred)	Block blob	514 B	Available
File6.X12	1/10/2018, 8:25:43 PM	Hot (Inferred)	Block blob	514 B	Available
File7.X12	1/10/2018, 8:25:43 PM	Hot (Inferred)	Block blob	514 B	Available
File8.X12	1/10/2018, 8:25:43 PM	Hot (Inferred)	Block blob	514 B	Available
File9.X12	1/10/2018, 8:25:43 PM	Hot (Inferred)	Block blob	514 B	Available

X12 to XML conversion – Portal - 4

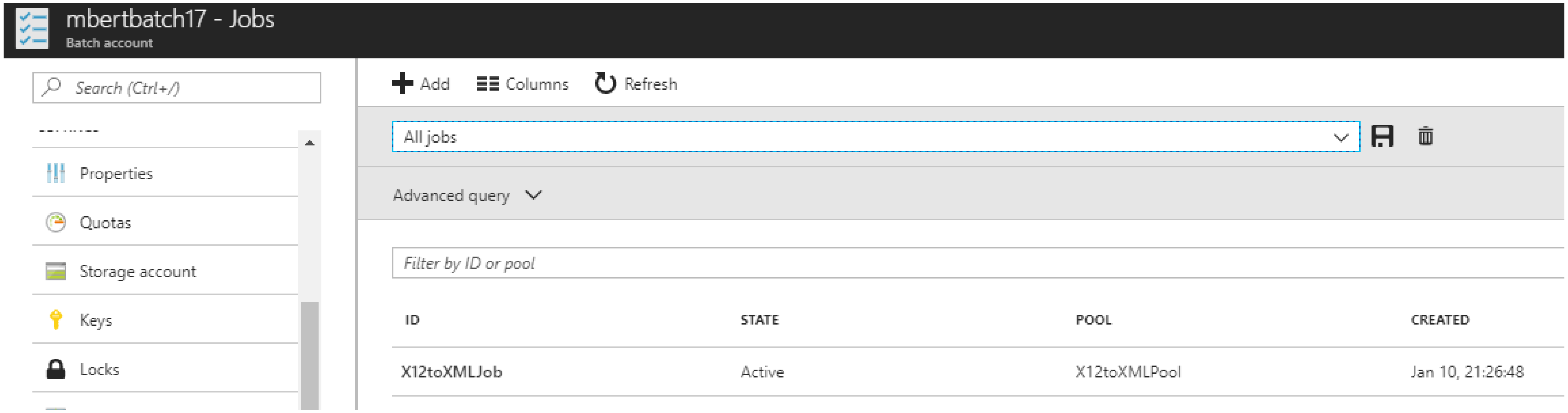
- A batch pool is created:



POOL ID	DEDICATED NODES	LOW-PRIORITY NODES	CURRENT CORES	VM SIZE	ALLOCATION STATE
X12toXMLPool	0 → 1	0	0	basic_a1	Resizing

X12 to XML conversion – Portal - 5

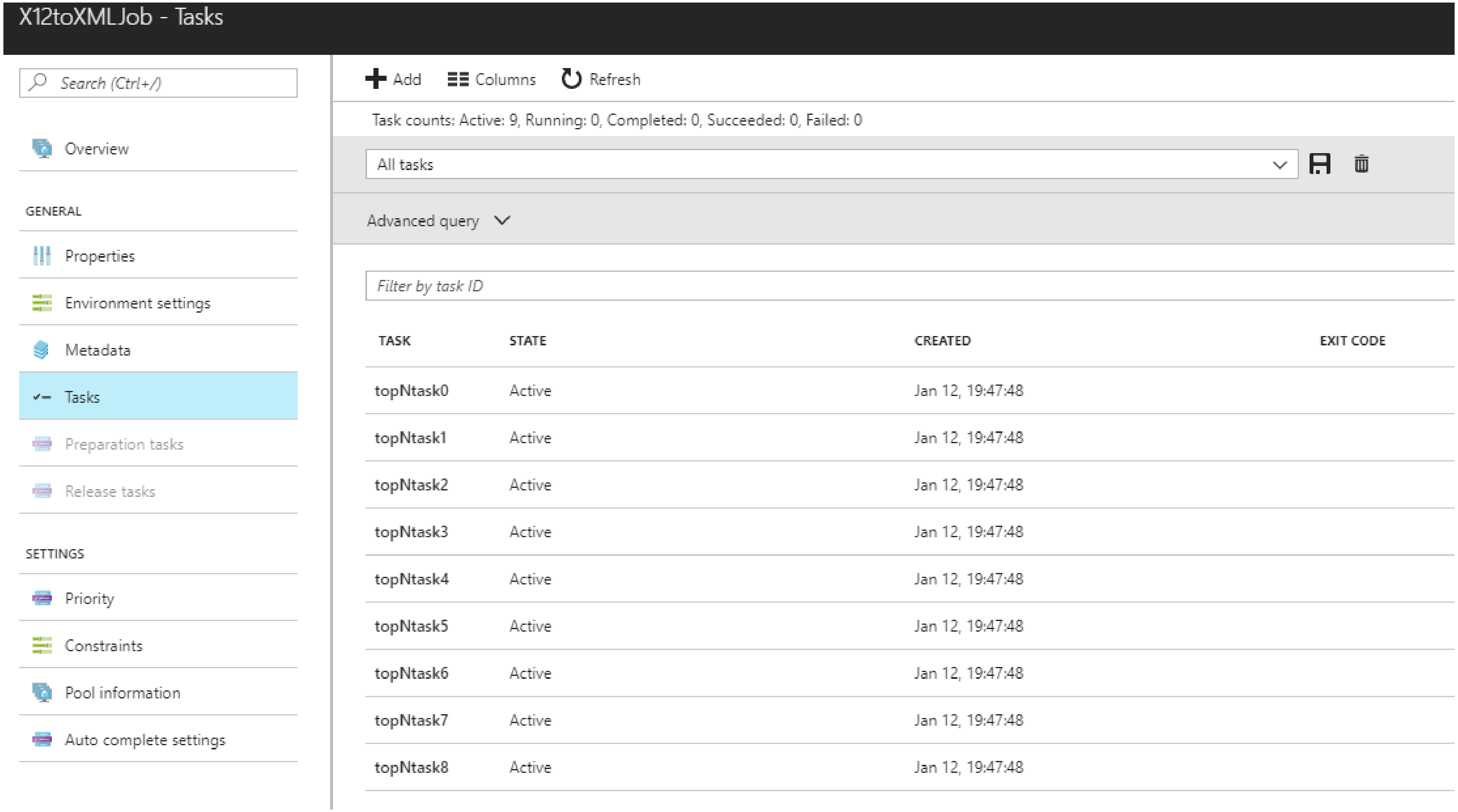
- A job is created:



ID	STATE	POOL	CREATED
X12toXMLJob	Active	X12toXMLPool	Jan 10, 21:26:48

X12 to XML conversion – Portal - 6

- Tasks are added to the job:



X12toXMLJob - Tasks

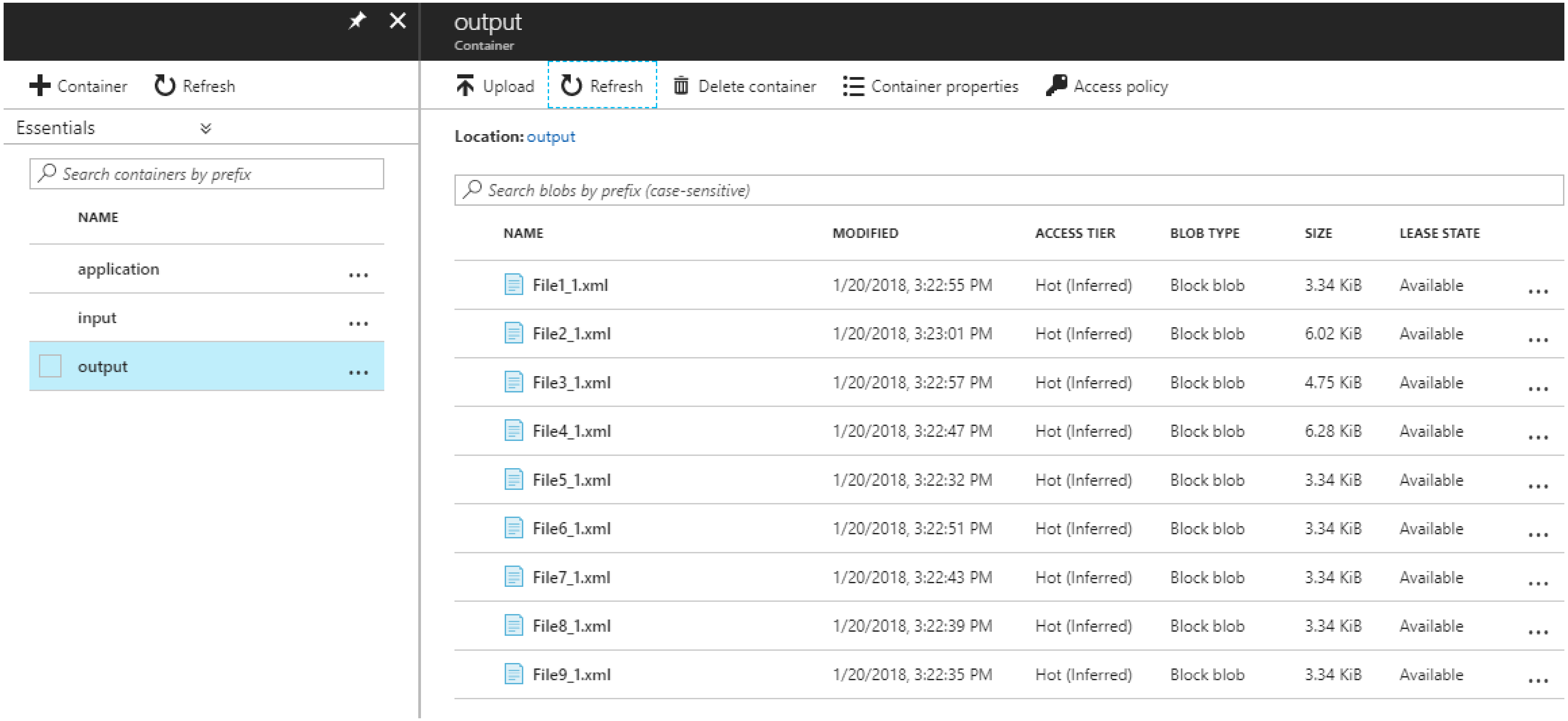
Task counts: Active: 9, Running: 0, Completed: 0, Succeeded: 0, Failed: 0

All tasks

TASK	STATE	CREATED	EXIT CODE
topNtask0	Active	Jan 12, 19:47:48	
topNtask1	Active	Jan 12, 19:47:48	
topNtask2	Active	Jan 12, 19:47:48	
topNtask3	Active	Jan 12, 19:47:48	
topNtask4	Active	Jan 12, 19:47:48	
topNtask5	Active	Jan 12, 19:47:48	
topNtask6	Active	Jan 12, 19:47:48	
topNtask7	Active	Jan 12, 19:47:48	
topNtask8	Active	Jan 12, 19:47:48	

X12 to XML conversion – Portal - 7

- As tasks complete the conversion, result files are uploaded to the Storage Account, in the “output” container:



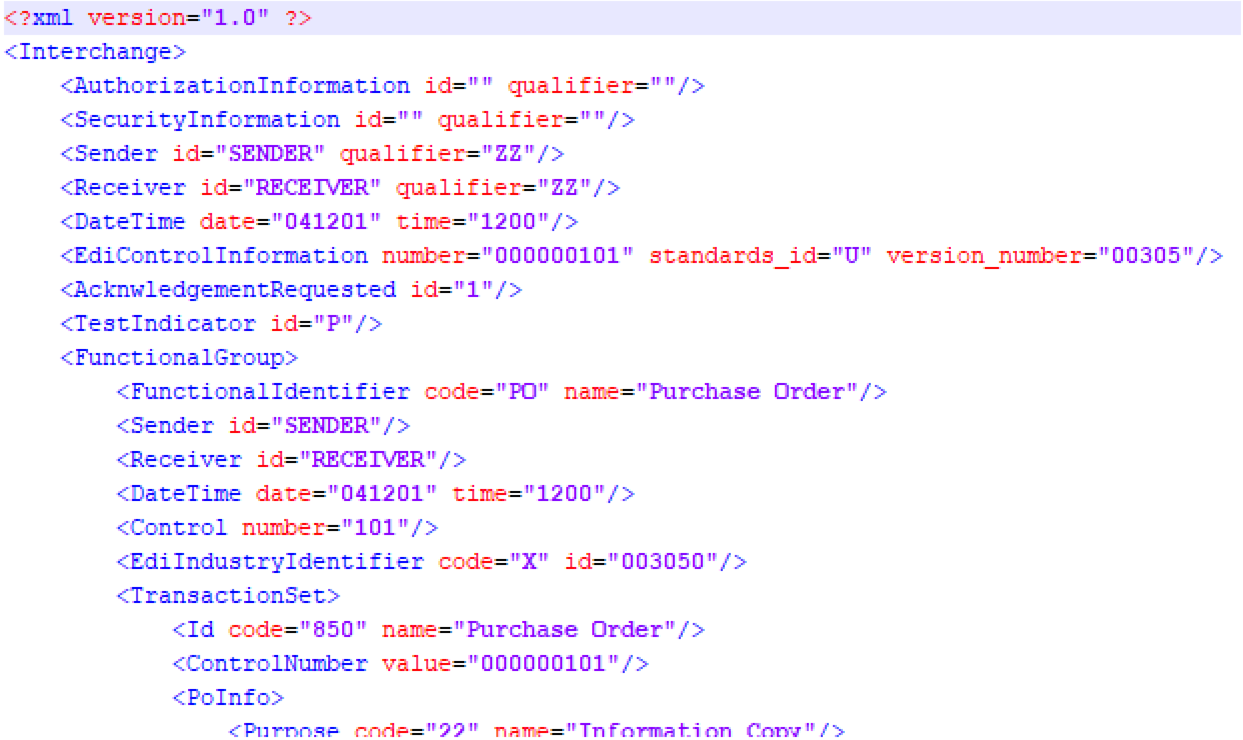
NAME
application
input
output

Location: output

NAME	MODIFIED	ACCESS TIER	BLOB TYPE	SIZE	LEASE STATE
File1_1.xml	1/20/2018, 3:22:55 PM	Hot (Inferred)	Block blob	3.34 KiB	Available
File2_1.xml	1/20/2018, 3:23:01 PM	Hot (Inferred)	Block blob	6.02 KiB	Available
File3_1.xml	1/20/2018, 3:22:57 PM	Hot (Inferred)	Block blob	4.75 KiB	Available
File4_1.xml	1/20/2018, 3:22:47 PM	Hot (Inferred)	Block blob	6.28 KiB	Available
File5_1.xml	1/20/2018, 3:22:32 PM	Hot (Inferred)	Block blob	3.34 KiB	Available
File6_1.xml	1/20/2018, 3:22:51 PM	Hot (Inferred)	Block blob	3.34 KiB	Available
File7_1.xml	1/20/2018, 3:22:43 PM	Hot (Inferred)	Block blob	3.34 KiB	Available
File8_1.xml	1/20/2018, 3:22:39 PM	Hot (Inferred)	Block blob	3.34 KiB	Available
File9_1.xml	1/20/2018, 3:22:35 PM	Hot (Inferred)	Block blob	3.34 KiB	Available

X12 to XML conversion – Results

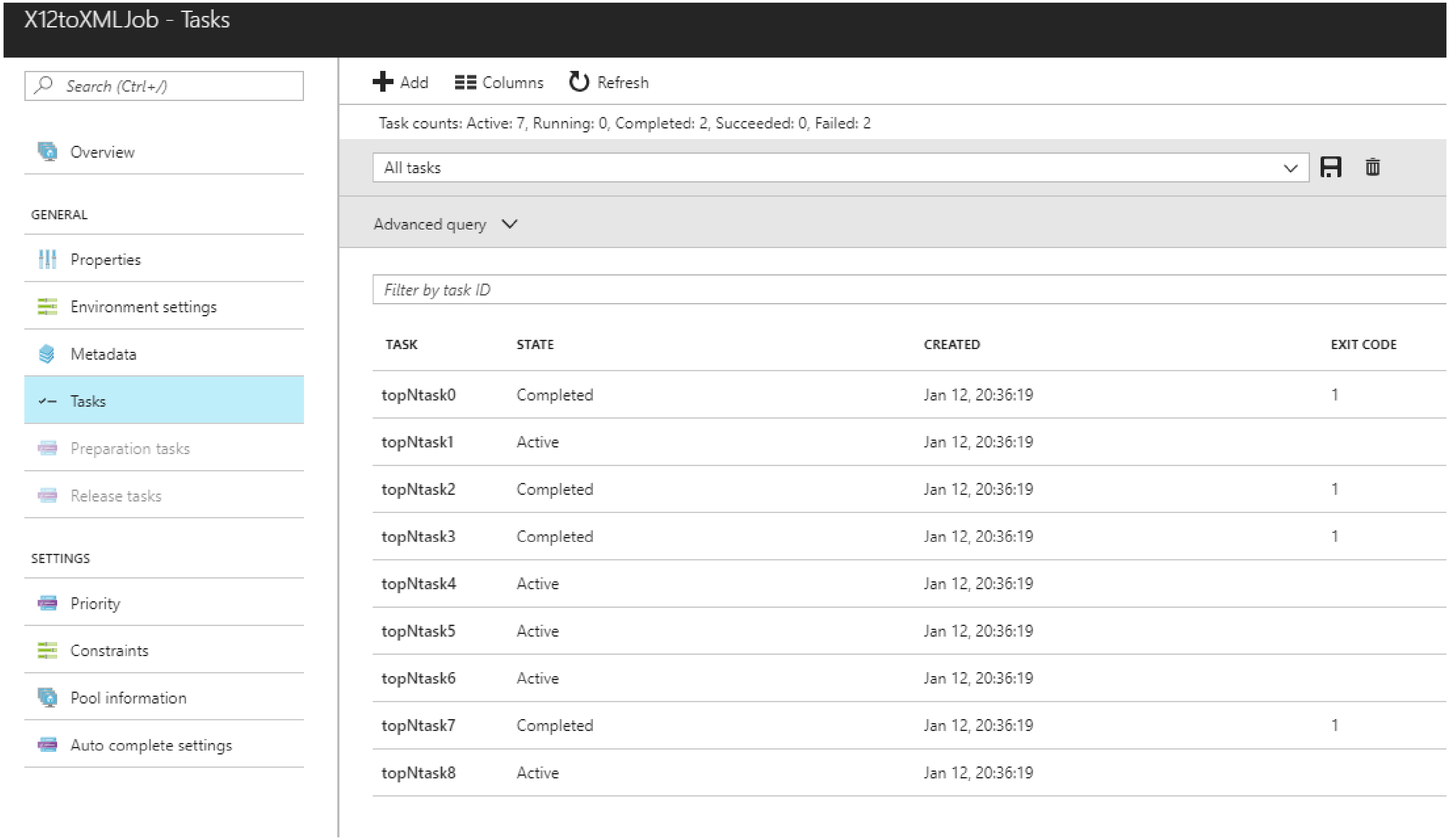
- Result files are downloaded from the “output” container of the Storage Account by the administration VM.
- If all goes well, these will now be XML representations of X12 files.



```
<?xml version="1.0" ?>
<Interchange>
    <AuthorizationInformation id="" qualifier=""/>
    <SecurityInformation id="" qualifier=""/>
    <Sender id="SENDER" qualifier="ZZ"/>
    <Receiver id="RECEIVER" qualifier="ZZ"/>
    <DateTime date="041201" time="1200"/>
    <EdiControlInformation number="000000101" standards_id="U" version_number="00305"/>
    <AcknwledgementRequested id="1"/>
    <TestIndicator id="P"/>
    <FunctionalGroup>
        <FunctionalIdentifier code="PO" name="Purchase Order"/>
        <Sender id="SENDER"/>
        <Receiver id="RECEIVER"/>
        <DateTime date="041201" time="1200"/>
        <Control number="101"/>
        <EdiIndustryIdentifier code="X" id="003050"/>
        <TransactionSet>
            <Id code="850" name="Purchase Order"/>
            <ControlNumber value="000000101"/>
            <PoInfo>
                <Purpose code="22" name="Information Copy"/>
```

Troubleshooting Batch

- The administration script only shows the tasks are completed, but does not show the exit code. While it is running, the status and exit codes can be seen in the console:



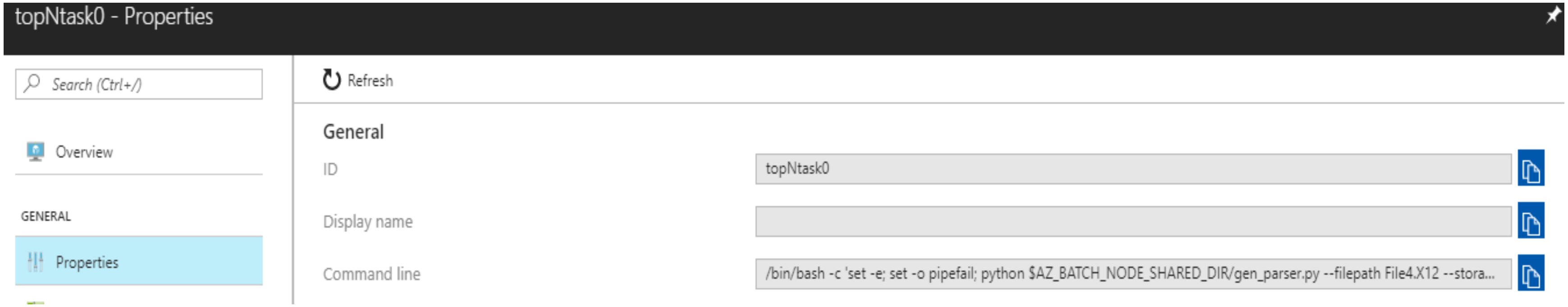
X12toXMLJob - Tasks

Task counts: Active: 7, Running: 0, Completed: 2, Succeeded: 0, Failed: 2

TASK	STATE	CREATED	EXIT CODE
topNtask0	Completed	Jan 12, 20:36:19	1
topNtask1	Active	Jan 12, 20:36:19	
topNtask2	Completed	Jan 12, 20:36:19	1
topNtask3	Completed	Jan 12, 20:36:19	1
topNtask4	Active	Jan 12, 20:36:19	
topNtask5	Active	Jan 12, 20:36:19	
topNtask6	Active	Jan 12, 20:36:19	
topNtask7	Completed	Jan 12, 20:36:19	1
topNtask8	Active	Jan 12, 20:36:19	

Troubleshooting Batch - 2

- You can verify the properties of a task, even after it is completed.
- The most crucial property is the command line.



General

ID: topNtask0

Display name:

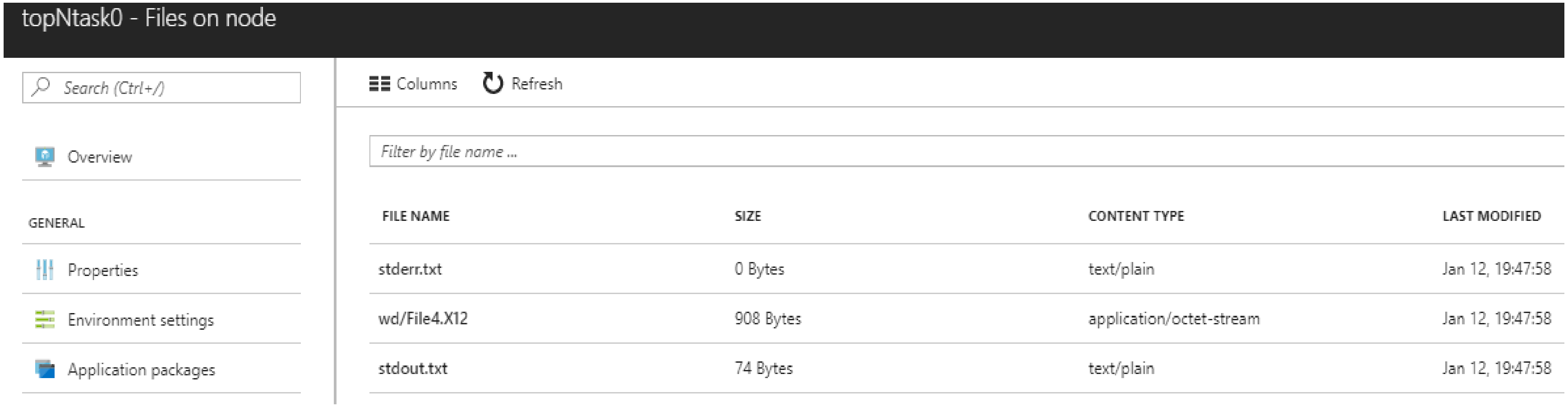
Command line:

```
/bin/bash -c 'set -e; set -o pipefail; python $AZ_BATCH_NODE_SHARED_DIR/gen_parser.py --filepath File4.X12 --stora...
```

- Ensure the command line is correct and the number of arguments to the application is correct.

Troubleshooting Batch - 3

- It is also possible to view certain files on the node that ran a task.



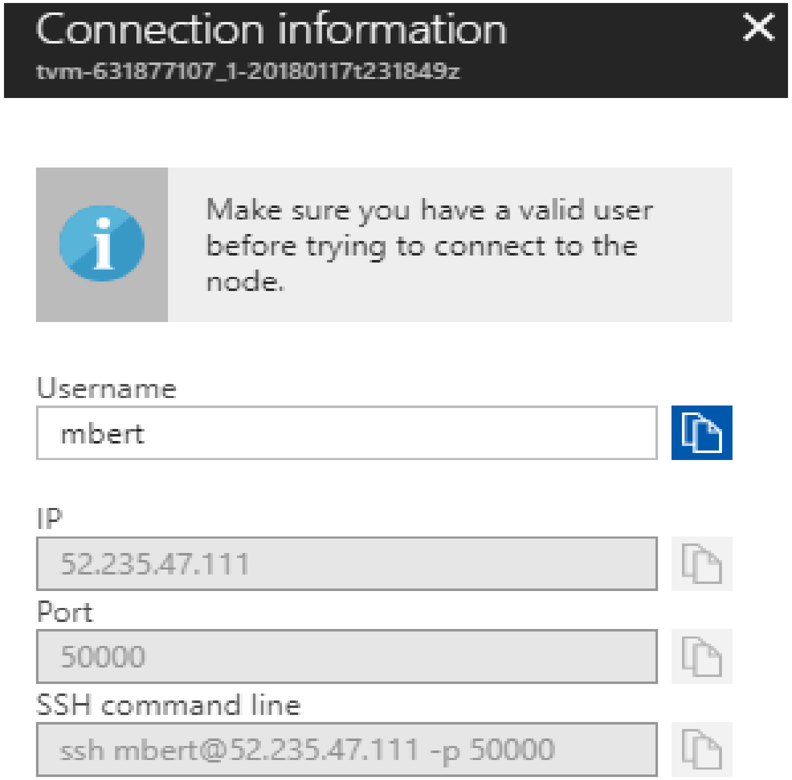
topNtask0 - Files on node

FILE NAME	SIZE	CONTENT TYPE	LAST MODIFIED
stderr.txt	0 Bytes	text/plain	Jan 12, 19:47:58
wd/File4.X12	908 Bytes	application/octet-stream	Jan 12, 19:47:58
stdout.txt	74 Bytes	text/plain	Jan 12, 19:47:58

- The most useful for debugging are “stderr.txt” and “stdout.txt”, which contain the output of the conversion script.

Troubleshooting Batch - 4

- It is also possible to SSH connect directly to a node for further troubleshooting and tests.
- Select “Connect” in the sub-menu displayed when clicking on the ··· icon.
- You will have the option of adding a user.
- Azure will then display connect information.



Connection information

tvm-631877107_1-20180117t231849z

Make sure you have a valid user before trying to connect to the node.

Username: mbert

IP: 52.235.47.111

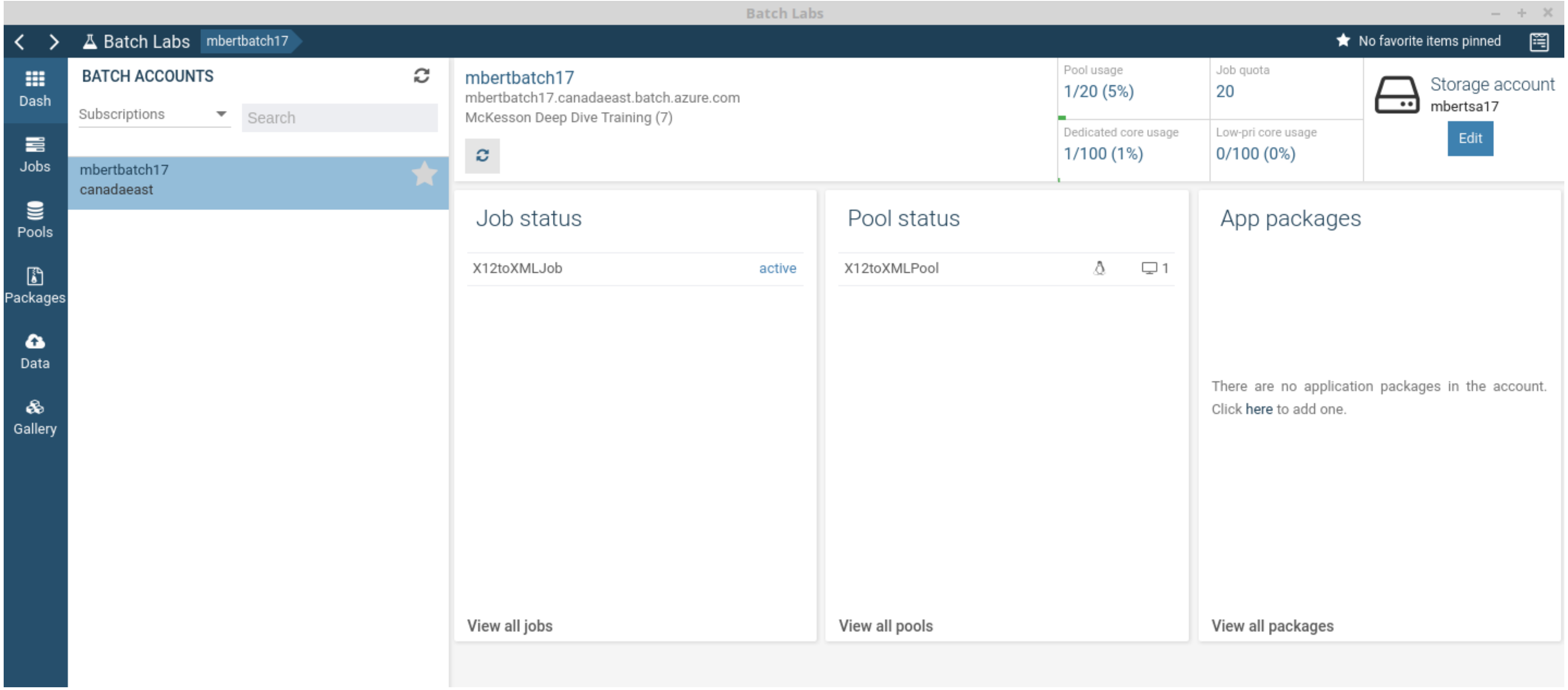
Port: 50000

SSH command line:

```
ssh mbert@52.235.47.111 -p 50000
```

Batch Labs

- Azure Portal is the primary tool for administering Azure Batch.
- Microsoft also provides Batch Labs (https://azure.github.io/BatchLabs).
- It can be used to create, debug and monitor Batch applications.
- Batch Labs dash view while running the demo application:



mbertbatch17
canadaeast

mbertbatch17
mbertbatch17.canadaeast.batch.azure.com
McKesson Deep Dive Training (7)

Pool usage: 1/20 (5%)
Job quota: 20
Dedicated core usage: 1/100 (1%)
Low-pri core usage: 0/100 (0%)
Storage account: mbertsa17

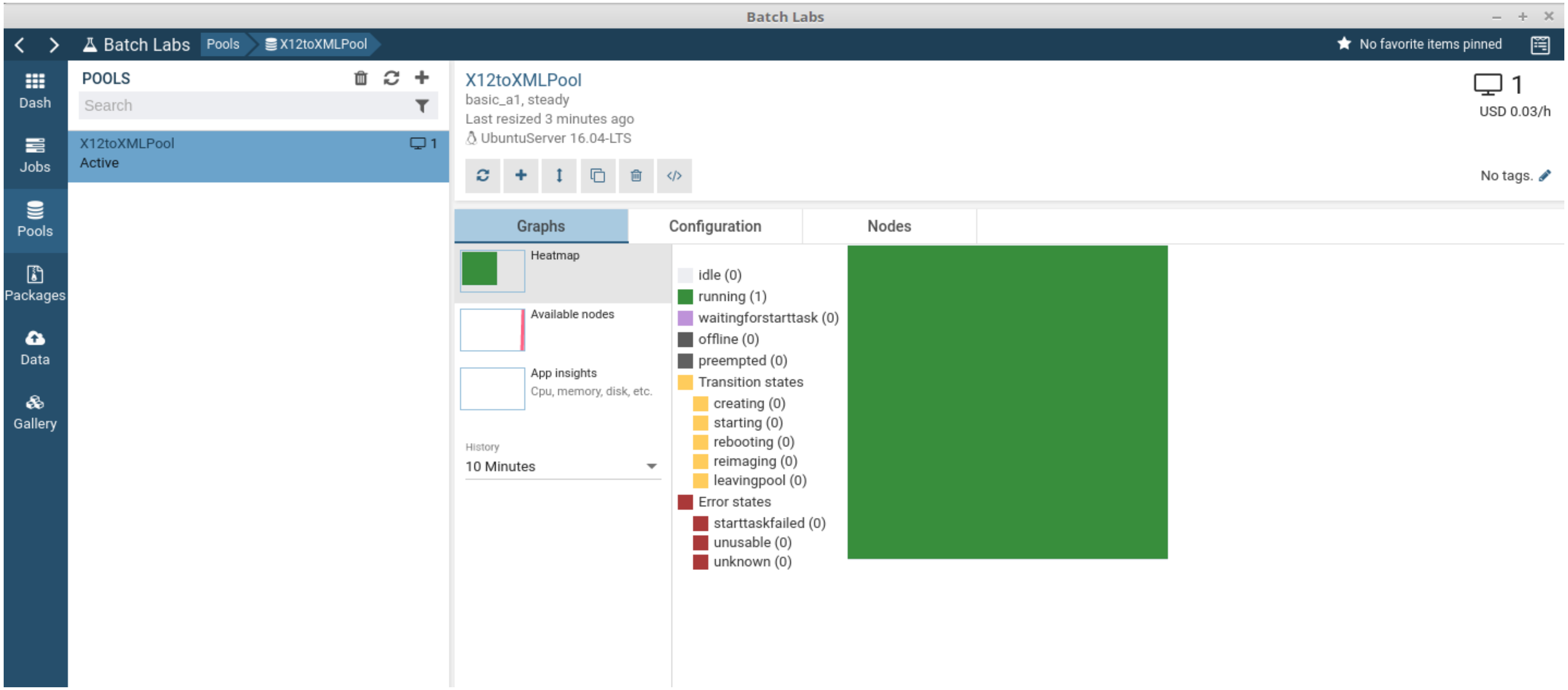
Job status
X12toXMLJob active

Pool status
X12toXMLPool 1

App packages
There are no application packages in the account. Click here to add one.

Batch Labs - 2

- Batch Labs Pools view while running the demo application:



X12toXMLPool 🖵 1
Active

X12toXMLPool
basic_a1, steady
Last resized 3 minutes ago
UbuntuServer 16.04-LTS

🖵 1
USD 0.03/h

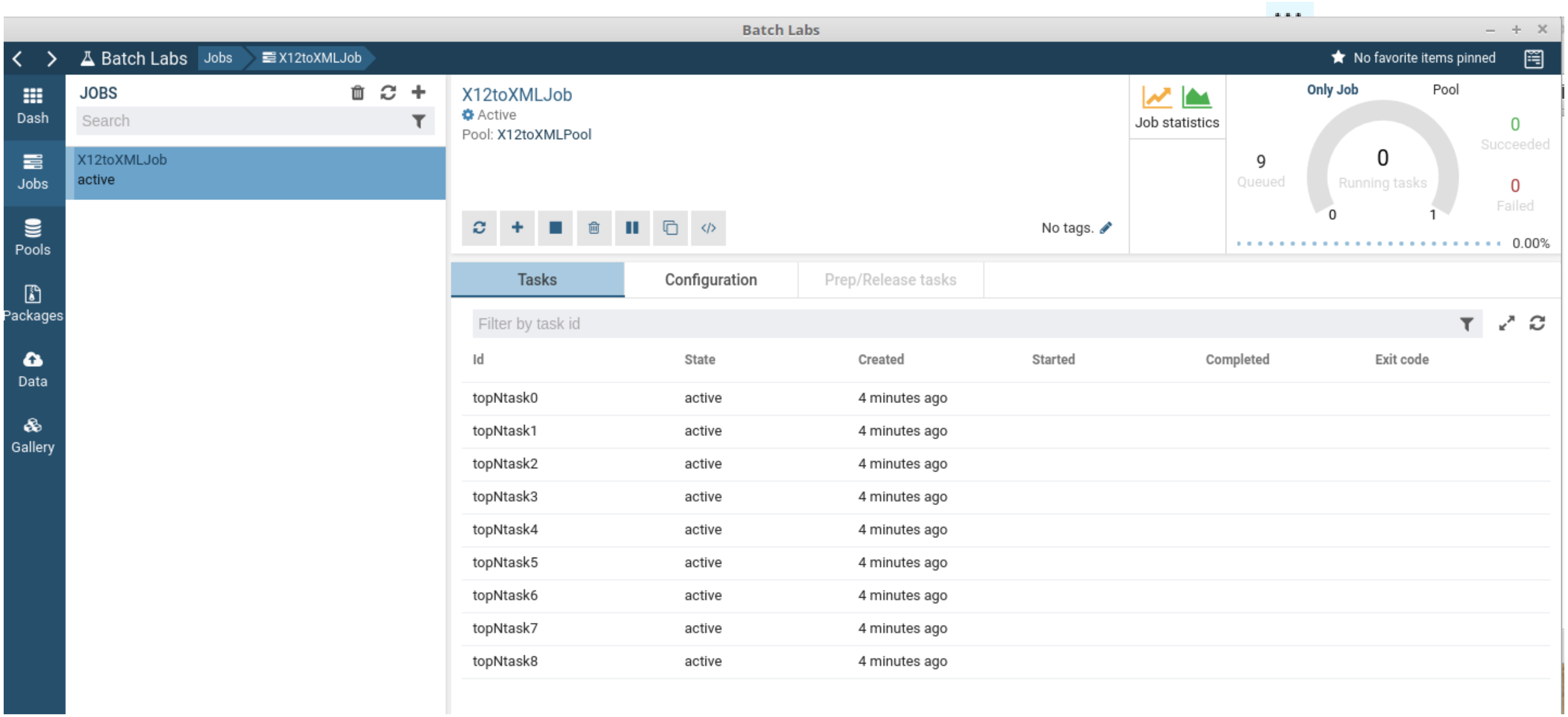
No tags.

History: 10 Minutes

- idle (0)
- 🟩 running (1)
- waitingforstarttask (0)
- offline (0)
- preempted (0)
- 🟨 Transition states
  - 🟨 creating (0)
  - 🟨 starting (0)
  - 🟨 rebooting (0)
  - 🟨 reimaging (0)
  - 🟨 leavingpool (0)
- 🟥 Error states
  - 🟥 starttaskfailed (0)
  - 🟥 unusable (0)
  - 🟥 unknown (0)

Batch Labs - 3

- Batch Labs Jobs view while running the demo application:



X12toXMLJob
active

X12toXMLJob
Active
Pool: X12toXMLPool

No tags.

9 Queued
0 Running tasks
0 Succeeded
0 Failed
0.00%

Id	State	Created	Started	Completed	Exit code
topNtask0	active	4 minutes ago			
topNtask1	active	4 minutes ago			
topNtask2	active	4 minutes ago			
topNtask3	active	4 minutes ago			
topNtask4	active	4 minutes ago			
topNtask5	active	4 minutes ago			
topNtask6	active	4 minutes ago			
topNtask7	active	4 minutes ago			
topNtask8	active	4 minutes ago			

YouTube URLs, GitHub URL

- Two minute (short):
- 15 minutes (long):
- GitHub Repository with all artifacts: