



GT-SUITE On-Demand Cloud Solution

Agenda

- Distributed Computing in GT-SUITE
- On-demand Cloud Solution
 - Why Use Cloud?
 - Common Use Cases
 - Example
 - How does it work?
 - End-User Perspective
 - Administrator Perspective



Distributed Computing in GT-SUITE

- Common for GT model to be split by operating conditions, i.e. “cases”

Case Setup - C:\GTI\w2022\examples\Engine_1D_Gas_Exchange_Combustion\Gasoline\SI_4cyl_Basic\SI_4cyl_Basic.gtm

Home | Advanced

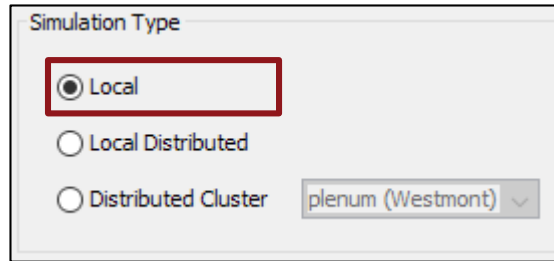
Help | Append Case | Insert Case | Delete Case | Turn All Cases ON | Turn All Cases OFF | Sort Cases | Filter Cases | Add Parameter | Add Super Parameter | Delete Parameter | Find Parameter | Show Formula | Replace | Move Up | Move Down | Add Folder | Hide Folder | Unhide Folder | Import Parameters from Model/GTO | Assign Excel/Text Values to Parameters

Main | Design of Experiments | All

Parameter	Unit	Description	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Case On/Off		Check Box to Turn Case On	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Case Label		Unique Text for Plot Legends	RPM = 6000	RPM = 5500	RPM = 5000	RPM = 4500	RPM = 4000	RPM = 3500	RPM = 3000	RPM = 2500
Ambient-Press	bar	Ambient Pressure	1	1	1	1	1	1	1	1
Ambient-Temp	K	Ambient Temperature	298	298	298	298	298	298	298	298
Ambient-TManifoldExt	K	Ambient Temp Surrounding Manifold	323	323	323	323	323	323	323	323
MuftWall	K	Muffler wall temperature	800	800	800	800	800	800	800	800
ncyc		Simulation Duration	40	40	40	40	40	40	40	40
RPM	RPM	Engine Speed	6000	5500	5000	4500	4000	3500	3000	2500
throtang		Throttle Angle	90	90	90	90	90	90	90	90

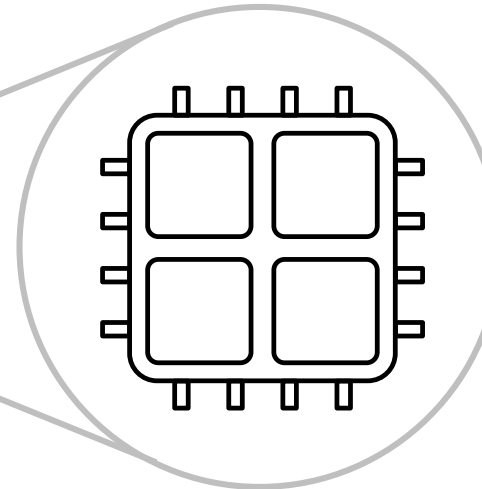


Distributed Computing in GT-SUITE

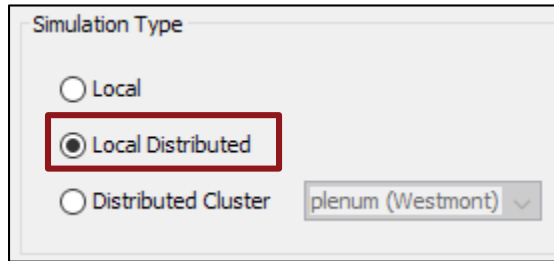


Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RPM = 6000	RPM = 5500	RPM = 5000	RPM = 4500	RPM = 4000	RPM = 3500	RPM = 3000	RPM = 2500
1 ...	1 ...	1 ...	1 ...	1 ...	1 ...	1 ...	1 ...
298 ...	298 ...	298 ...	298 ...	298 ...	298 ...	298 ...	298 ...
323 ...	323 ...	323 ...	323 ...	323 ...	323 ...	323 ...	323 ...
800 ...	800 ...	800 ...	800 ...	800 ...	800 ...	800 ...	800 ...
40 ...	40 ...	40 ...	40 ...	40 ...	40 ...	40 ...	40 ...
6000 ...	5500 ...	5000 ...	4500 ...	4000 ...	3500 ...	3000 ...	2500 ...
90 ...	90 ...	90 ...	90 ...	90 ...	90 ...	90 ...	90 ...

Example: If each case takes 5 minutes to run...
8 cases x 5 minutes = **40 minutes**

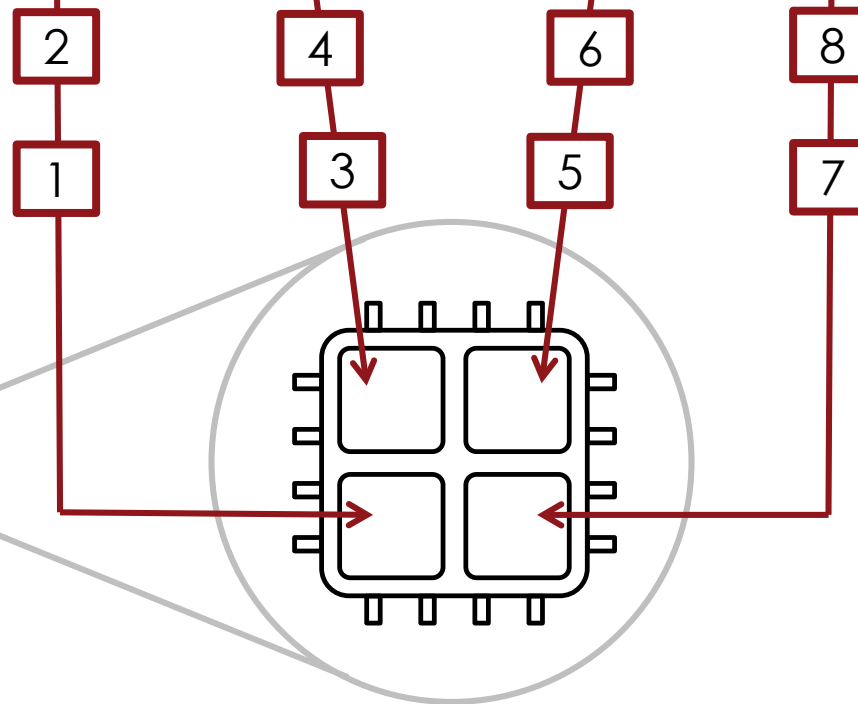


Distributed Computing in GT-SUITE

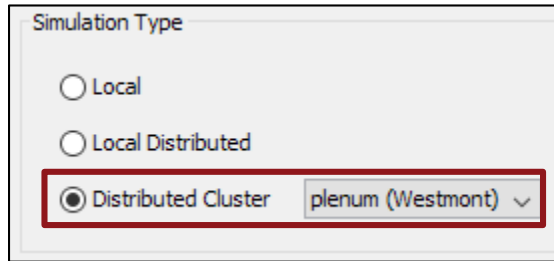


Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RPM = 6000	RPM = 5500	RPM = 5000	RPM = 4500	RPM = 4000	RPM = 3500	RPM = 3000	RPM = 2500
1 ...	1 ...	1 ...	1 ...	1 ...	1 ...	1 ...	1 ...
298 ...	298 ...	298 ...	298 ...	298 ...	298 ...	298 ...	298 ...
323 ...	323 ...	323 ...	323 ...	323 ...	323 ...	323 ...	323 ...
800 ...	800 ...	800 ...	800 ...	800 ...	800 ...	800 ...	800 ...
40 ...	40 ...	40 ...	40 ...	40 ...	40 ...	40 ...	40 ...
6000 ...	5500 ...	5000 ...	4500 ...	4000 ...	3500 ...	3000 ...	2500 ...
90 ...	90 ...	90 ...	90 ...	90 ...	90 ...	90 ...	90 ...

Example: If each case takes 5 minutes to run...
8 cases / 4 cores x 5 minutes = **10 minutes**



Distributed Computing in GT-SUITE



Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RPM = 6000	RPM = 5500	RPM = 5000	RPM = 4500	RPM = 4000	RPM = 3500	RPM = 3000	RPM = 2500
1 ...	1 ...	1 ...	1 ...	1 ...	1 ...	1 ...	1 ...
298 ...	298 ...	298 ...	298 ...	298 ...	298 ...	298 ...	298 ...
323 ...	323 ...	323 ...	323 ...	323 ...	323 ...	323 ...	323 ...
800 ...	800 ...	800 ...	800 ...	800 ...	800 ...	800 ...	800 ...
40 ...	40 ...	40 ...	40 ...	40 ...	40 ...	40 ...	40 ...
6000 ...	5500 ...	5000 ...	4500 ...	4000 ...	3500 ...	3000 ...	2500 ...
90 ...	90 ...	90 ...	90 ...	90 ...	90 ...	90 ...	90 ...

Example: If each case takes 5 minutes to run...
8 cases / 8 cores x 5 minutes = **5 minutes**



Distributed Computing in GT-SUITE

Simulation Type

Local

Local Distributed

Distributed Cluster

Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RPM = 6000	RPM = 5500	RPM = 5000	RPM = 4500	RPM = 4000	RPM = 3500	RPM = 3000	RPM = 2500
1 ...	1 ...	1 ...	1 ...	1 ...	1 ...	1 ...	1 ...
298 ...	298 ...	298 ...	298 ...	298 ...	298 ...	298 ...	298 ...
323 ...	323 ...	323 ...	323 ...	323 ...	323 ...	323 ...	323 ...
800 ...	800 ...	800 ...	800 ...	800 ...	800 ...	800 ...	800 ...
40 ...	40 ...	40 ...	40 ...	40 ...	40 ...	40 ...	40 ...
6000 ...	5500 ...	5000 ...	4500 ...	4000 ...	3500 ...	3000 ...	2500 ...
90 ...	90 ...	90 ...	90 ...	90 ...	90 ...	90 ...	90 ...

Example: If each case takes 5 minutes to run...
8 cases / 8 cores x 5 minutes = **5 minutes**

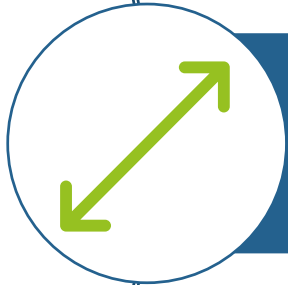


Why Use Cloud?



Get Results Faster

- Usage tracked by time instead of solver instances (no license limits)
- More concurrent simulations, less queuing time



Elastic Burst Computing Capabilities

- Automatic scaling of resources based on demand
- Occasional large DOE studies, urgent projects, seasonal variation in simulation needs



Accessibility and Reliability

- Reduce need to set up and maintain costly hardware on-premises
- Powerful high-performance computing available to all organizations



Common Use Cases

Occasional Large Design Studies

- Design of experiments
- Optimization studies
- Occurs periodically during development

Urgent Projects

- Last minute design changes
- Component failure in the field
- Immediate investigation and fast results required

Variations in Simulation Needs

- Fluctuating demand during development cycle
- Periods of high peak usage and lower baseline usage



Example Use Case

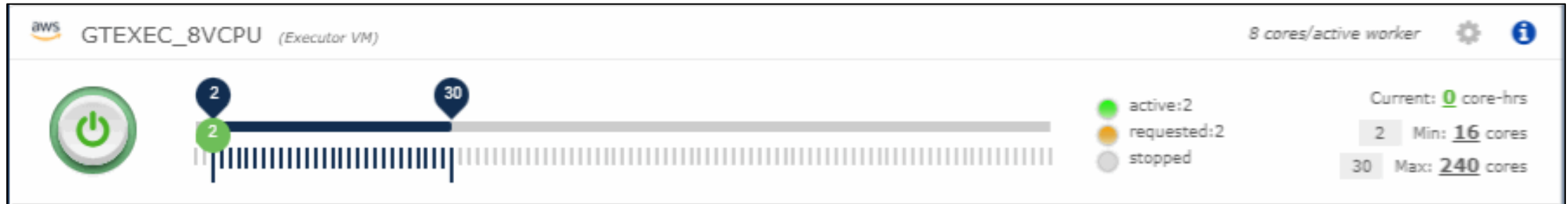
- Design of Experiments early in the development process:
 - Want to look at 8,000 DOE experiments x 5 operating points = **40,000 cases**
 - Moderately complex model, approximately **3 minutes per case**

	Local (Serial) Solver	On-Premises Distributed Cluster	On-Demand Cloud Solution
Cores / Concurrent Cases	1	40	800
Cases in Model	40,000	40,000	40,000
Runtime Per Case	3 minutes	3 minutes	3 minutes
Results Merging Time	None	30 minutes	30 minutes
Core-Hours Required	2,000 core-hours	2,000.5 core-hours	2,000.5 core-hours
Actual Model Runtime	2,000 hours	50.5 hours	3 hours



How Does It Work?

- GT provides a complete platform via partnership with Parallel Works
 - Software images for GT-SUITE / Distributed Service deployed to cloud
 - Dedicated hardware and licensing set up per customer
 - Jobs are submitted to Distributed Service in the cloud (same as on-premises)
 - Usage tracked by time (core-hour)—no license limit on concurrent solver instances
 - Automatic scaling of compute resources based on current demand



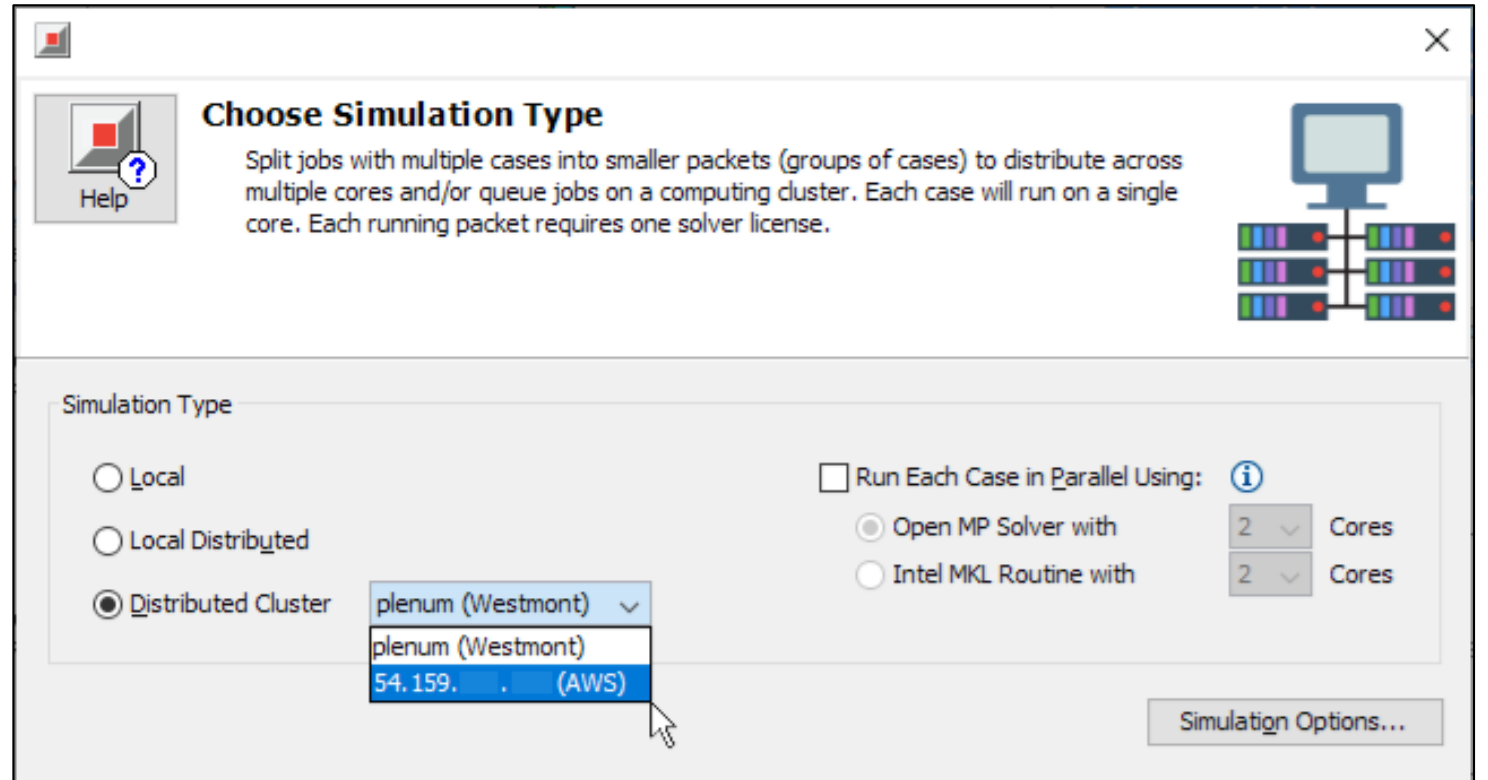
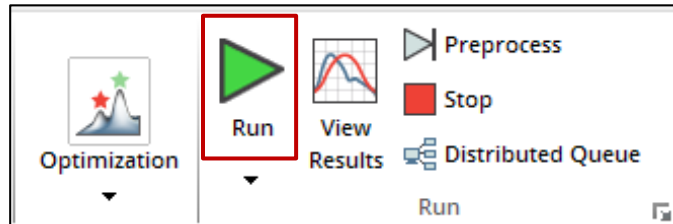
How Does It Work?

- Cloud Hardware Providers:

- GT-provided: Google Cloud Platform
- “Bring Your Own”: Google Cloud Platform, Amazon AWS, Microsoft Azure



End-User Perspective



***Supported in all versions starting in v2018 and newer**



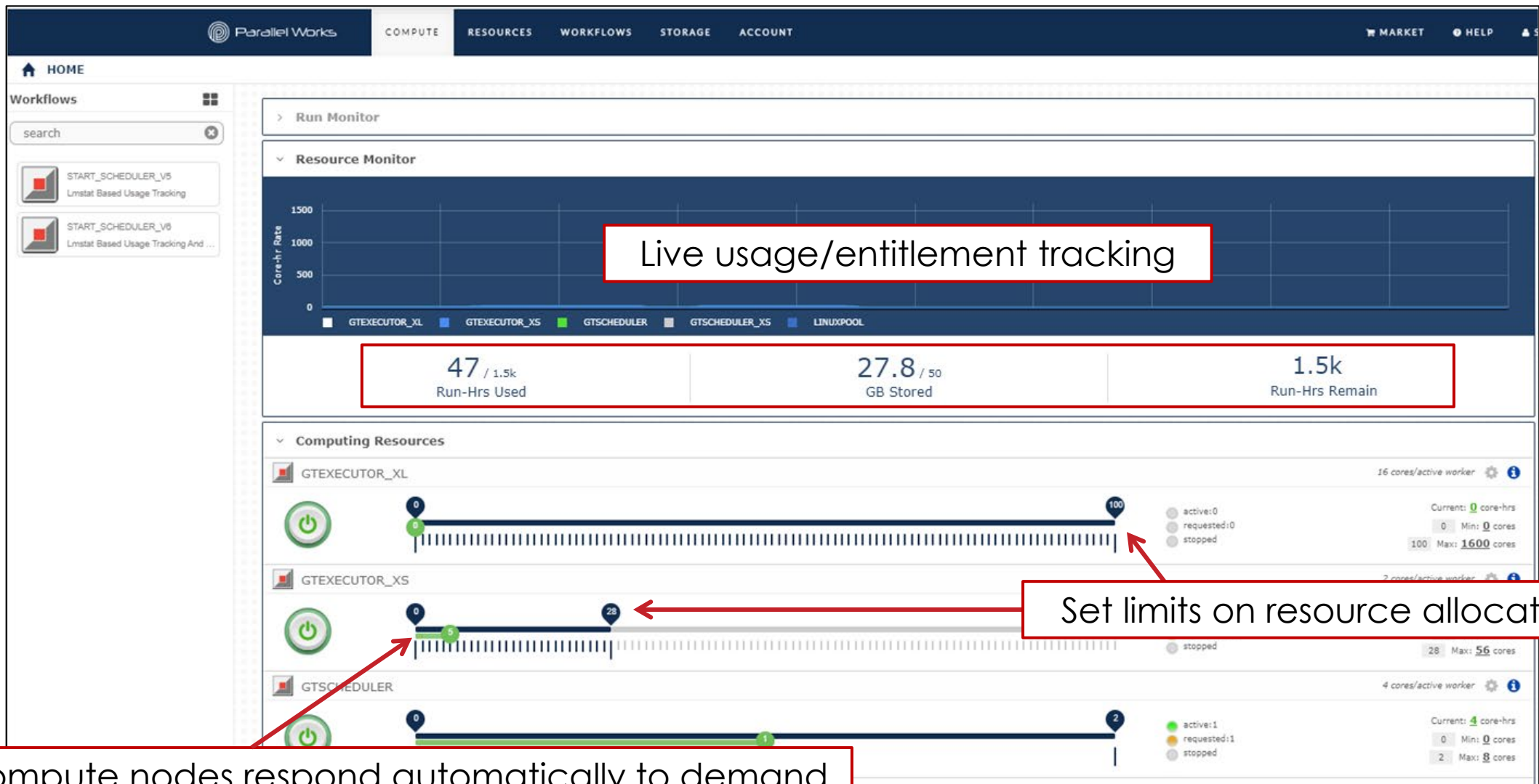
End-User Perspective

The screenshot displays the 'Distributed Queue' application window. The title bar shows 'Distributed Queue' and a close button. The main window has a tab labeled 'GSUTKV • DOE_for_Max_Torque'. Below the tab is a toolbar with several groups of icons: 'Navigate' (Home, Close Tab), 'Job Options' (Resubmit, Pause, Resume, Skip Case, Stop), 'Results' (Download Results, View Results in GT-POST), 'Job Info' (View Job Summary, View Logs), and 'View' (Reset View). Below the toolbar is a table with the following columns: Description, Solver Host, Version, Status, Elapsed, Pend, Run, Done, Skip, and ID↓. The table contains 14 rows of job data.

Description	Solver Host	Version	Status	Elapsed	Pend	Run	Done	Skip	ID↓
Split Simulation			Completed	0s	0	0	0	0	0000
Cases 1 to 4		2021.1.1118	Running	11s	0	1	3	0	0001-00
Cases 5 to 8		2021.1.1118	Running	11s	1	1	2	0	0002-00
Cases 9 to 12		2021.1.1118	Running	11s	1	1	2	0	0003-00
Cases 13 to 16		2021.1.1118	Running	11s	1	1	2	0	0004-00
Cases 17 to 20		2021.1.1118	Running	11s	0	1	3	0	0005-00
Cases 21 to 24		2021.1.1118	Running	11s	0	1	3	0	0006-00
Cases 25 to 28		2021.1.1118	Running	11s	1	1	2	0	0007-00
Cases 29 to 32		2021.1.1118	Running	11s	1	1	2	0	0008-00
Cases 33 to 36			Queued	13s	4	0	0	0	0009
Cases 37 to 40			Queued	13s	4	0	0	0	0010
Cases 41 to 44			Queued	13s	4	0	0	0	0011
Cases 45 to 48			Queued	13s	4	0	0	0	0012
Cases 49 to 52			Queued	13s	4	0	0	0	0013



Administrator Perspective



Administrator Perspective



Distributed Computing Status

[\[Home\]](#)
[\[Admin Portal\]](#)

Scheduler Overview

ID: 02f40b0b-2d76-4d55-97f8-6e42df53ce7d
Creation Time: 2020-06-29T12:55:52.553Z
Added Job Count: 27937
Removed Job Count: 15859
Present Job Count: 12078
Event Count: 281795
Queued Event Count: 0
Task Count: 70327
Queued Task Count: 0
Thread Count: 20
Snapshot Count: 62
Pending Transaction Count: 0
[Configuration Properties...](#)

Capabilities ⁶

Job Pause Enabled: true
Number of Free Cores: 0
Operation Inhibited: false
Solver Builds:
Solver Versions: 2016, 2017, 2018, 2019, 2020
Total Number of Cores: 3072

Clients ¹

Host Name	Type	Connected	User Name
gtisoft.com	2gen	2020-06-29T17:57:24.673Z	

Executors ⁹⁶

Batch Jobs ²

ID	Created	Name	Owner	Priority	Status	Elapsed Time	Solver		Case Count			
							Host	Version	Pending	Running	Done	Skipped
A6X67L	2020-06-29T18:12:34.539Z	DOE_for_Max_Torque-V2020		Normal	Completed	PT40M21.731S			0	0	40000	0
7Q7RT0	2020-06-29T17:58:06.148Z	DOE_for_Max_Torque		Normal	Completed	PT47M17.695S			0	0	40000	0



Summary



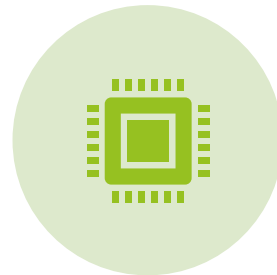
Faster results on large and complex models



Scalable resources to meet fluctuating needs



Efficient management of cloud hardware



Accessible high-performance computing for all organizations



Questions

- To learn more about the on-demand cloud solution, please contact your account representative or email support@gtisoft.com

