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Introduction

Microsoft Windows Azure

Use cases

Space Situational Awareness using a cloud based architecture

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Tools

Summary

Space situational awareness

- Space Surveillance and Tracking (SST) of man-made space objects
- Space Weather (SWE) monitoring and forecasting
- Near-Earth Object (NEO) surveillance and tracking
- “Clouds in Space” project
  - Active debris removal
  - Example of cloud computing applied to SSA (Windows Azure)

What is Cloud computing?

- Pay-per-use
- Quick provisioning
- Unlimited resources ($)
- Compare with a datacentre or outsourcing
  - Bulk hardware purchase
  - Bulk admin
  - High utilisation
- No capital cost / lead time
- “Architect well and trade time for cost”

Cloud types

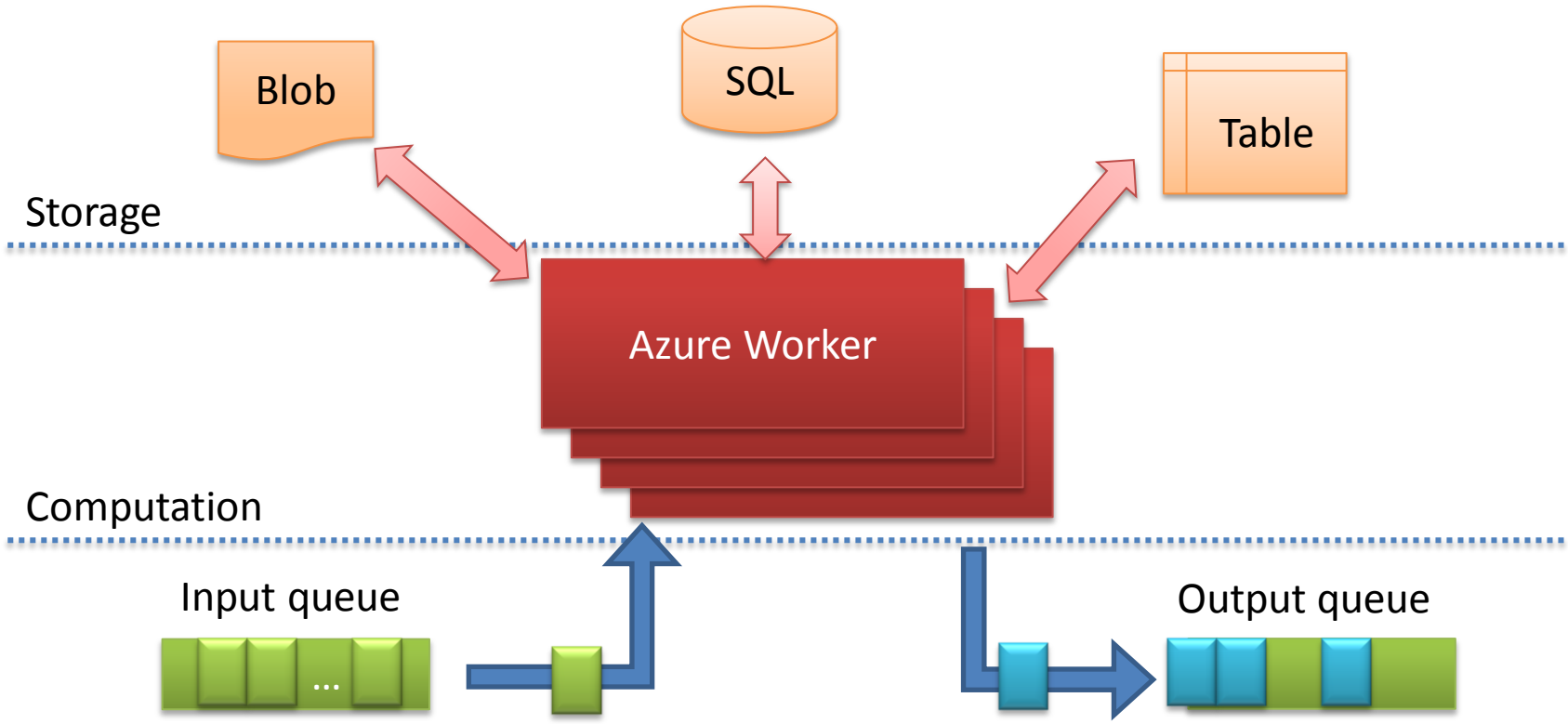
- Infrastructure as a Service (IaaS)
  - Cloud IaaS sells/rents out infrastructure such as servers, virtual machines and networking. For example renting a virtual machine on Amazon EC2
- Platform as a Service (PaaS)
  - Often build upon IaaS, cloud PaaS offerings include an Operating System and perhaps a software stack. For example Microsoft Windows Azure Workers
- Software as a Service (SaaS)
  - SaaS offers an end user application. For example SalesForce CRM

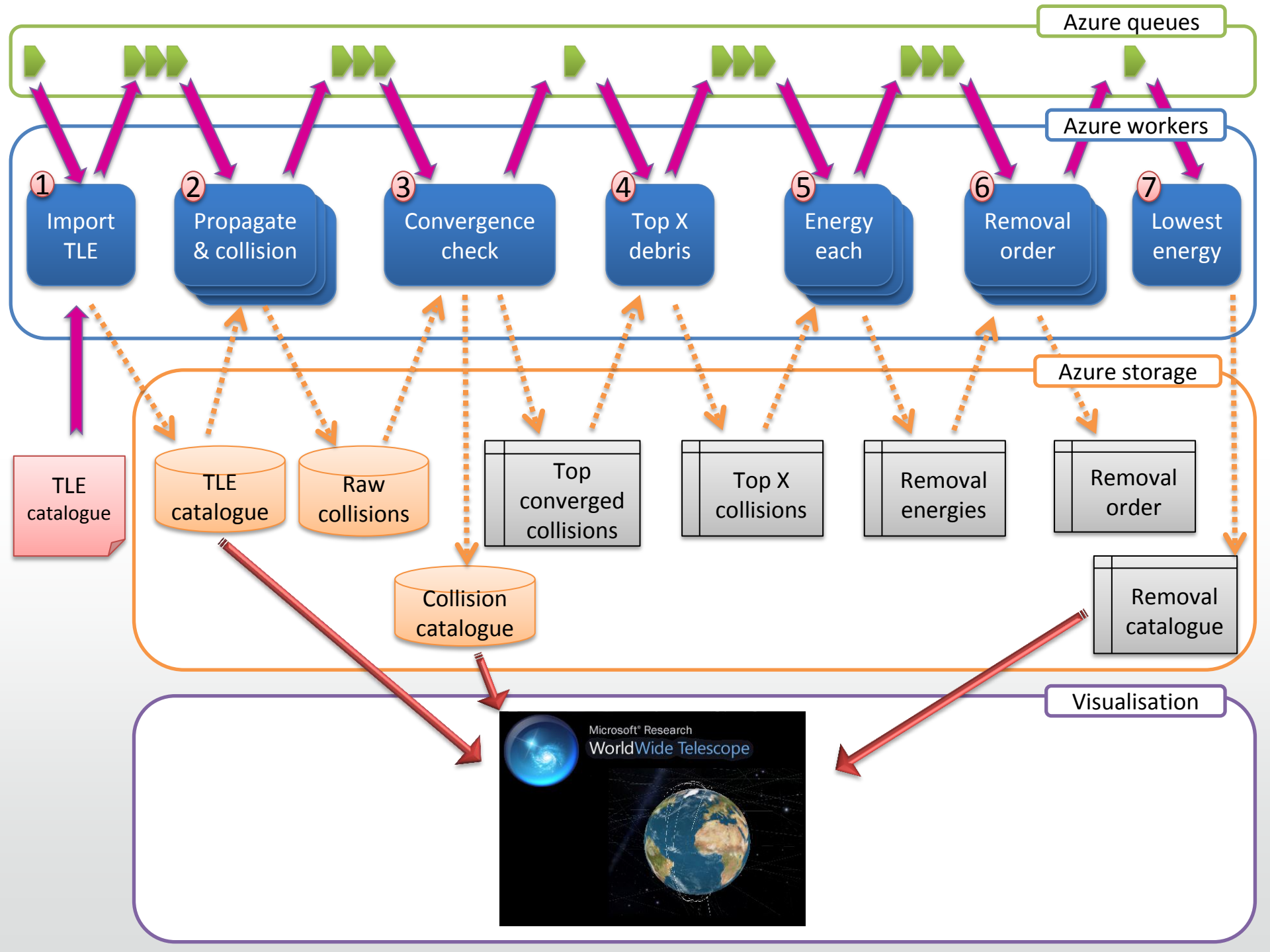
Microsoft Windows Azure

- Azure Compute
  - Windows 2008 R2 (64 bit)
  - VM Role (build locally)
  - Scale out (more hardware)
  - Scale up (faster hardware)
- Azure Storage
  - Blob
  - Table
  - Queue
  - SQL Azure
  - Consider database sharding over scale-up

Image: www.microsoft.com/windowsazure

Architecture pattern




Azure queues
Azure workers
1
Import TLE
2
Propagate & collision
3
Convergence check
4
Top X debris
5
Energy each
6
Removal order
7
Lowest energy
Azure storage
TLE catalogue
TLE catalogue
Raw collisions
Top converged collisions
Top X collisions
Removal energies
Removal order
Collision catalogue
Removal catalogue
Visualisation
Microsoft® Research
WorldWide Telescope

On/Off or Burst capability

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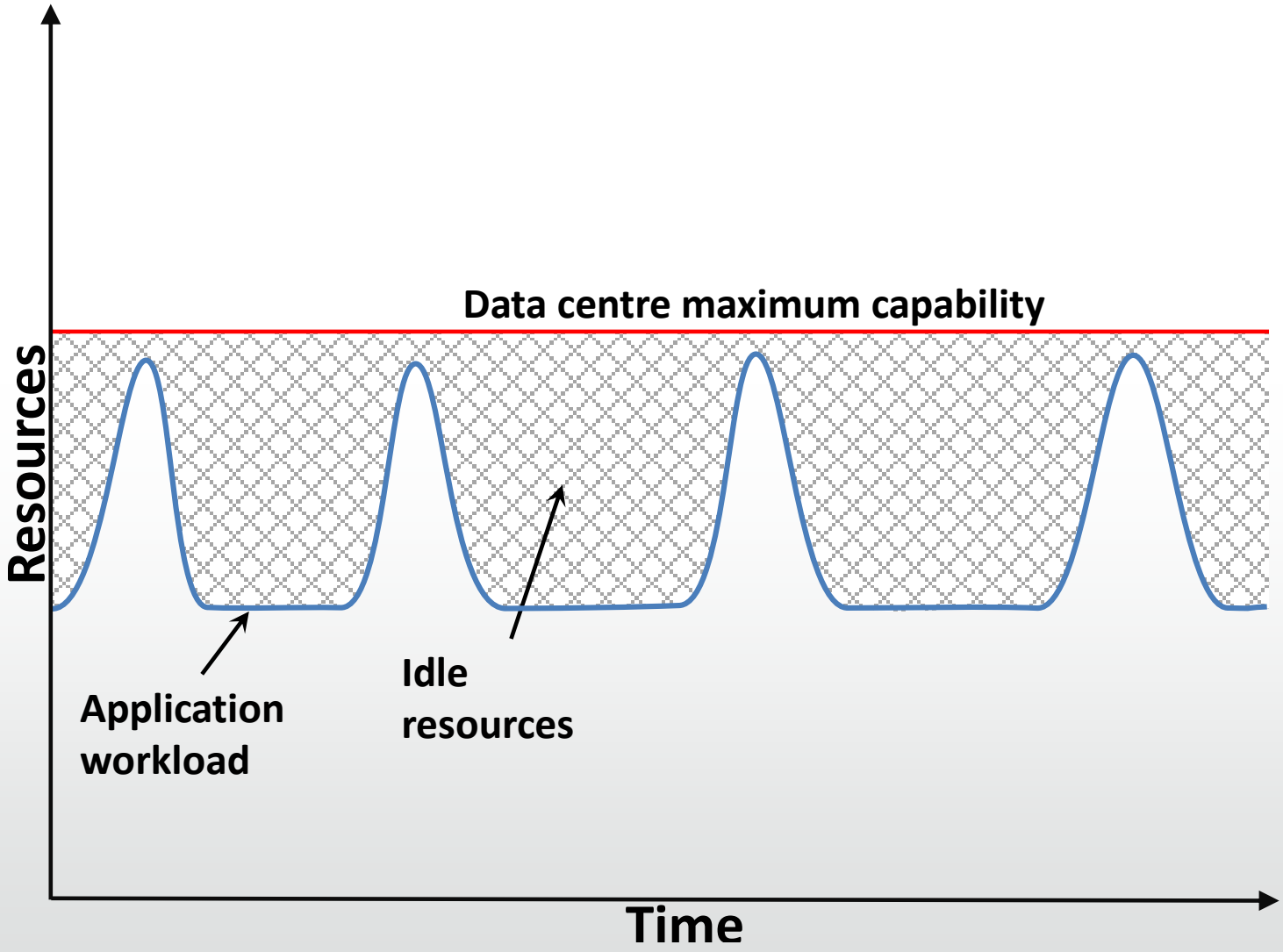
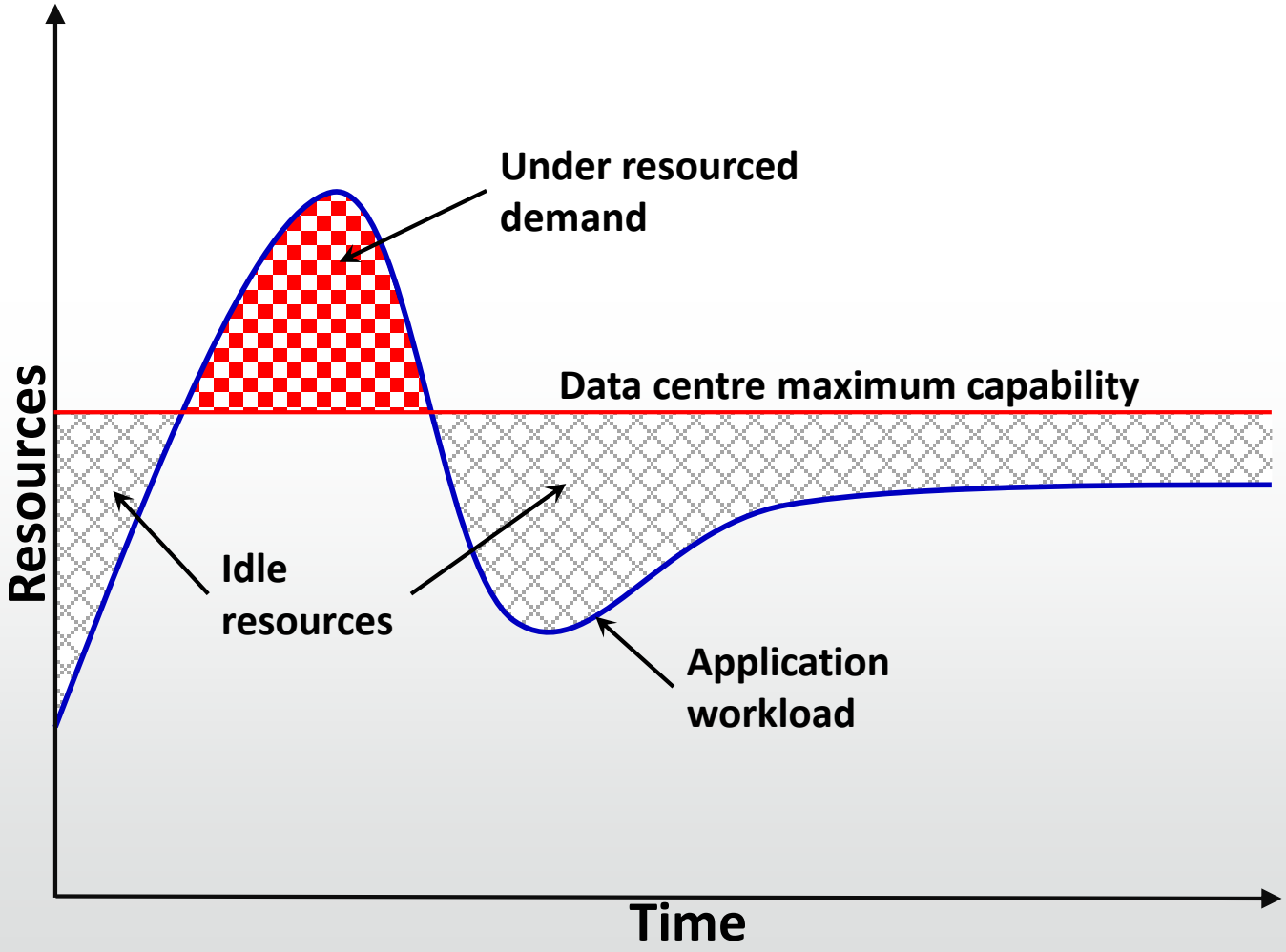


Un-predictable burst capability



(Super) - scalability

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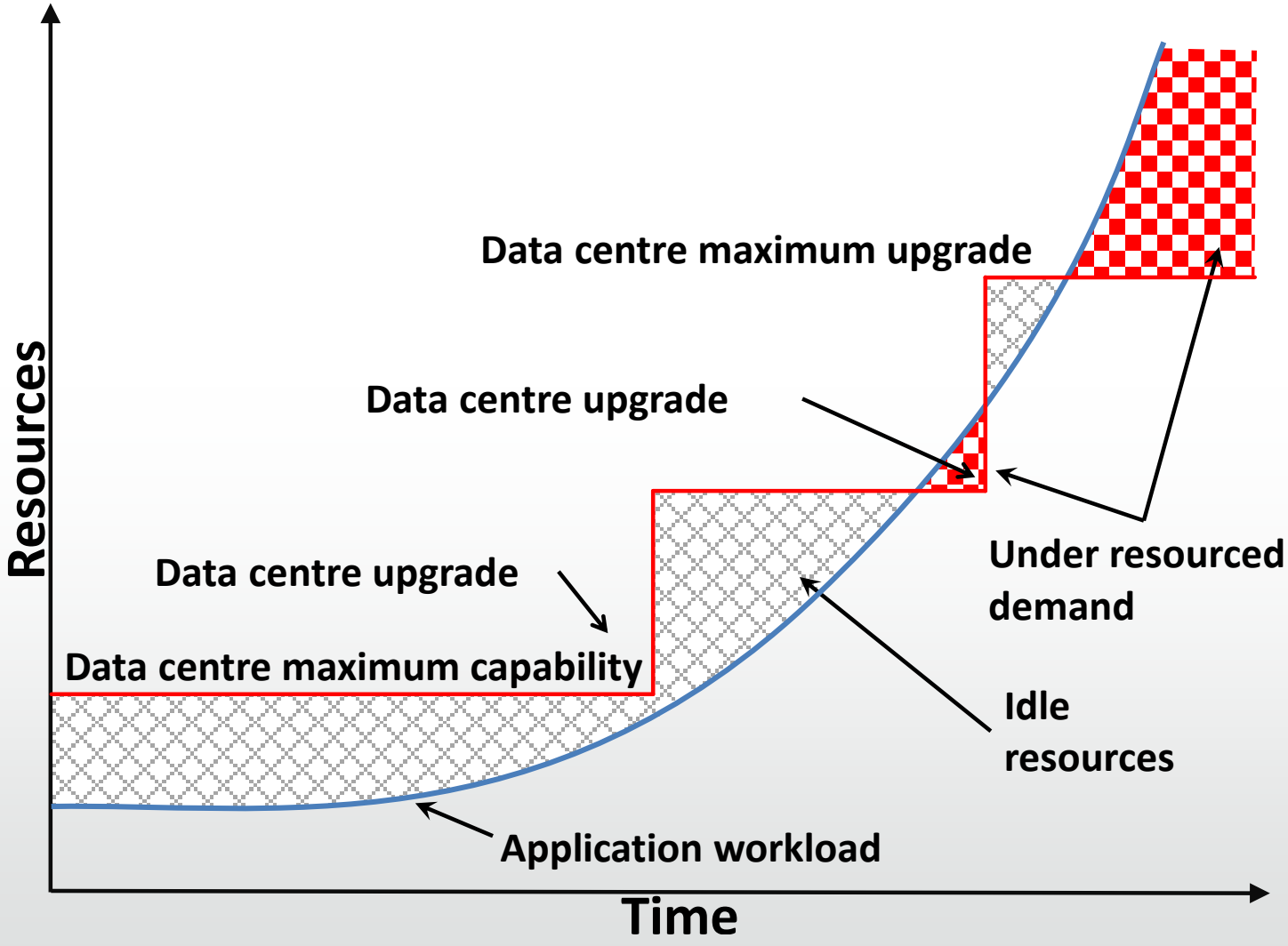


Data and algorithms

- Data dissemination
  - Co-locate data and processing power
  - Easier costing model for shared datasets.
  - DataMarket section of the Windows Azure Marketplace
- Algorithm development / validation
  - In general a serial task
  - Many require a large test dataset (large computation)
  - ‘Rent’ an appropriate machine for development tasks

Compute

Web and Worker roles to host applications around the world.

Database

Highly available and scalable relational cloud database service.

Virtual Machines

Deploy custom Windows Server 2008 R2 images to Windows Azure.

Storage

Persistent and durable storage in the cloud via four core services.

Content Delivery Network

Deliver high-bandwidth content through 24 global physical nodes.

Caching

Distributed, in-memory application cache service.

Virtual Network

Networking functionality to connect on-premises and cloud applications.

Service Bus

Secure messaging capabilities for distributed and hybrid applications.

Access Control

Standards-based service for identity and access control.

Business Intelligence

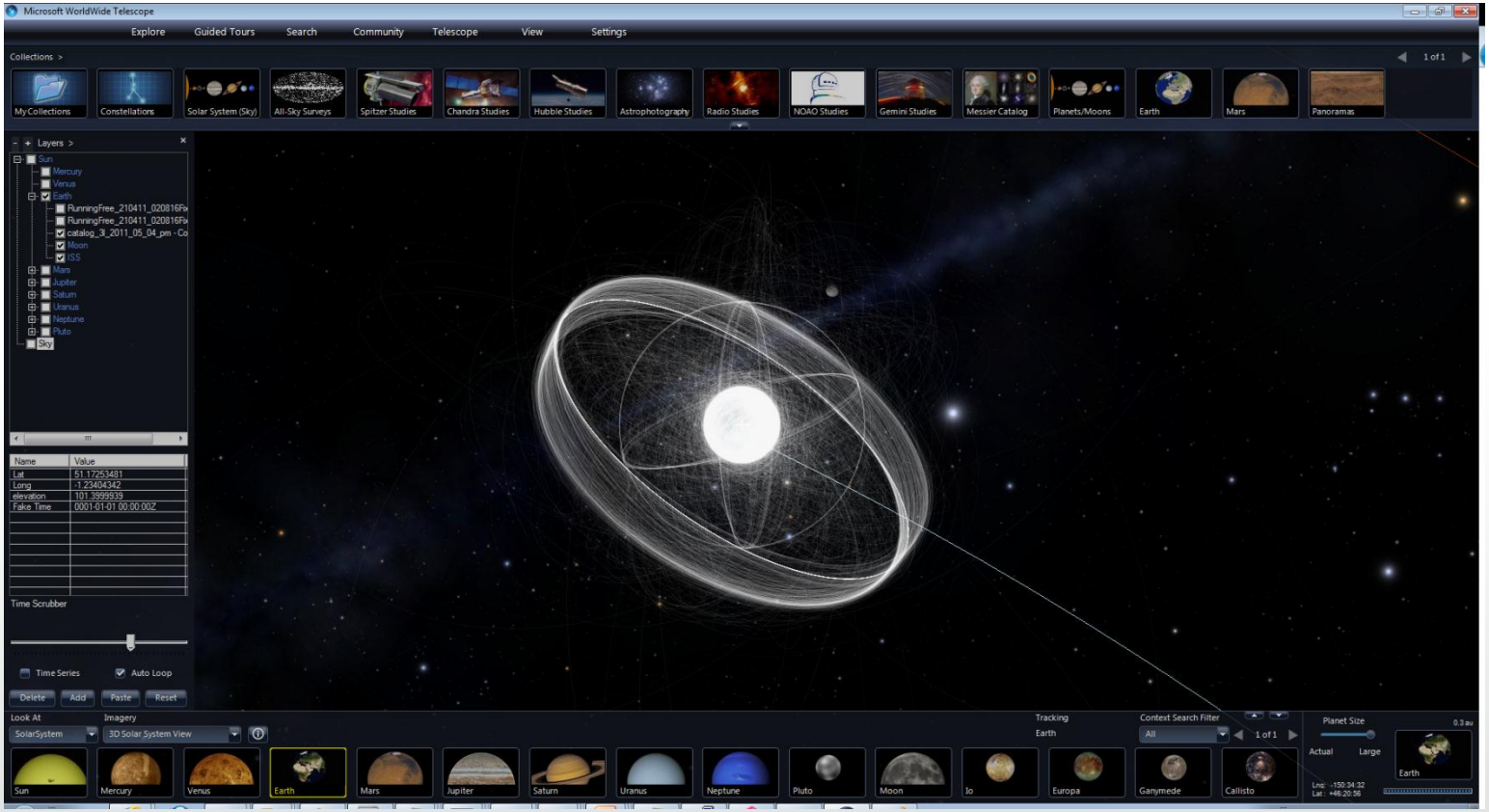
Develop and deploy operational reports to the cloud using familiar tools.

Marketplace

Buy and sell finished applications, data sets, components and more.

http://www.microsoft.com/windowsazure/features/

World Wide Telescope (WWT)



Summary

- Cloud features
  - Burst capability (predictable and unpredictable)
  - Super-scalability
  - Algorithm development
  - Data dissemination

Cloud computing is opening up new opportunities for science

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Further information

- Clouds in space

  G. Aloisio and S. Fiore, editors. Grid and Cloud Database Management, chapter Scientific computation and data management using Microsoft Azure. Springer.

  http://cmg.soton.ac.uk/research/projects/cloud-computing-for-planetary-defense/ (Previous version)

  http://cloudresearch.jiscinvolve.org/wp/category/projects/clouds-in-space/ (Blog)

- WWT

  http://www.worldwidetelescope.org/ (Main page)

  http://www.worldwidetelescope.org/help/SupportHelp.aspx?Page=UserGuide (User guide)

  http://www.worldwidetelescope.org/Authoring/Authoring.aspx?Page=DevelopersProgram (Developer)

  http://www.worldwidetelescope.org/Docs/WorldWideTelescope_lcapi.html (API)

  http://www.worldwidetelescope.org/ExcelPlugin.aspx (Excel plugin)

Further information

- Azure

  http://www.microsoft.com/windowsazure/ (Main page)

  http://www.microsoft.com/windowsazure/getstarted/ (Start here)

  http://www.microsoft.com/windowsazure/features/ (Features starting point)

  http://social.msdn.microsoft.com/Forums/en-US/category/windowsazureplatform (Support forum)

  http://www.microsoft.com/windowsazure/whitepapers/ (Extra reading)

Further information

- Azure tools ($)

  http://www.cerebrata.com/products/cloudstoragestudio/ (Data access)

  http://www.red-gate.com/search?fi=1&s=azure (SQL Azure backup & admin)

- PowerPoint plugin

  http://www.officelabs.com/projects/pptPlex/Pages/default.aspx

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