

CAB432 Cloud Computing

Lecture 1 - Introduction

Faculty of Science



Queensland University of Technology

CRICOS No. 00213J



Some are just a little bit bigger than the rest...

THE MAJORS



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Serious Players in Cloud

- **AWS, Microsoft and Google** really *are* different
- They already had global-scale distributed computing infrastructure
 - Amazon and the global bookstore
 - Google and search
 - Microsoft and software distribution (Live Update)
- They had enough cash to invest in new global scale businesses
- They have R & D capacity to develop new services – and they do this all the time

Perspective on the Hyperscalers

- Global data centres in almost identical locations.
- Laid their own high-capacity cables
- AWS began with IaaS, the others PaaS
- Now comparable service offerings
- Multiple cloud applications now common

Perspective on the Hyperscalers



Gartner Quadrant for Cloud Computing IaaS (2016)

You want to be in the top right hand corner, the sweet spot of the best vision and the ability to execute it.

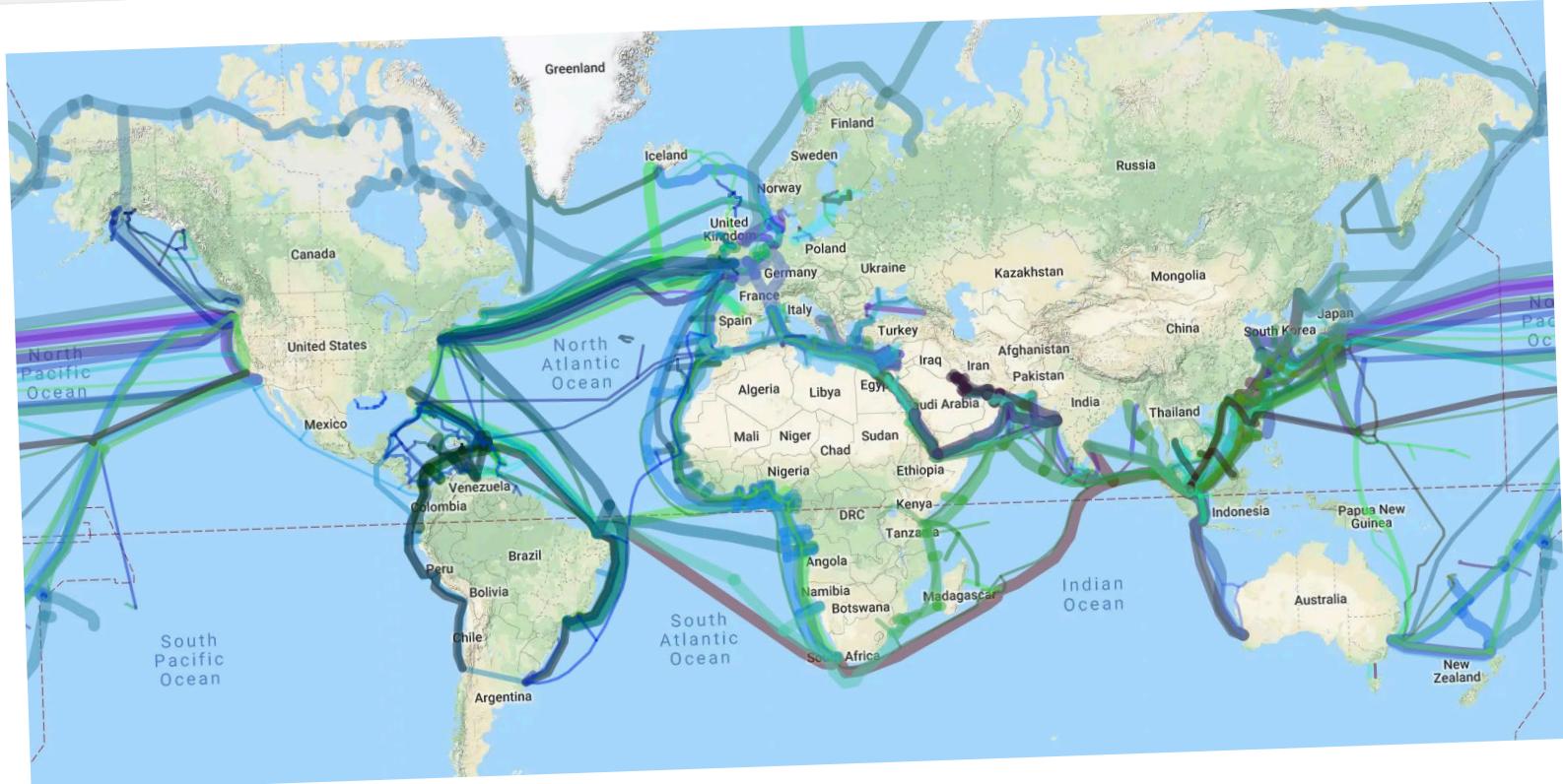
Longer article in *The Register*:

<http://bit.ly/2sNeoSU>



Networks: Some Perspective

- The next slide shows global internet sea cables
- AWS, Google and Azure have their own cables
- All of them are better than the internet
- The Internet is no longer the core transit for business.
- It is the handoff point between the Hyperscalers
- Source – cablemap.info





Azure, Google and AWS **AN OVERVIEW**



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Microsoft Azure

- A mix of XaaS services, mainly IaaS and PaaS
- Windows Cloud Services support SaaS directly
 - Office365 et al see: <http://bit.ly/VdFjPJ>
- Focus areas include big data and Machine Learning
- Azure SQL, SQL Server in instances
- Cognitive Services and Azure ML are key offerings



Microsoft Azure <https://azure.microsoft.com/en-au/>

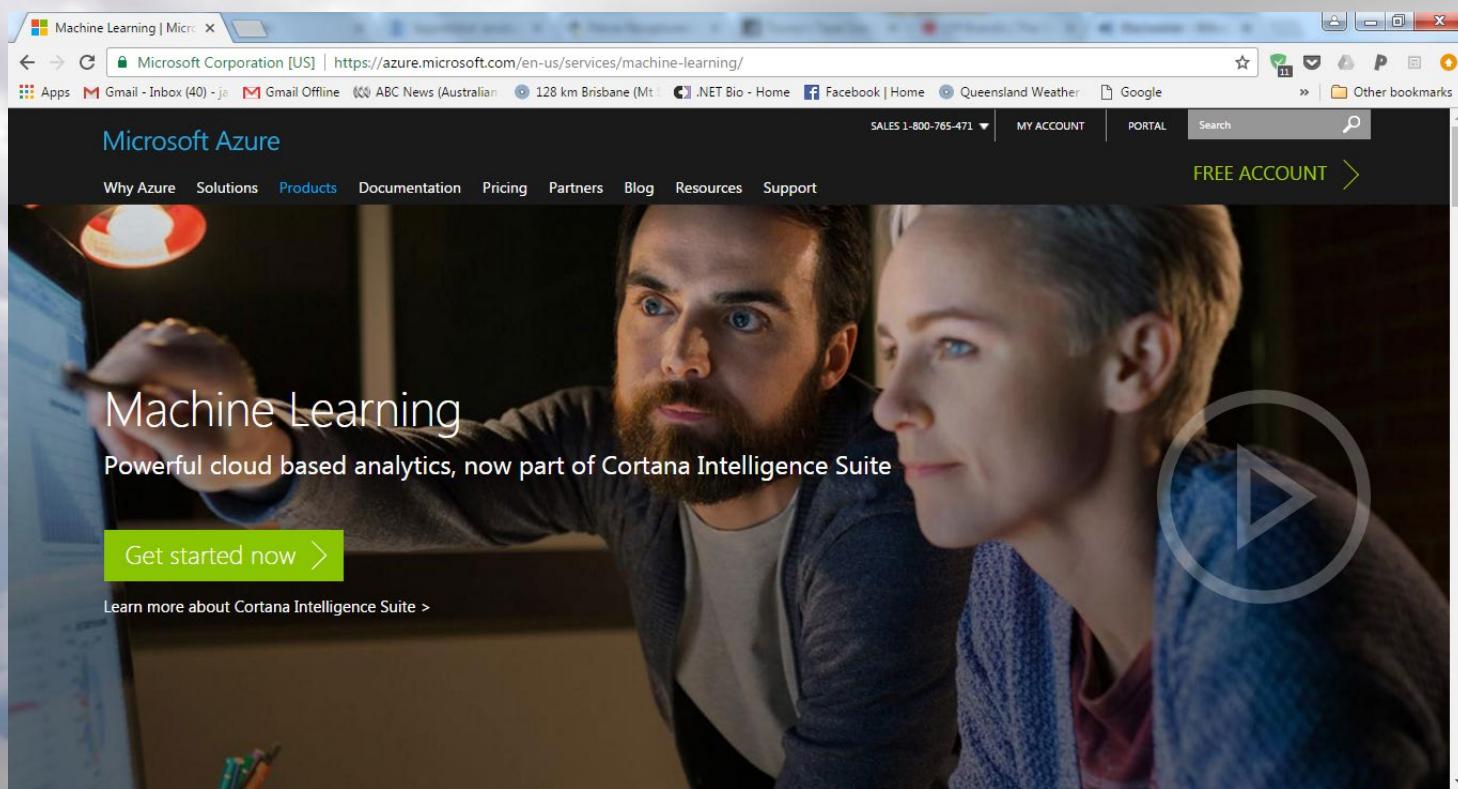
The screenshot shows the Microsoft Azure homepage. At the top, there's a navigation bar with links like Overview, Solutions, Products, Documentation, Pricing, Training, Marketplace, Partners, Support, Blog, More, My account, Portal, Sign in, and a Free account button. Below the navigation is a large banner with the text "Invent with purpose." and "Empower your inner inventor to turn ideas into outcomes." A green "Start for free >" button is visible. To the right of the text is a graphic of server racks and a cloud with checkmarks. A call-to-action button below the graphic says "Get step-by-step guidance for moving to the cloud with the new Azure Migration Program >". Below the banner, there are four main sections: "Be future-ready" (with a rocket icon), "Build on your terms" (with a server icon), "Operate hybrid seamlessly" (with a city icon), and "Trust your cloud" (with a cloud and location pin icon). Each section has a brief description and a link to "Continuous innovation from Microsoft" or "Get security from the ground up, backed by a team of experts and proactive".

Microsoft Azure

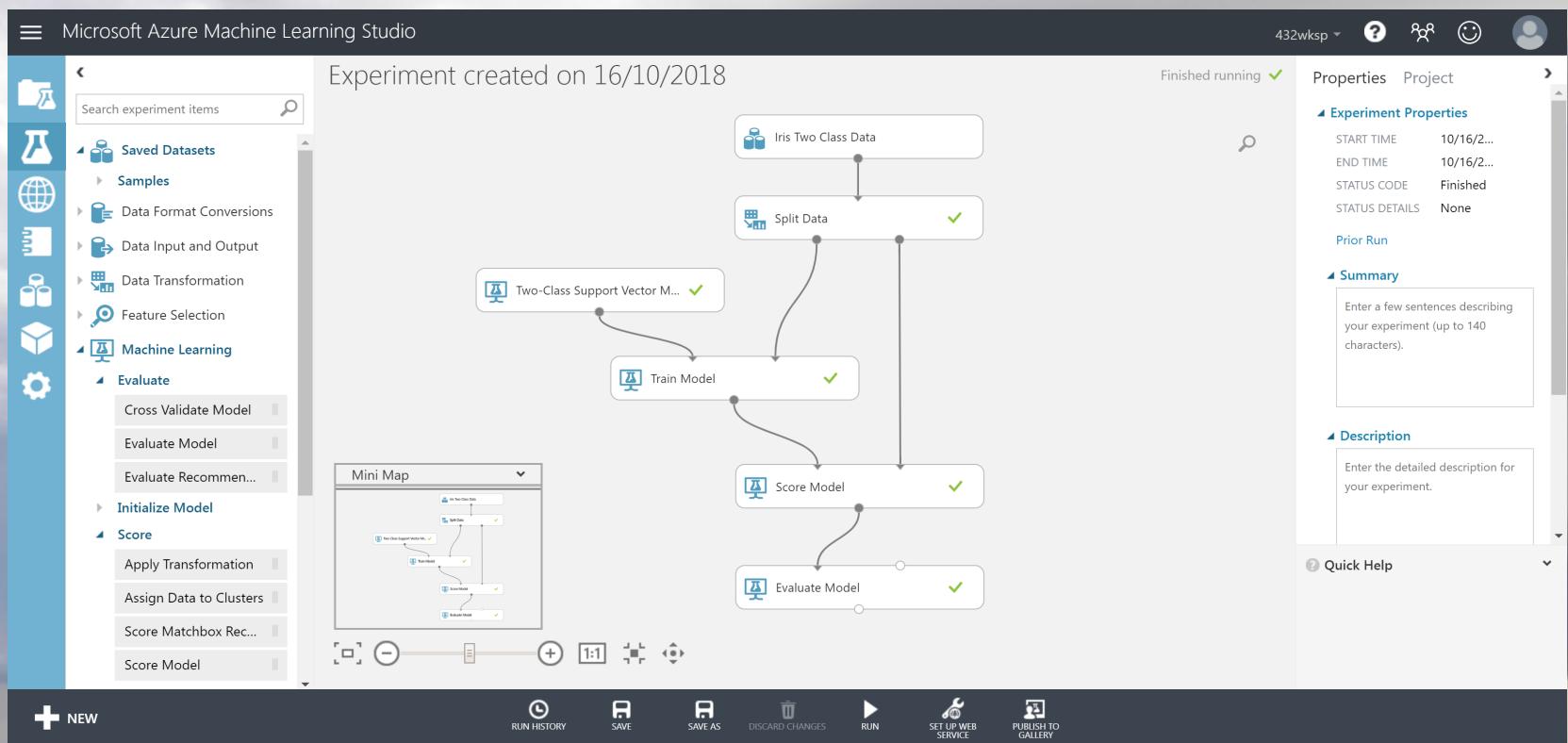
The screenshot shows the Microsoft Azure homepage with a navigation bar at the top featuring links for Sales, My Account, Portal, and Search. A prominent 'FREE ACCOUNT' button is also visible. Below the navigation, a section titled 'Popular products' displays eight cards, each representing a different Azure service:

- Virtual Machines**: Provision Windows and Linux virtual machines in seconds. Icon: Computer monitor with a cube.
- App Service**: Quickly create powerful cloud apps for web and mobile. Icon: Cloud with a gear.
- SQL Database**: Managed, relational SQL Database as a service. Icon: Blue cylinder with 'SQL'.
- Storage**: Durable, highly available and massively scalable cloud storage. Icon: Grid of colored squares.
- Cloud Services**: Create highly available, infinitely scalable cloud applications and APIs. Icon: Cloud with gears.
- Azure Cosmos DB**: Try Azure Cosmos DB for a globally distributed, multi-model database. Icon: Planets and stars.
- Azure Active Directory**: Synchronise on-premises directories and enable single sign-on. Icon: Network graph.
- Backup**: Simple and reliable server backup to the cloud. Icon: Cloud with a checkmark.

Azure ML – Machine Learning Service



Azure ML – example Machine Learning Service



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Azure ML – example Machine Learning Service

The screenshot shows the Microsoft Azure Machine Learning Studio interface. The main title bar reads "Experiment created on 16/10/2018". Below the title, there's a summary table with the following data:

True Positive	False Negative	Accuracy	Precision	Threshold	AUC
13	0	1.000	1.000	0.5	1.000
False Positive	True Negative	Recall	F1 Score		
0	12	1.000	1.000		
Positive Label	Negative Label				
1	0				

Below this, a detailed table provides metrics for different score bins:

Score Bin	Positive Examples	Negative Examples	Fraction Above Threshold	Accuracy	F1 Score	Precision	Recall	Negative Precision	Negative Recall	Cumulative AUC
(0.900,1.000]	13	0	0.520	1.000	1.000	1.000	1.000	1.000	1.000	0.000
(0.800,0.900]	0	0	0.520	1.000	1.000	1.000	1.000	1.000	1.000	0.000
(0.700,0.800]	0	0	0.520	1.000	1.000	1.000	1.000	1.000	1.000	0.000
(0.600,0.700]	0	0	0.520	1.000	1.000	1.000	1.000	1.000	1.000	0.000
(0.500,0.600]	0	0	0.520	1.000	1.000	1.000	1.000	1.000	1.000	0.000
(0.400,0.500]	0	0	0.520	1.000	1.000	1.000	1.000	1.000	1.000	0.000
(0.300,0.400]	0	0	0.520	1.000	1.000	1.000	1.000	1.000	1.000	0.000
(0.200,0.300]	0	0	0.520	1.000	1.000	1.000	1.000	1.000	1.000	0.000
(0.100,0.200]	0	0	0.520	1.000	1.000	1.000	1.000	1.000	1.000	0.000
(0.000,0.100]	0	12	1.000	0.520	0.684	0.520	1.000	1.000	0.000	1.000

At the bottom of the interface, there are several buttons: NEW, RUN HISTORY, SAVE, SAVE AS, DISCARD CHANGES, RUN, SET UP WEB SERVICE, and PUBLISH TO GALLERY.

Google Cloud Platform

- Mix of IaaS and PaaS services
- Focus on IaaS at very large scale
- PaaS remains through Servlet based AppEngine
- Application areas in search, data and machine learning



Google Cloud <https://cloud.google.com/>

The screenshot shows the Google Cloud Platform homepage in a web browser. The URL https://cloud.google.com/ is visible in the address bar. The page features a large banner with the text "Build What's Next" and "Better software. Faster." Below the banner is a list of three benefits: "Use Google's core infrastructure, data analytics and machine learning.", "Secure and fully featured for all enterprises.", and "Committed to open source and industry leading price-performance.". At the bottom of the page are two buttons: "TRY IT FREE" and "CONTACT US". A navigation bar at the top includes links for "Why Google", "Products", "Solutions", "Launcher", "Pricing", "Customers", "Documentation", "Support", and "Partners". There are also buttons for "Try It Free" and "Contact Sales". The background of the page features a landscape image of a field under a cloudy sky.

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Google Cloud

The screenshot shows the Google Cloud Platform homepage. At the top, there's a navigation bar with links for 'Why Google', 'Products', 'Solutions', 'Launcher', 'Pricing', 'Customers', 'Documentation', 'Support', 'Partners', 'Try It Free', and 'Contact Sales'. Below the navigation, there are six main service sections:

- Compute**: From virtual machines with proven price/performance advantages to a fully managed app development platform.
 - Compute Engine
 - App Engine
 - Container Engine
- Storage and Databases**: Scalable, resilient, high performance object storage and databases for your applications.
 - Cloud Storage
 - Cloud Bigtable
 - Cloud Datastore
- Networking**: State-of-the-art software-defined networking products on Google's private fiber network.
 - Cloud Virtual Network
 - Cloud Load Balancing
 - Cloud CDN
- Big Data**: Fully managed data warehousing, batch and stream processing, data exploration, Hadoop/Spark, and reliable messaging.
 - BigQuery
 - Cloud Dataflow
 - Cloud Dataproc
- Machine Learning**: Fast, scalable, easy to use ML services. Use our pre-trained models or train custom models on your data.
 - Cloud Machine Learning Platform
 - Vision API
 - Speech API
- Management Tools**: Monitoring, logging, diagnostics and more, all in an easy-to-use web management console or mobile app.
 - Stackdriver Overview
 - Monitoring
 - Logging



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AppEngine

- AppEngine is designed for web applications
- In the Java EE API, we assume URLs map to servlets
- The programming model is thus familiar
- The difference lies in the infrastructure and services
- Scalable compute and very large data store
- In memory caching of local results
- Access to numerous google services
- Exploitation of the Java libraries to access web services
- Google Web Toolkit
- Now generalised to allow other run times

Google App Engine

The screenshot shows a web browser window with the URL <https://cloud.google.com/appengine/>. The page is titled "Google App Engine" and features a sub-header "Build scalable web and mobile backends in any language on Google's infrastructure". Below this is a blue "TRY IT FREE" button. The main content area is titled "App Engine for All" and describes the platform as an open cloud platform for building modern web and mobile applications. It highlights that Google App Engine is a fully managed platform that abstracts away infrastructure. To the right of the text is an illustration of a smartphone, a laptop displaying the Google Cloud logo, and a smartwatch. At the bottom, there is a section titled "For All Language Communities" with a note about supported languages: "Out of the box, App Engine supports Node.js, Java, Ruby, C#, Go, Python, and PHP. Developers can also run Java, .NET, and Node.js on Google Cloud Platform using App Engine flexible environment." The browser's address bar shows the secure connection and the page title.

<https://cloud.google.com/appengine/>



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Amazon Web Services

- Mix of XaaS services ranging from EC2 and S3 through to marketplace.
- Massive range of elastic application services
- Major improvement in machine learning services in recent years
- Developing focus on IoT and devices.



AWS <http://aws.amazon.com/>

The screenshot shows the AWS homepage with a dark header bar. The header includes the AWS logo, navigation links like Products, Solutions, Pricing, Documentation, Learn, Partner Network, AWS Marketplace, Customer Enablement, Events, Explore More, and a search bar. On the right, there are links for Contact Us, Support, English, My Account, and a prominent orange "Sign In to the Console" button.

The main content area features a large banner for "Amazon Managed Service for Prometheus". The banner text reads: "Monitor containerized applications securely and at scale". Below this, there is a "Learn more" link. To the right of the text is a graphic illustrating a network connection between a user profile, a funnel icon, and a computer monitor displaying a grid of squares.

Below the banner, there is a horizontal navigation bar with five dots, indicating a scrollable section. This section contains four service highlights:

- Amazon Lightsail Extended Free Tier**: Illustration of a small robot giving a thumbs up.
- S3 Multi-Region Access Points**: Illustration of a globe with location pins and a bucket icon.
- AWS Backup Audit Manager**: Illustration of a cloud with various icons like a gear, a document, and a cube.
- AMD Powered EC2 Instances**: Illustration of a computer monitor connected to a central processing unit (CPU) with the AMD logo.

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AWS – IaaS ++ (2018)

The screenshot shows the AWS homepage with a large banner at the top reading "Start Building on AWS Today". Below the banner, there's a call-to-action button "Create A Free Account" and a link "View AWS Free Tier Details". The page is divided into four main sections:

- Broad & Deep Platform**: AWS has more than 90 services and is continually launching new features and functionality. [Learn more »](#)
- Customer Success**: Explore how millions of active customers every month are innovating with AWS. [Learn more »](#)
- Pace of Innovation**: The AWS Cloud platform expands daily. Take a look at what we launched this week. [Learn more »](#)
- Global Infrastructure**: AWS operates 43 Availability Zones within 16 geographic Regions around the world, with 11 more Availability Zones and 4 more Regions coming online soon. [Learn more »](#)

Below these sections are three numbered icons: 1. A green circle with a computer monitor icon, 2. A blue circle with a clock icon, and 3. A blue circle with a cloud and video camera icon.

<http://aws.amazon.com/>



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AWS Elastic Beanstalk – PaaS (2014)



New AWS Elastic Beanstalk Console

Deploy, monitor, and grow your application quickly and easily.

[Learn more about the new console »](#)



[Get Started for Free »](#)

Launch virtual machines and apps in minutes.

<http://aws.amazon.com/>



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AWS MarketPlace - SaaS

The screenshot shows the AWS Marketplace Home page. At the top, there's a search bar with "AMI & SaaS" selected. A prominent feature is a promotional banner for "Informatica" with the headline "Rapid Data Integration for Amazon Redshift – Go Live Today". It claims "Process > 10M records for just \$1" and has a "START FREE TRIAL" button. To the right of the banner is a network diagram showing various cloud services connected to a central "Informatica" node, including Amazon Web Services, Salesforce, Oracle, SAP, and others. Below the banner, there's a section titled "Popular Categories" with icons and links for Operating Systems, Security, Networking, Storage, Business Intelligence, Databases, Dev Ops, and SaaS Subscriptions. The URL "https://aws.amazon.com/marketplace" is displayed at the bottom.

<https://aws.amazon.com/marketplace>



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Services: AWS 2021

Networking & Content Delivery

VPC

CloudFront

Route 53

API Gateway

Direct Connect

AWS App Mesh

AWS Cloud Map

Global Accelerator

Editor

Amazon Grafana

Amazon Prometheus

AWS Proton

Incident Manager

Media Services

Kinesis Video Streams

MediaConnect

MediaConvert

MediaLive

MediaPackage

MediaStore

MediaTailor

Elemental Appliances &
Software

Amazon Interactive
Video Service

Elastic Transcoder

Nimble Studio

GuardDuty

Inspector

Amazon Macie

AWS Single Sign-On

Certificate Manager

Key Management
Service

CloudHSM

Directory Service

WAF & Shield

AWS Firewall Manager

Artifact

Security Hub

Detective

AWS Audit Manager

AWS Signer

AWS Network Firewall

IoT Events

IoT Greengrass

IoT SiteWise

IoT Things Graph

Game Development

Amazon GameLift



Some Readings

- Become familiar with the ideas considered in the lecture
- Follow all the links given – and explore the APIs offered.
- Here are some less technical articles:
- <http://www.economist.com/topics/cloud-computing>