CLOUD COMPUTING SYSTEMS

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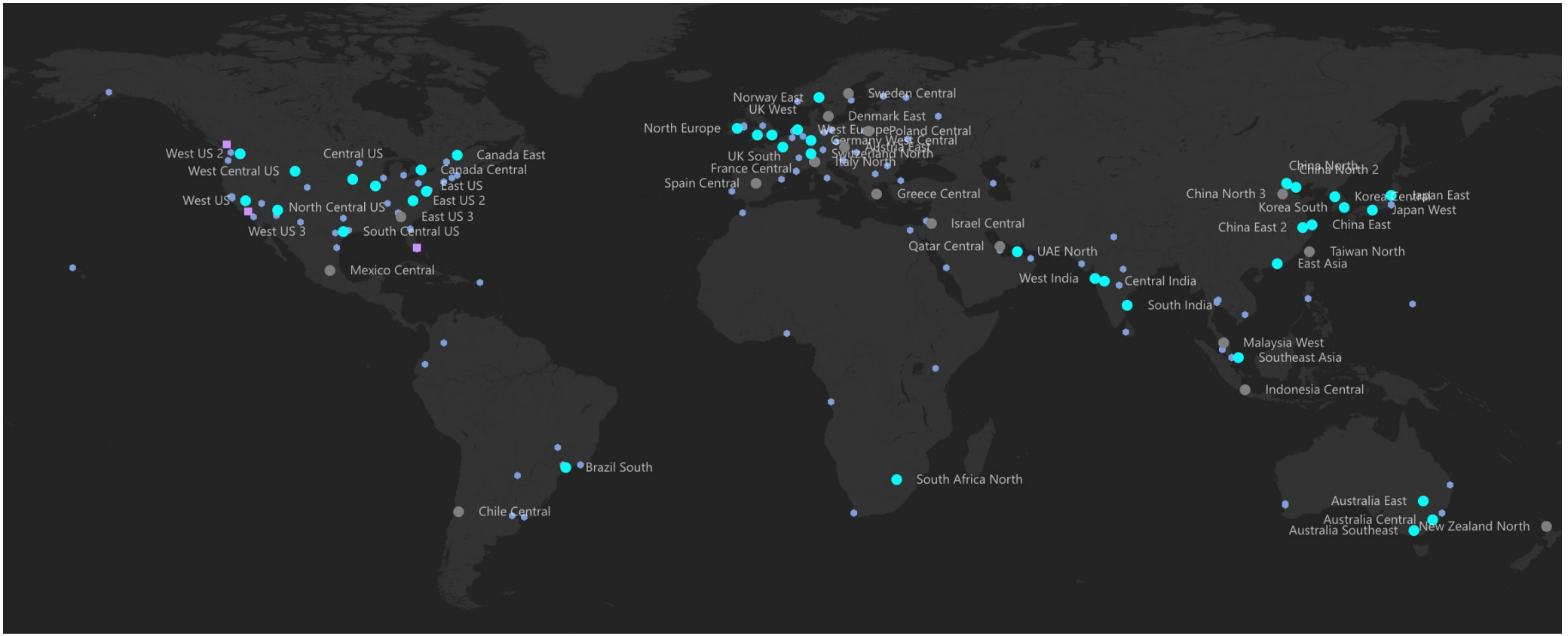
CONTEXT

Cloud computing infrastructures are becoming pervasive for creating new applications and services

- Reliability
- Scalability
- Performance

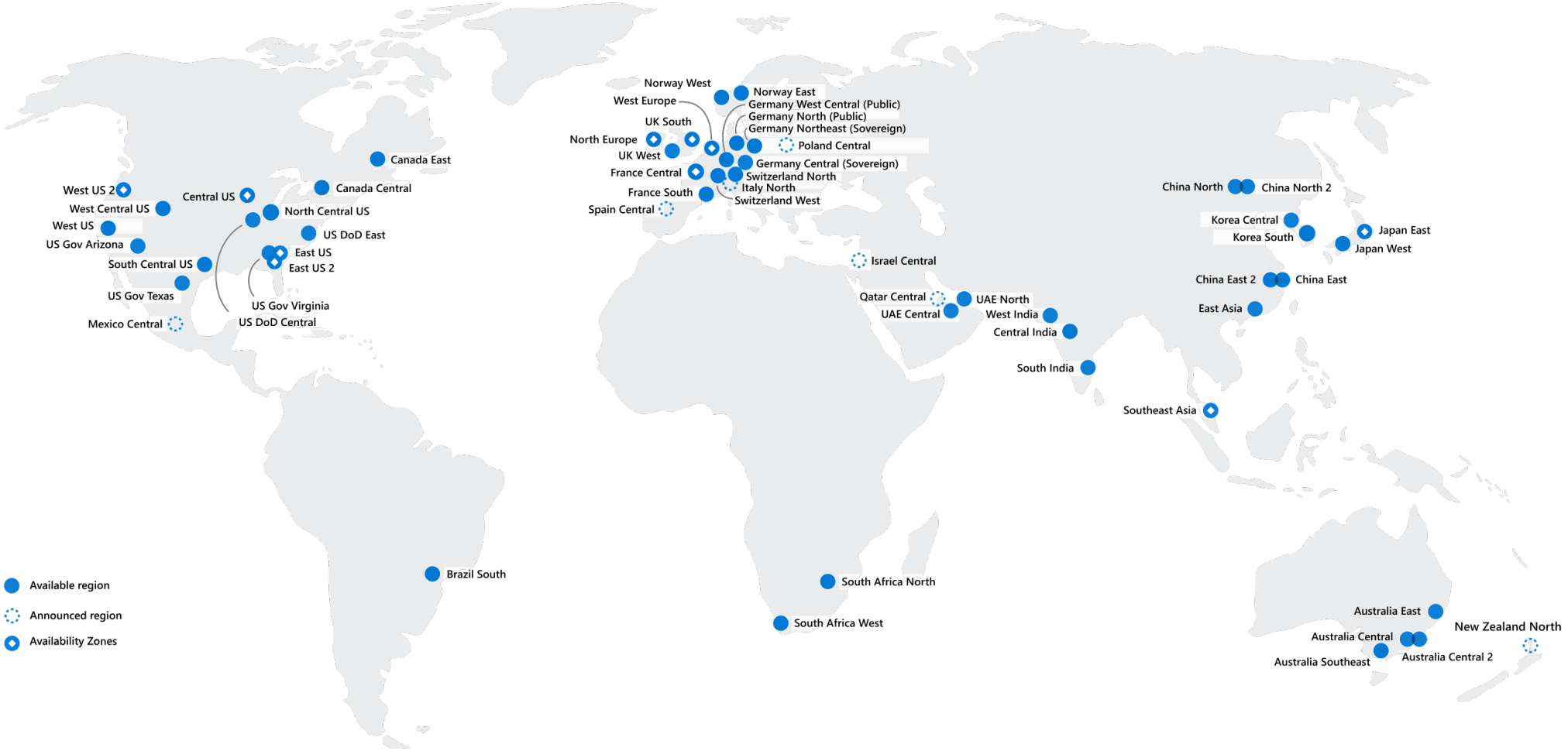
Cloud computing infrastructures are becoming the new OS

CONTEXT



Azure locations: https://infrastructuremap.microsoft.com/explore (accessed: Sep, 2021)

CONTEXT (2)



Azure locations: https://azure.microsoft.com/en-us/global-infrastructure/geographies/ (accessed: Sep, 2020)

CONTEXT (3)

Azure locations: https://azure.microsoft.com/en-us/global-infrastructure/regions/ (accessed: Sep, 2019)

Goals of the Course

Understand the fundamentals of Cloud Computing Systems:

- Cloud computing models;
- Underlying infrastructure and constraints;
- Cloud services: how they work, why, and how to use them;
- How to explore services to build applications that are reliable and efficient.

Focus on simplicity, correctness and efficiency.

Students should be able to create an application that explores cloud services for providing good quality-of-service to users.

- We will use Microsoft Azure platform.

PROGRAM: LECTURES

Introduction.

- Models. Building blocks.

Storage services.

- Block storage and filesystems.
- Key-value store and databases.

Caching services.

- Application caches at the DCs.
- Content-distribution networks.

Edge services.

- Serverless functions.

Processing data.

- Queuing services.
- Computing services.

PROGRAM: LECTURES (CONT.)

IaaS

- Virtualization. Containers
- Deployment (Kubernets).

Networking.

- Virtual networks.

Infrastructure.

- The physical data center.
- Hybrid cloud solutions.

PROGRAM: LABS

1. Develop a multi-cloud backend application, starting from a simple backend application, and exploring Azure cloud services for improving its reliability and efficiency, using:
    1. (Geo-replicated) Storage services
    2. Caching services
    3. Serverless services
    4. Computing services

2. Deploy a multi-component application using Kubernetes.

PROJECT: LAST YEAR

- Backend for a reservation service
  - Service (e.g. hairdresser, etc.)
  - Reservation
  - Comment
- Endpoints
  - Initial page
  - Reservation management
  - Comments page
- Functionalities
  - Geo-replicated deployment, caching, serverless, computing, etc.
  - Evaluation

PROJECT: TWO YEARS AGO

Backend of a system like Reddit

- Users
- Community
- Multimedia objects
- Post

Endpoints

- Initial page
- Thread page
- Like set/un

Functionalities

- Geo-replicated deployment, caching, serverless, search (incl. image), etc.
- Evaluation

Any suggestion for this year?
Send me an email !!

PLAN

Dates	Holiday	Lectures	Labs	Project	Tests
27/sep-1/oct		Introduction. Models.	Classes only tuesay.		
4/oct-8/oct	tues	Storage service: block storage and filesystems.	Application deployment using PaaS.		
11/oct-15/oct		Storage service: key-value stores and databases.	App evaluation. Add durability using block storage.		
18/oct-22/oct		Caching service: memcached and Redis. CDN.	Add durabiliity w/ databases.		
25/oct-29/oct		Serverless and micro-services.	Add caching.		
1/nov-5/nov		Computing services: map-reduce.	Add serverless.	Checkpoint: 5-Nov	
7/nov-11/nov		Computing services: Spark.			12-Nov
15/nov-19/nov		IaaS. Virtualization.	Add computation.		
22/nov-26/nov		Containers and deployment.		Deliver: 28-Nov	
29/nov-3/dec	wed	Kubernets.	Kubrernets intro.		
6/dec-8/dec	wed	Virtual networking + physical data center.			
14/dec-19/dec		Security. Advanced infrastrucutres: hybrid cloud + edge computing.			
20/dez-22/dez				Deliver: 22-Dec ???	
3/jan-7/jan		Support for exam.			08-Jan
10/jan-14/jan					
		Project and tests dates to be confimed !!!			

BIBLIOGRAPHY

Lectures:

- Selected set of papers and documents.
- Slides and notes.

Labs:

- Slides, examples and notes.
- Azure documentation.

GRADING

Tests: 55%

- Midterm (25%) and final (30%)
- Exam (55%)
- Minimum grade for approval: 9.0

Project 1: 30% - **groups of 3 students**

- Deadline for delivery: Nov-28 (TBC)
- Checkpoint: Nov-5
- Minimum grade for frequency: 89.0

Project 2: 15%

- Deadline: Dec-22 (Dec-30)

SUPPORT SOFTWARE

Options:

- Discord
- Slack
- Google groups
- Moodle groups