# Assignment 2

# Targets

- **The main objective is to understand the cost differences between public, private and hybrid clouds. Additionally carbon footprint should be compared.**

- **Present own problem solving skills**

- **Simulates real problem but it is not 100% real!**

- **If some data you need is missing, ask or define your own assumptions**

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# Problem statement

- **Virtual Phone ltd, a new startup, will start a new mobile service in Finland, starting 2013 and expanding to Europe 2014 and global markets 2015. Their service is backend system for HTML5 enabled mobiles that are fully virtualized [1]. This means that most of the mobile content and applications reside in the cloud. Virtual Phone ltd considers purchasing a computing platform from you, A2 ltd. We can ignore data storage and transmission costs. Your task is to write a summary of your tender that defines the computation system and costs. You have to optimize your system based on load and cost, and evaluate CO2 consumption.**

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# Requirements (1/2)

- **Number of customers: end of 2013: 1 M +/- 10%, 2014: 10 M +/-30%, 2015: 100 M +/-50%**
- **Provide your offer with Amazon ECU equivalent computation units**
- **1 ECU provides the equivalent CPU capacity of a 1.0-1.2 GHz 2007 Opteron or 2007 Xeon processor**
- **~10 customers need during peak totally 1 ECU computation power**
- **Customer growth is even/exponential**
- **50% PaaS (Linux or Windows), 50% IaaS (Linux)**
- **Load distribution similar every day, and load evenly distributed between max and min load**
- **Keep 10% safe margin for real-time services**

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# Requirements (2/2)

- **PUE:**
  - Public cloud: PaaS = 1.2; IaaS = 1.1
  - Private cloud (web hotel) = 1.7
  - Private cloud (own cluster) = 2.5
- **Data should be stored close to customer to minimize Round Trip Time (RTT) and transmission costs**
- **Period of evaluation: 3 years, interest rate: 10%**

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# Alternatives

1. **Public cloud (PaaS, IaaS)**
   - You may use, for example, Amazon (IaaS), Google or Azure (PaaS)
   - Pay per use, 1 year or 3 year contract
2. **Private cloud (hosted)**
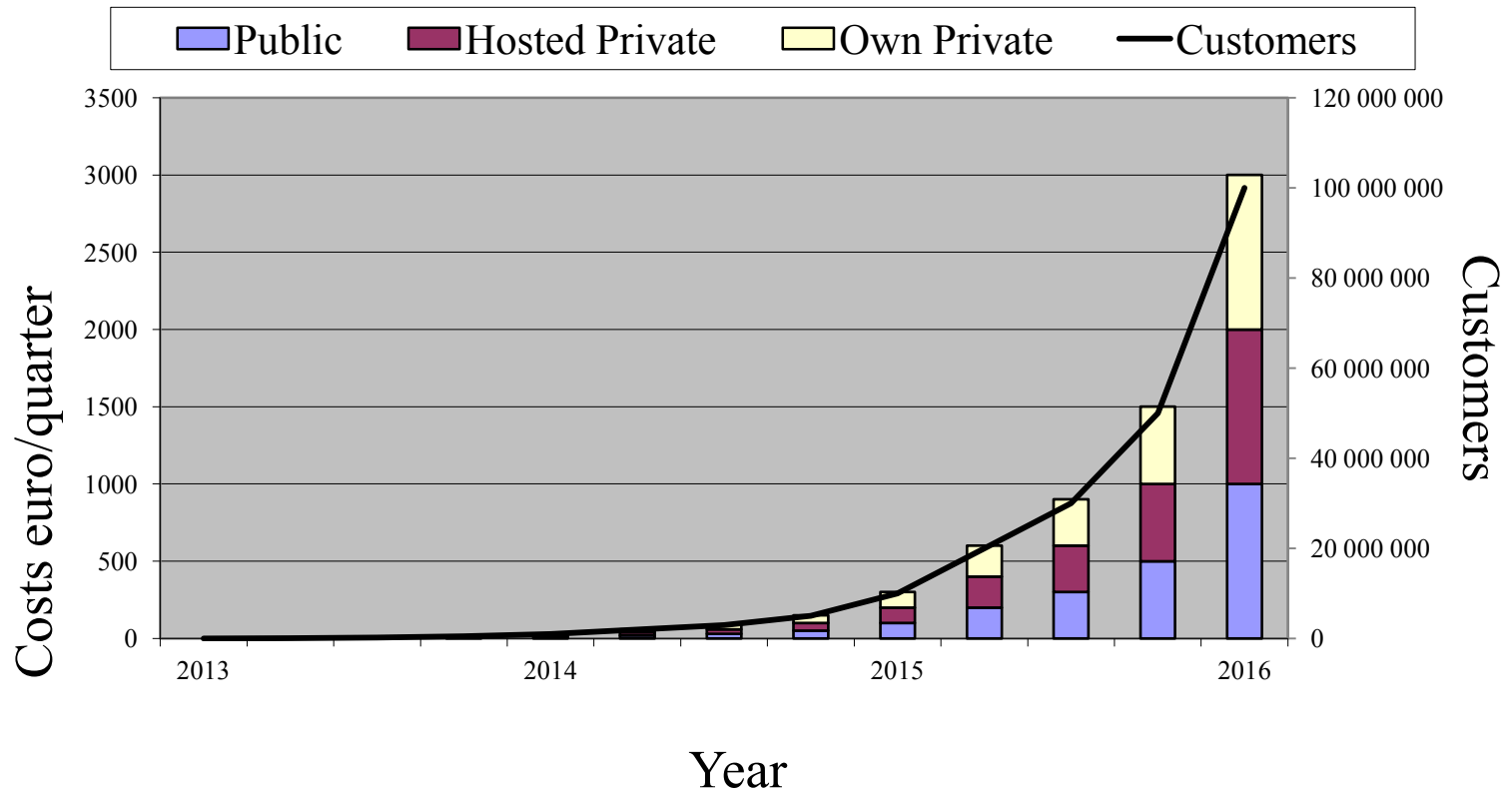   - For example Nebula
3. **Private cloud (own cluster)**
   - DCS cluster, 3000 €/blade; one blade equals to 16 cores, max 64 blades per rack, 20 000 €/rack
   - Greenberg [2]: From all ICT costs 45% comes from servers
   - Note that 1 euro servers requires 8 euro admin
4. **Hybrid [3] using previous alternatives (1-2, 1-3, 2-3)**

# Server cost split example



Virtual Phone ltd quarterly server costs 2013-2015

# Report, pdf, 4 page, IEEE template

- **Title, author details with email and student number**
- **Abstract and keywords**
- **Introduction: explain assignment requirements, restrictions and alternatives.**
- **Background: explain the cloud alternatives, their major differences.**
- **Architecture: describe your chosen architecture. Give reasons why you picked up this one, what are the critical issues in other options.**
- **Cost analysis: Calculate all costs relating to computing (also admin with your own cluster) during 36 months (2013-2015) with the current price data. Show the cost curves per month during the time period.**
- **Carbon footprint analysis: Evaluate carbon footprint values in each scenario.**
- **Discussion: what are the restrictions, pros and cons, risks and security challenges of your proposal. Greeness? Elaborate future development ideas.**
- **Conclusions: summary of your work.**
- **References**

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# Grading

- **Each subsection evaluated 0, 1, 3, 5**
  - Overall quality
  - Alternative analysis
  - Architecture analysis (cost, carbon footprint)
  - Discussion (pros/cons)
- **Average rounded to closest integer gives your Assignment grade**

# References and Links

1. A. Taivalsaari and K. Systä, "Cloudberry: An HTML5 Cloud Phone Platform for Mobile Devices," IEEE Software, July/August 2012, pp. 40-45.

2. A. Greenberg, J. Hamilton, D.A. Maltz and P. Patel, "The Cost of a Cloud: Research Problems in Data Center Networks," ACM SIGCOMM Computer Communication Review, vol. 39, no. 1, Jan 2009, pp. 68-73.

3. M. Hajjat, X. Sun, Y-W. E. Sung, D. Maltz, S. Rao, K. Sripanidkulchai, and M.Tawarmalani, Cloudward Bound, 2Planning for Beneficial Migration of Enterprise Applications to the Cloud," ACM SIGCOMM'10.

- **http://www.ieee.org/conferences_events/conferences/publishing/templates.html**
- **http://aws.amazon.com/ec2/instance-types/**
- **http://aws.amazon.com/ec2/pricing/**
- **https://cloud.google.com/pricing/**
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# Questions?

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