Energy Efficiency and EU Policy affecting Data Centres

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Outline

**Background** – State of the EU DC sector based on findings from the EURECA project

**Ecodesign Regulation** on servers and data storage products

**Wider EU initiatives** towards digital and sustainable society

**Panel Discussions**
Data Centre Energy Consumption Trends

In Europe, 25% increase over 3 years
Data centre size (in racks)

- 80% up to 25
- 17% 25 to 125
- 3% > 125
Energy Consumption breakdown by IT Equipment type

- Servers: 65%
- Storage: 25%
- Networking: 10%
Power Usage Effectiveness (PUE)
Server Distribution

- Compute Capacity: 93% > 5 years old, 7% < 5 years old
- Age: 60% > 5 years old, 40% < 5 years old
- Energy Consumption: 34% > 5 years old, 66% < 5 years old
<table>
<thead>
<tr>
<th>Scenario</th>
<th>PUE</th>
<th>Beta (%)</th>
<th>Hardware 1 (7.5Y old)</th>
<th>Hardware 2 (6Y old)</th>
<th>Hardware 3 (4.5Y old)</th>
<th>Hardware 4 (3Y old)</th>
<th>Hardware 5 (1.5Y old)</th>
<th>Hardware 6 (Current)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Premise</td>
<td></td>
<td></td>
<td>51,372,685</td>
<td>15,414,061</td>
<td>12,840,312</td>
<td>6,257,229</td>
<td>2,453,698</td>
<td>2,093,779</td>
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<tr>
<td>Worst</td>
<td>3</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>2</td>
<td>10%</td>
<td>17,708,754</td>
<td>5,533,001</td>
<td>4,617,433</td>
<td>2,356,780</td>
<td>952,302</td>
<td>820,422</td>
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<tr>
<td>Best</td>
<td>1.5</td>
<td>25%</td>
<td>5,838,699</td>
<td>2,015,383</td>
<td>1,688,826</td>
<td>950,967</td>
<td>406,652</td>
<td>356,373</td>
</tr>
<tr>
<td>Colocation</td>
<td></td>
<td></td>
<td>42,810,571</td>
<td>12,845,052</td>
<td>10,700,260</td>
<td>5,214,358</td>
<td>2,044,749</td>
<td>1,744,816</td>
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<tr>
<td>Worst</td>
<td>2.5</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.8</td>
<td>10%</td>
<td>15,937,879</td>
<td>4,979,702</td>
<td>4,155,690</td>
<td>2,121,102</td>
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<tr>
<td>Best</td>
<td>1.3</td>
<td>25%</td>
<td>5,060,206</td>
<td>1,746,666</td>
<td>1,463,650</td>
<td>824,172</td>
<td>352,433</td>
<td>308,857</td>
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<tr>
<td>On-Premise</td>
<td></td>
<td></td>
<td>43,102,834</td>
<td>13,042,542</td>
<td>10,868,925</td>
<td>5,349,876</td>
<td>2,111,950</td>
<td>1,806,064</td>
</tr>
<tr>
<td>Worst</td>
<td>3</td>
<td>6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>2</td>
<td>30%</td>
<td>6,682,286</td>
<td>2,370,976</td>
<td>1,988,917</td>
<td>1,146,976</td>
<td>496,637</td>
<td>436,802</td>
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<tr>
<td>Best</td>
<td>1.5</td>
<td>60%</td>
<td>2,944,252</td>
<td>1,185,352</td>
<td>998,841</td>
<td>633,394</td>
<td>287,041</td>
<td>255,673</td>
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<tr>
<td>Private Cloud</td>
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<td></td>
<td>30,996,498</td>
<td>9,457,166</td>
<td>7,883,993</td>
<td>3,918,139</td>
<td>1,556,537</td>
<td>1,333,795</td>
</tr>
<tr>
<td>Worst</td>
<td>2.5</td>
<td>7%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.8</td>
<td>30%</td>
<td>6,014,058</td>
<td>2,133,878</td>
<td>1,790,026</td>
<td>1,032,279</td>
<td>446,974</td>
<td>393,122</td>
</tr>
<tr>
<td>Best</td>
<td>1.3</td>
<td>60%</td>
<td>2,551,685</td>
<td>1,027,305</td>
<td>865,662</td>
<td>548,941</td>
<td>248,769</td>
<td>221,583</td>
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<tr>
<td>Public Cloud</td>
<td></td>
<td></td>
<td>24,797,198</td>
<td>7,565,733</td>
<td>6,307,194</td>
<td>3,134,511</td>
<td>1,245,229</td>
<td>1,067,036</td>
</tr>
<tr>
<td>Worst</td>
<td>2</td>
<td>7%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.5</td>
<td>40%</td>
<td>3,977,983</td>
<td>1,481,792</td>
<td>1,245,265</td>
<td>746,813</td>
<td>329,759</td>
<td>291,637</td>
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<tr>
<td>Best</td>
<td>1.1</td>
<td>70%</td>
<td>1,942,527</td>
<td>807,147</td>
<td>680,852</td>
<td>440,725</td>
<td>201,546</td>
<td>179,958</td>
</tr>
</tbody>
</table>

* As of 2016

Server Utilisation

15% 25%
Points affecting server utilisation

• Active – Active / clustering deployments

• Peak utilisation vs performance degradation

• Ensuring there is enough capacity in the system to cater for workload peaks

• Having the right server configuration for the workload
The Ecodesign Regulation on servers and data storage products
Relative sustainability of products

Cut out least sustainable products

Incentivise choice of higher sustainability products

Encourage development of new, more sustainable products

Ecodesign

Energy Label

Mandatory minimum requirements

Market transformation: Mandatory Labelling

GPP

Support Innovation: voluntary initiatives

Ecolabel

Products on the market

Low

High

Relative sustainability of products
An Ecodesign Regulation on servers and data storage products has been recently voted by European Union (EU) Member States. It aims to reduce, in a sustainable way, the environmental impact on these products in the EU market. It contains requirements (as of 03/2020) on:

A. Energy Efficiency aspects (maximum idle power consumption, minimum server efficiency in active state, minimum efficiency of the power supply unit, information requirements on product operating conditions and on idle power at higher temperature)

B. Material efficiency aspects
- Servers and data storage products show good examples of refurbishment practices, take-back schemes, etc..

- The proposed requirements aim to overcome a few barriers and further improve the Circular Economy of these product in a sustainable way for businesses:

1. Design for disassembly
2. Secure data deletion of reusable data storage equipment.
3. Securing that firmware updates for product are available for repairers.
4. Critical raw material information requirement.
Scope - servers

Servers with up to four processor sockets, including among others: Tower servers, rack servers, blade servers, multi-node servers, resilient servers etc.

* Note that these are pictorial representations, actual products may differ.
Online 2, 3 and 4 data storage products

*Online 1-6 products are based on Online classification by SNIA Emerald.
**Note that these are pictorial representations, actual products may differ.
Towards a digital and sustainable society
A European Commission perspective
Political context

- Paris Agreement & EU sustainability objectives
- Strong cross-border dimension of the cloud
- Contributing to the Sustainable Development Goals

**EU sustainability targets compared to 1990 levels:**

<table>
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<tr>
<th></th>
<th>2020</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease in GHG emissions</td>
<td>20%</td>
<td>40%</td>
<td>80-95% (100% for energy sector)</td>
</tr>
<tr>
<td>Renewable energy</td>
<td>20%</td>
<td>27-&gt;35%</td>
<td>75-97%</td>
</tr>
<tr>
<td>Improvement in Energy efficiency</td>
<td>20%</td>
<td>27-&gt;35%</td>
<td>41% (vs 2005-6 peak)</td>
</tr>
</tbody>
</table>
Digitalising of society

Micro-electronics

Autonomous driving

5G

Smart Energy

IoT

Artificial Intelligence

Big Data

Software
Interoperability and standardisation

The Urban Platform

Agree common requirements, and speed adoption
- Requirements
- Leadership guide
- Management framework

By 2025, ensure that 300m residents of EU cities are supported by Urban Platform(s) to manage their business with a city and that the city in turn drives efficiencies, insight and local innovation through the platform(s)

European Innovation Partnership on Smart Cities and Communities

Accelerate the adoption of Urban Platforms in EU cities

Bring together EU Industry to adopt common open solutions
- Reference architecture and design principles
- Standards
- Scale

Formalise the capture of the core content as international standards

H2020 ESPRESSO

Demand Side
LoI

Supply Side
MoU

Standards

110 cities

93 signatories

Individual cities plus associations

DIN 91357 standard
• SAREF (Smart Appliances REFerence ontology), the creation of which was fostered by the European Commission, is an ETSI SmartM2M/OneM2M standard since 2015

• Commercial products based on it since 2016

• Since January 2017 a new modular version of SAREF with ever expanding number of extensions - from Energy, Buildings and Environment towards Smart Cities, Smart AgriFood, Smart Industry & Manufacturing, Automotive, Health/Ageing-well, Water, Wearables...
EU FP7/H2020 initiatives on sustainable data centers

**FP7 First Call**
- Individual efficiency of a data centre vs efficiency of a cluster of data centres
- 12MC
  - CoolEmAll
  - All4Green
  - Fit4Green
  - GAMES

**FP7 Second Call**
- Renewables; Heat Reuse; Smart Grids
- 18MC
  - RenewIT
  - GreenDataNet
  - Delfin
  - GENIC
  - DC4Cities
  - GEYSER

**H2020**
- Public procurement of fast evolving technologies
- 1.5MC
  - EURECA
- Support for measuring environmental efficiency
- 0.4MC
  - ICTFootprint
- Bringing to market more energy-efficient and integrated data centres
- 0MC
  - Catalyst
  - BodenType

Project Cluster
Common Metrics and Methodologies
Digital in MFF 2021-2027

DIGITAL IN THE NEXT MFF: OVERVIEW

**Digital Europe: Capacities & roll out**
1. High Performance Computing (HPC)
2. Artificial Intelligence (AI)
3. Cybersecurity
4. Advanced digital skills
5. Digital transformation and interoperability

- €9.2 billion

**Connecting Europe Facility - Digital Connectivity**
- 5G roll out
- BB 4EU, Connecting communities
- Synergies with Transport /Energy

- €3 billion

**Digital in Horizon Europe R&D&I**
1. Digital under "global challenges"
   - Digital and industry cluster
   - Digital in other clusters - health, mobility, energy, environment...
2. FET Open under Open Innovation
3. Research Infra under Open Science

- > €12 billion for digital

**Creative Europe MEDIA**
- Distribution of works
- Creation

- €1.1 billion
Panel Discussion

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Additional Material
Process

WE ARE HERE!
Is idle power consumption of servers relevant in the EU?
A data center taxonomy for the EU market – current figures and expected trends

<table>
<thead>
<tr>
<th>Data centre type</th>
<th>2015</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>SME data centres</td>
<td>20%</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>Mid-tier/older data centres</td>
<td>18%</td>
<td>15%</td>
<td>12%</td>
</tr>
<tr>
<td>Colocation data centres</td>
<td>34%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Hyperscale/Cloud data centres</td>
<td>28%</td>
<td>30%</td>
<td>35%</td>
</tr>
</tbody>
</table>
- When servers are running idle (i.e., doing no useful work), they still consume energy! (typically 25%-65% of the maximum power)
- Our understanding of the EU market shows that still nowadays, a not negligible portion of the servers on the market is operated at idle power for several hours per day
- Servers running at high utilization levels most of the time are already excluded from the idle power requirements (HPC servers, servers with integrated APA and resilient servers)
Findings from the EU H2020 EURECA Project (close to finalisation)

- over 350 data centres of public administrations in the EU were analysed (ministries, universities, etc)
And elsewhere?


Table 1. Average Active Volume Server Utilization Assumptions

<table>
<thead>
<tr>
<th>Space Type</th>
<th>2000-2010</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>10%</td>
<td>15%</td>
</tr>
<tr>
<td>Service Provider</td>
<td>20%</td>
<td>25%</td>
</tr>
<tr>
<td>Hyperscale</td>
<td>45%</td>
<td>50%</td>
</tr>
</tbody>
</table>
And what will happen in the short-medium term?

- Reliable forecasts are very difficult
- Future upcoming trends: virtualisation, but also others who could go in the opposite direction, such as 'fog computing' and 'edge computing'.
- Consumer choice (perceived security for in house operations) and external constraints (infrastructures) could further delay the trend towards virtualisation
Main instruments

**Ecodesign Directive 2009/125/EC:** "Framework" defining the "rules" for setting product-specific requirements/legislation on energy efficiency and further parameters. Compliant products receive "CE Mark".

**Energy Labelling Directive 2010/30/EU:** "Framework" defining the "rules" for setting product-specific requirements/legislation on standard information of the consumption of energy and other resources.

Other related instruments

**Ecolabel:** The EU Ecolabel helps identify products and services that have a reduced impact on the environment throughout their life cycle, from the extraction of raw material through production, use and disposal.

**Green Public Procurement:** A voluntary instrument. GPP can help stimulate a critical mass of demand for more sustainable goods and services which otherwise would be difficult to get onto the market.
What is the problem

- European data centres consuming more than **104TWh (2015)** per annum representing **3%** of total electricity (PEDCA project)
- This could grow with **20%** by 2020 (**35% over 9 years** (Smart 2012/0064)) – compared to **falling or flat** rest of ICT
- Even worse for networks – growth in consumption **150% in 9 years** (Smart 2012/0064) – compared to **falling or flat** rest of ICT
- Some new trends such as **IoT, edge computing, SDN/NFV, etc. not taken** into account in above growth figures
- The **percentage** (and if no action the total consumption) **will only go up** as the other sectors become more efficient with ICT (**smartening**)
- Some member countries/cities are hitting the **limit of their power grids**
- There is an **ongoing improvement**, but pace is **slow** with potential to get slower
The EIP-SCC
European Innovation Partnership for Smart Cities & Communities

- 4,600 partners
- 370 commitments
- 31 countries

Deliver: scale, acceleration, & impact,...

Through: common solutions, an integrated approach, & collaboration

Focus on Energy, Transport and ICT

H2020

- Lighthouse projects (~100 M€/year; ~4 projects/year; per project – 3 lead cities, 3 follower cities and other cities)
- CSAs (Espresso, CityKeys, etc.)