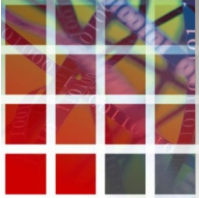


Tools, results and future requirements for the energy assessment of virtualized IT systems and Datacenters and the EKT case study

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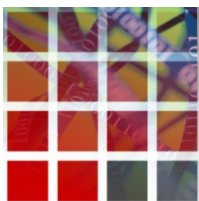
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National Documentation Center/National Hellenic Research Foundation
(EKT/NHRF)



- *Measure and control efficiency of IT systems*
 - Including *energy, environmental, technological assessment*
 - *Tools*
 - *for the energy assessment of virtualized IT systems and Datacenters in different levels*
 - *Results*
 - *EKT case study*
- & future requirements

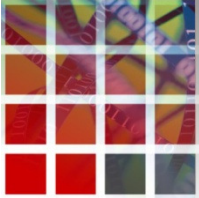




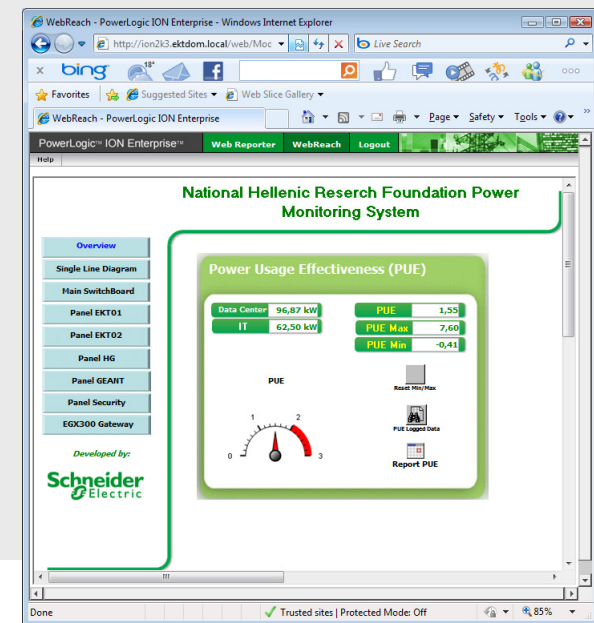
The National Documentation Centre (EKT) is the national Infrastructure for collecting, aggregating and provisioning scientific documentation, online information and support services on research, science and technology. Acts as a hub for universities, research centres, enterprises, public and private sector bodies.

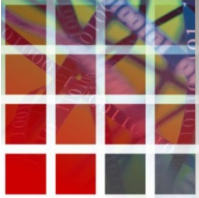
- **Purpose:** Development of interoperable content e-infrastructure at the national level for the aggregation, organization and dissemination of scientific content
- **Aim:** **Open Access** to knowledge
- + **Open Data & Open Source** proponent
- National Information System for Research and Technology:
<http://epset.gr>



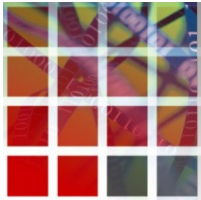


- EKT Hosts:
 - EKT IT infrastructure &
 - Hellas Grid HG-06
- Features: *100m², 291KVA UPS power, 550KVA backup generator, Access Control, FM200 fire suppression, VESDA, etc.*
- Green IT initiatives:
 - **Virtualisation** and virtualisation **energy gains** estimation (2007)
 - **Cold Isle Containment** (2012)
 - Full **energy monitoring** and **live PUE** reporting (2012):
 - live PUE reporting by APC ION tool and **purpose built EKT s/w**
 - <http://epset.gr/Nisrt/GreenIT>

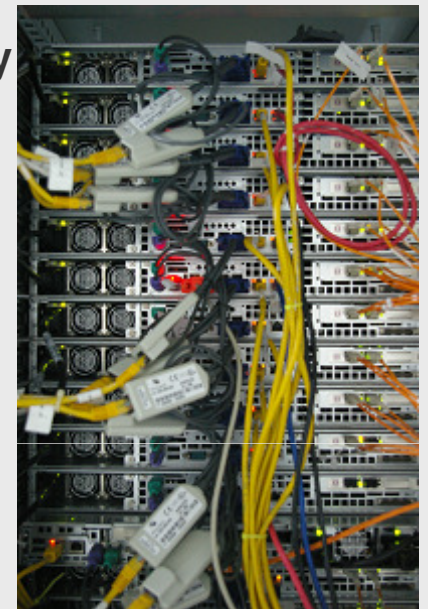




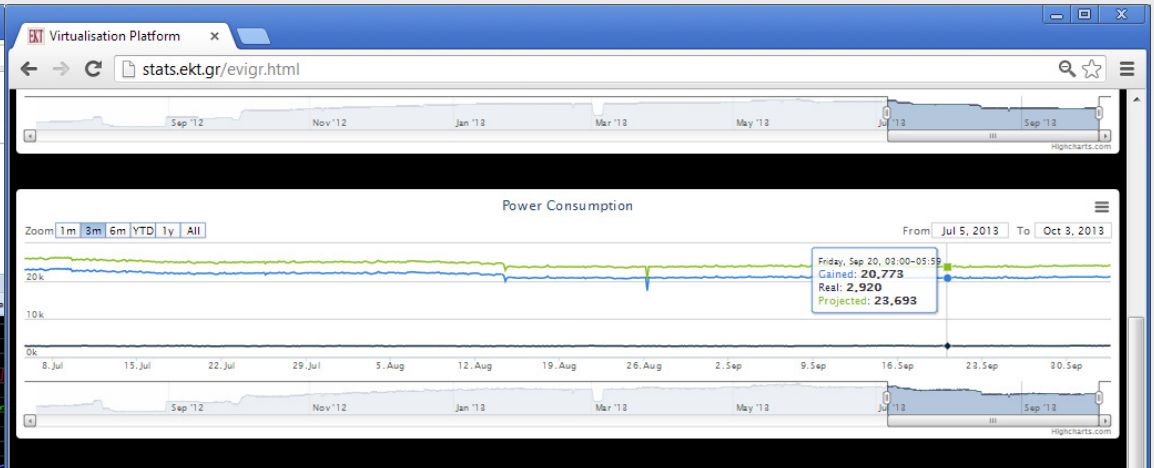
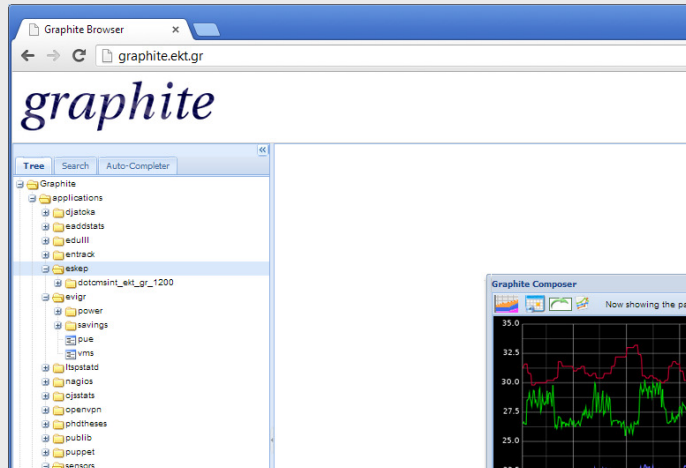
- **Measure and control efficiency:**
 - Virtualisation: how we measure, evaluate and asses its energy gains? (Q.1)
 - arisen very early (2007)
 - Datacenter Green IT: how we measure, evaluate and asses energy efficiency? (Q.2)
 - And what about beyond energy: **environmental impact** and **cost**? (Q.3)
 - **Cost**: how we can easily measure, evaluate and asses actual energy costs
 - in an environment where you have neutral collocation of multiple entities (NHRF, EKT and Hellas Grid)



- **Custom built tools where already available did not exist + already available tools**
 - Scripting languages and rapid prototyping
 - Release them as open source
- **e-vigr**: EKT's virtual infrastructure Green Meter
 - First version (2010) <http://hdl.handle.net/10442/8360>
 - Real time virtualisation energy gains: measure VM platform energy footprint VS projected physical footprint:
 1. Measure in real time the consumption of virtualisation platform (server ILOM SNMP)
 2. Grab VMs names (ESX 5.1 and KVM SNMP)
 3. Grab the load from each VM (SNMP)
 4. Calculate projected load
 5. Energy gain: subtrack projected energy consumption from actually measured
 6. visualise and publish!
 - In real time (DEMO) – available as <http://code.google.com/p/e-vigr/>
 - Main issue: No **standard energy ILOM for servers** even after BIOS updates



Εθνικό Κέντρο Τεκμηρίωσης Demo and tools: calculation, storage, presentation

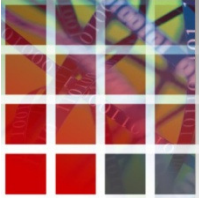


The screenshot shows the website 'www.epset.gr/en/Nisrt/GreenIT'. The page has a header with the 'NISRT' logo and the text 'Social Networks - User Generated Content'. Below the header is a navigation menu with items: 'NISRT', 'Digital Content', 'SaaS Services', 'NISRT Files', and 'Press Center'. The main content area includes a sidebar with 'About NISRT' and 'Green IT' sections. The 'Green IT' section contains text about research infrastructure and a list of bullet points. A box titled 'EKT and Green IT' provides specific statistics and a 'Learn more' link.

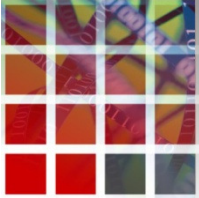
- What is Green IT?
- Why Green IT is so important?
- The International Landscape
- How the National Documentation Centre of Greece (EKT) applies Green IT?;
- Green IT and the National Information System for Research and Technology (NISRT)
- Future Plans

EKT and Green IT
Now:
• 110 virtual servers running
• By 40,48 KW lower power consumption
• Power Usage Effectiveness (PUE): 1,91
Estimated since 2008:
• 783,92 fewer tones of CO2 emissions released into the atmosphere
• By 783,918,48 KWh lower energy consumption
[Learn more](#)

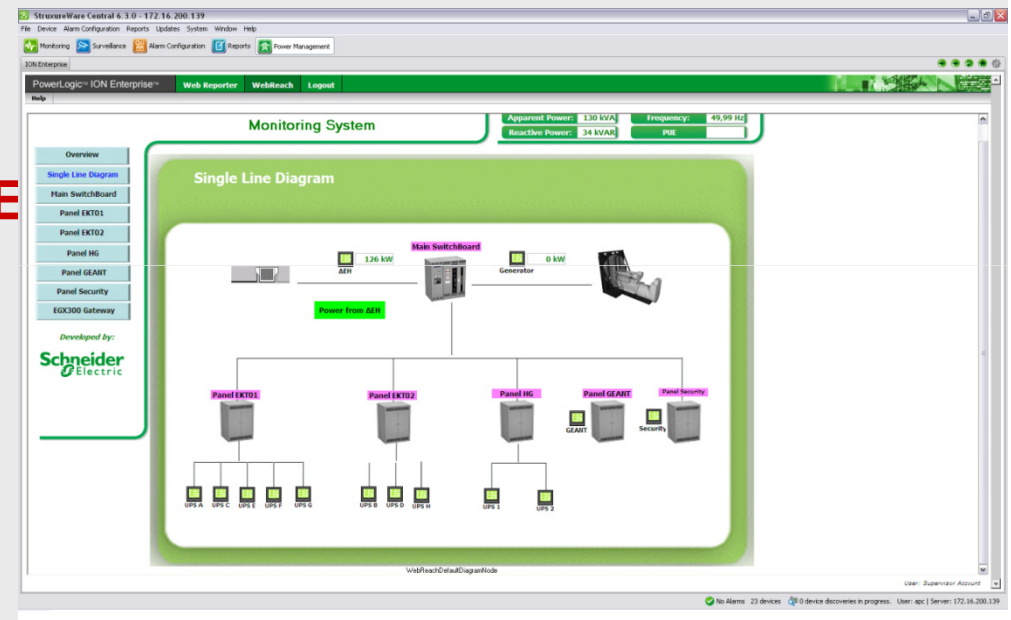


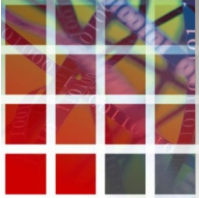


- 783.918,48Kwh (from 2008 to present)
 - Only from utilizing virtualization
 - And an estimated (?) 783 CO2 tons less and a rough estimation of 80KEuros
- Main issues:
 - No **reliable** and **easily accessed data** (OR API) for
 - **Actual energy costs** VS energy consumption profile
 - **Actual environmental impact** (CO2) to energy mapping
 - A future requirement for:
 - **Reliable, local, APIs** and **data** for correlating costs, energy, power and CO2 emmissions
 - Industry? Governments/NGOs?



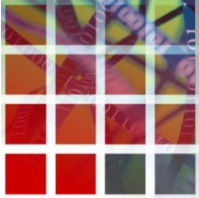
- Installation of a full energy monitoring system
 - >14 energy meters
 - ION Scheider
 - Energy and Power based **PUE** metering
- Developed tools for
 - live PUE reporting
 - Storage (graphite)
 - Visualisation
- epset.gr/en/Nisrt/GreenIT



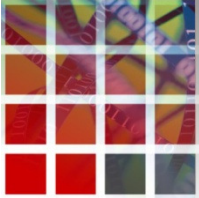


- Results, PUE /year:
 - 2012: 1.67
 - 2013: 1.58 (7/2013)
- Daily reporting of EKT's PUE
 - not done in any formal Data/API specification
 - Repeating(?) issue:
 - How to estimate energy/costs/CO2 benefits from PUE improvement
 - APIs/Data seem (?) to be missing



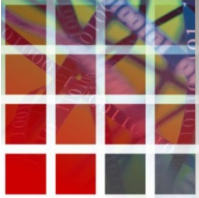


- Collocation of 3 different organisations (EKT,NHRF,HG)
- Based on actual costs not a standard fee
- Approach: measure/store energy values reading and emulate costs calculation
 - Not a trivial task to accurately calculate costs over this environment
- Thus again we seem to lack an API/Service for cost/data calculation



- EKT is a Datacenter operator (supporting open access, open data and open APIs)
 - Employs Green IT principles
 - We have **developed some** tools and **reused others** for presenting, storing and calculating data for PUE/power gain/virtualisation power gains
- Based on our experience what is missing and needed is **Public APIs/Web Services** and **Open Data** for:
 - Energy to Cost calculation
 - Energy to CO2 emissions (and environmental impact)
 - And other second level metrics

Conclusion: We believe that **open APIs, services** and **specifications** are a better solution than tightly integrated monolithic solutions



Thanks for your attention!