# Redução do consumo de energia de infraestruturas elétricas

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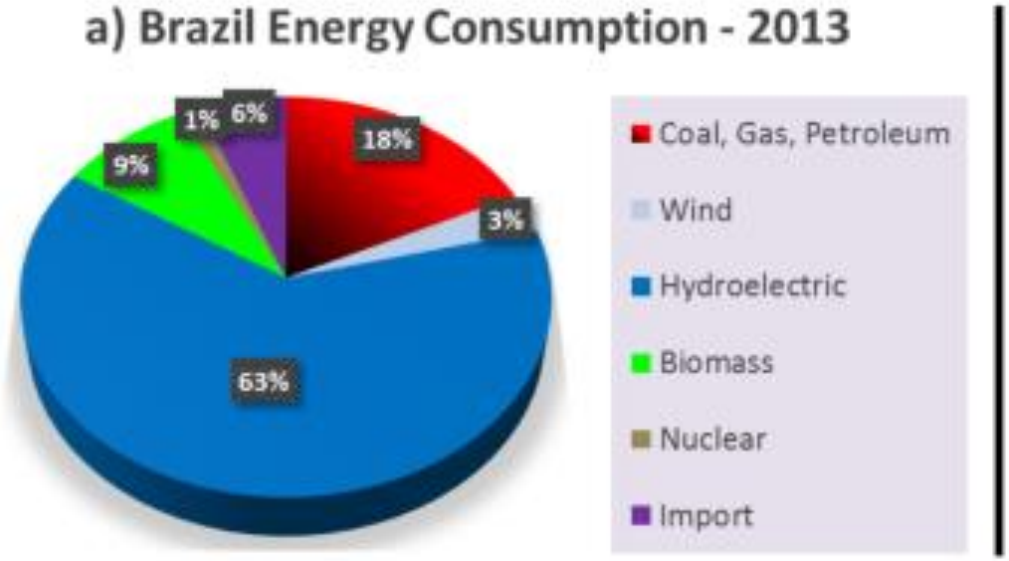
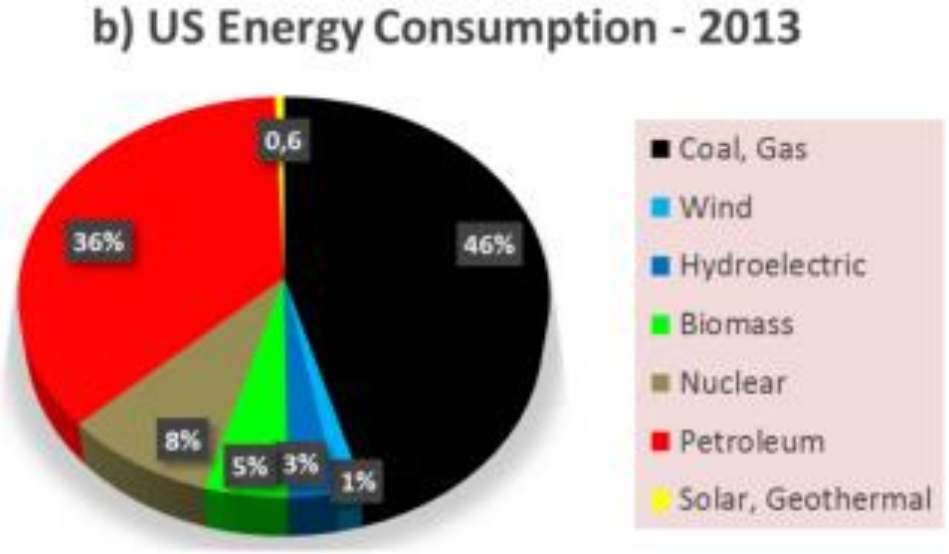
# Introdução

- Data center
  - Infraestrutura de TI
  - Infraestrutura de Resfriamento
  - Infraestrutura Elétrica



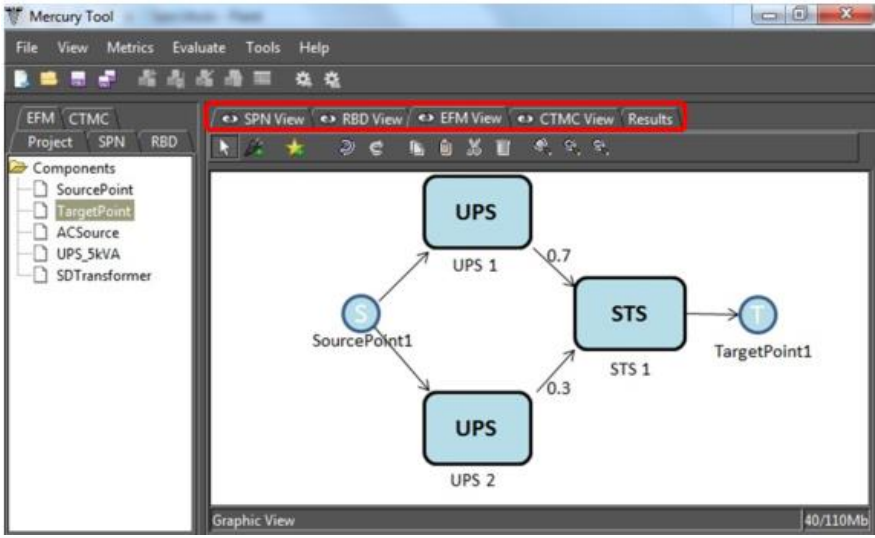




  - Ambiente Sustentável

# Mercury

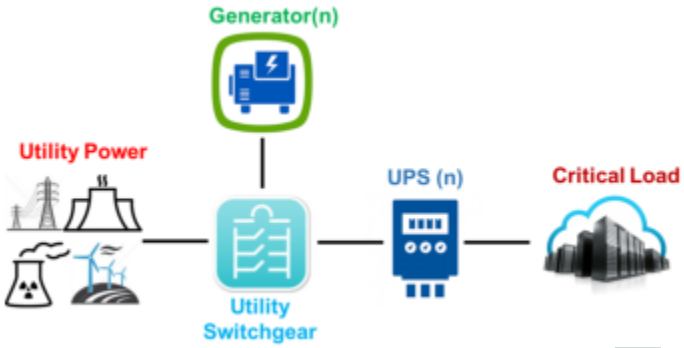
- Como estamos fazendo isso?
  - Utilizamos um conjunto de modelos para a **quantificação integrada** do impacto na **sustentabilidade, custo e confiabilidade** das infra-estruturas de energia e refrigeração do data center.

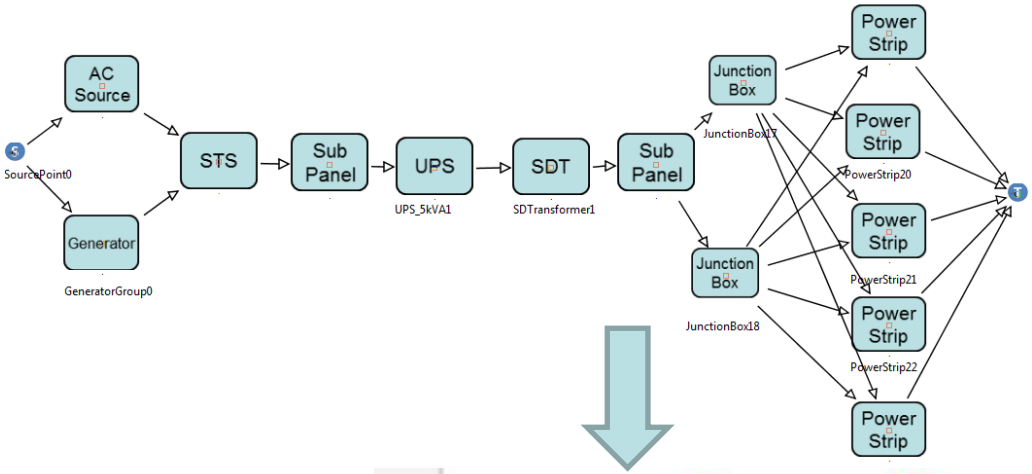
- Com o que?
  - Mercury

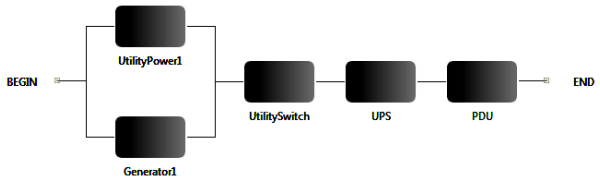


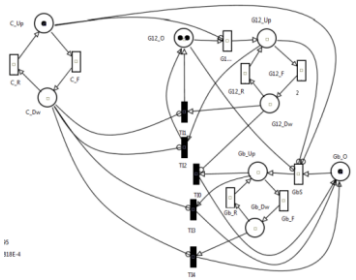
# Como usamos o Mercury

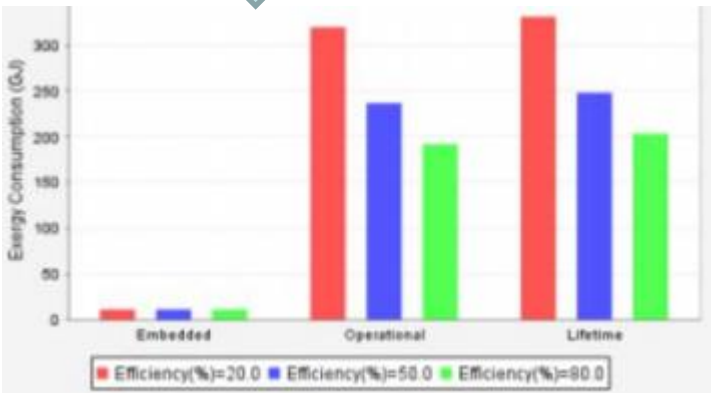
- Como estamos fazendo isso?



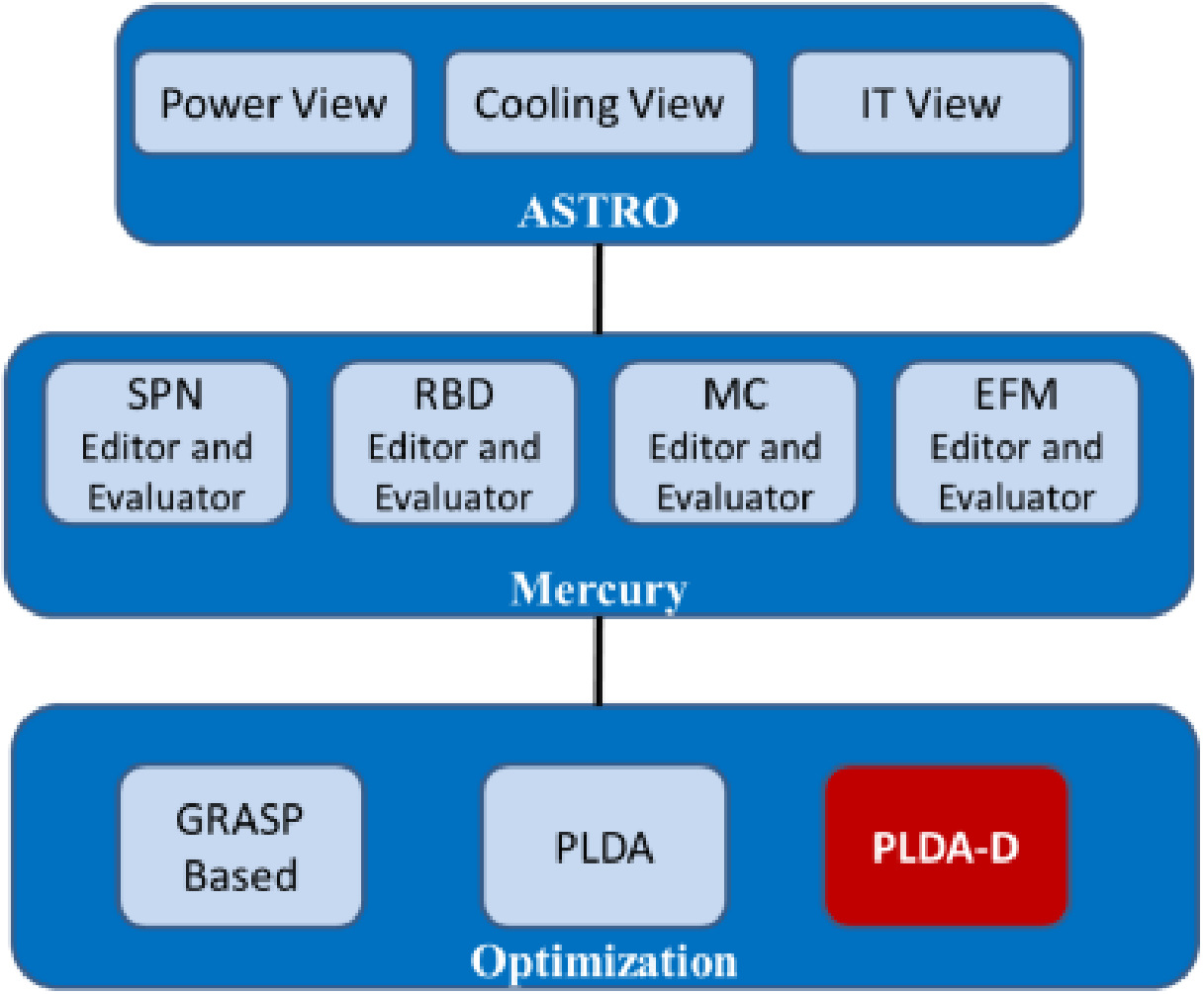



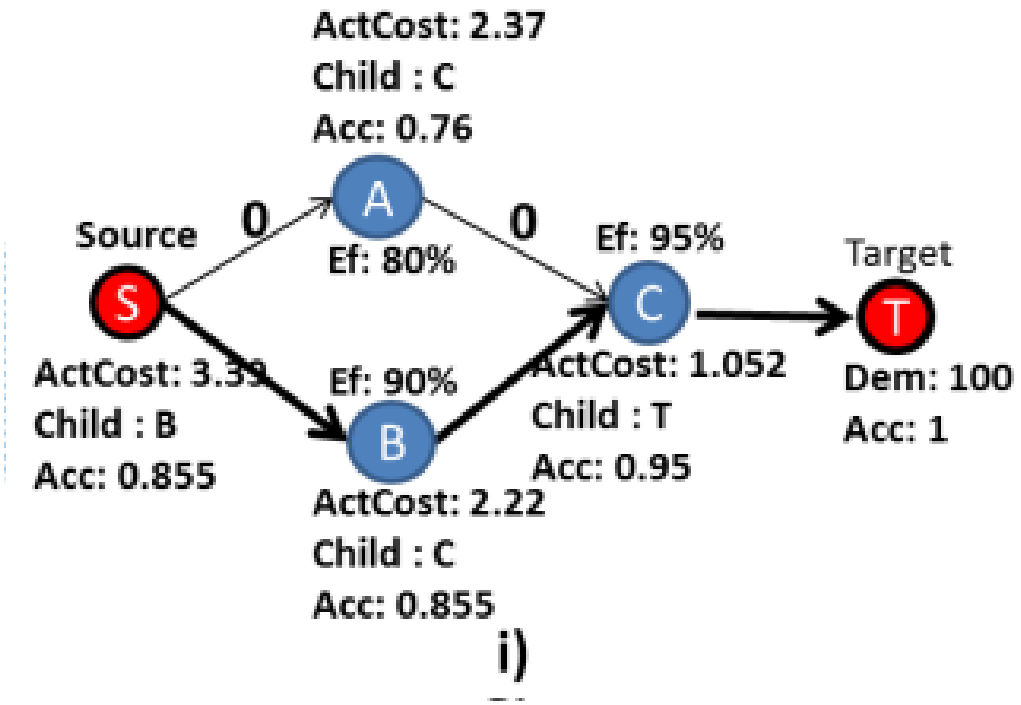





# Mercury


Power View
Cooling View
IT View
ASTRO
SPN
Editor and
Evaluator
RBD
Editor and
Evaluator
MC
Editor and
Evaluator
EFM
Editor and
Evaluator
Mercury
GRASP
Based
PLDA
PLDA-D
Optimization

# Exemplo do PLDA-D



# Métricas

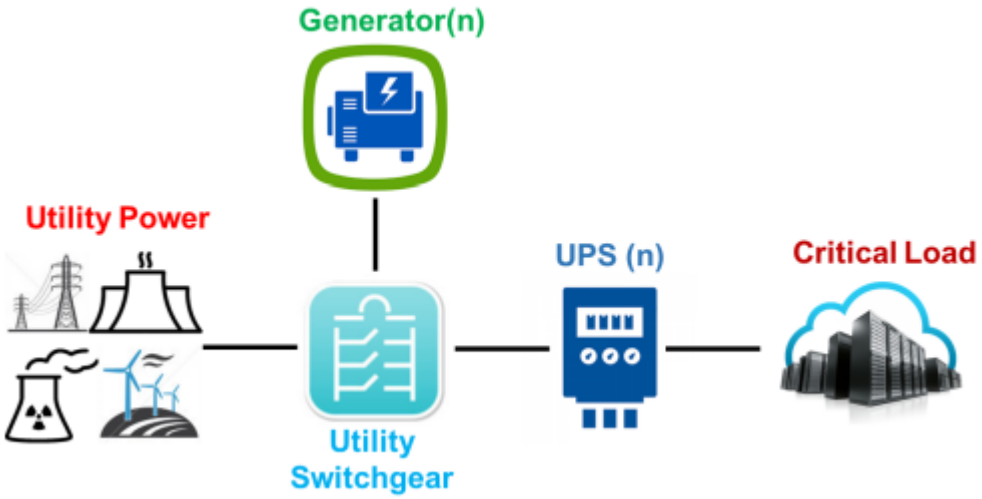
- **Dependability**
  - – Availability
  - – Reliability
  - – Reliability Importance (RI)
  - – Reliability and Cost Importance (RCI)

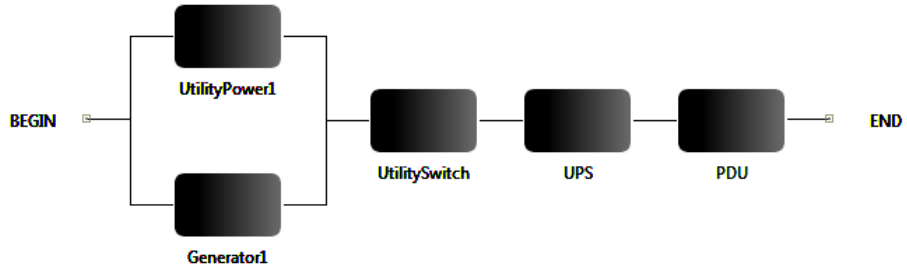
- **Sustainability Impact**
  - – Exergy Consumption
  - – CO2 Emissions
  - - Input Power

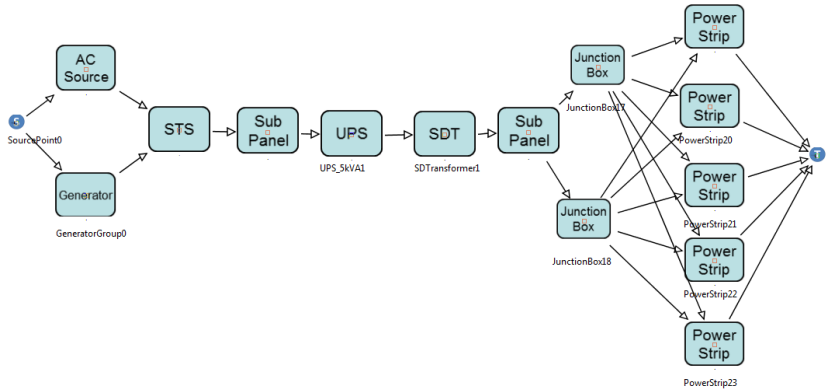
- **Cost**
  - – Acquisition cost
  - – Operational cost

# Estudo de Caso – Tiers 1, 2, 3 e 4

## Exemplo Tier 1



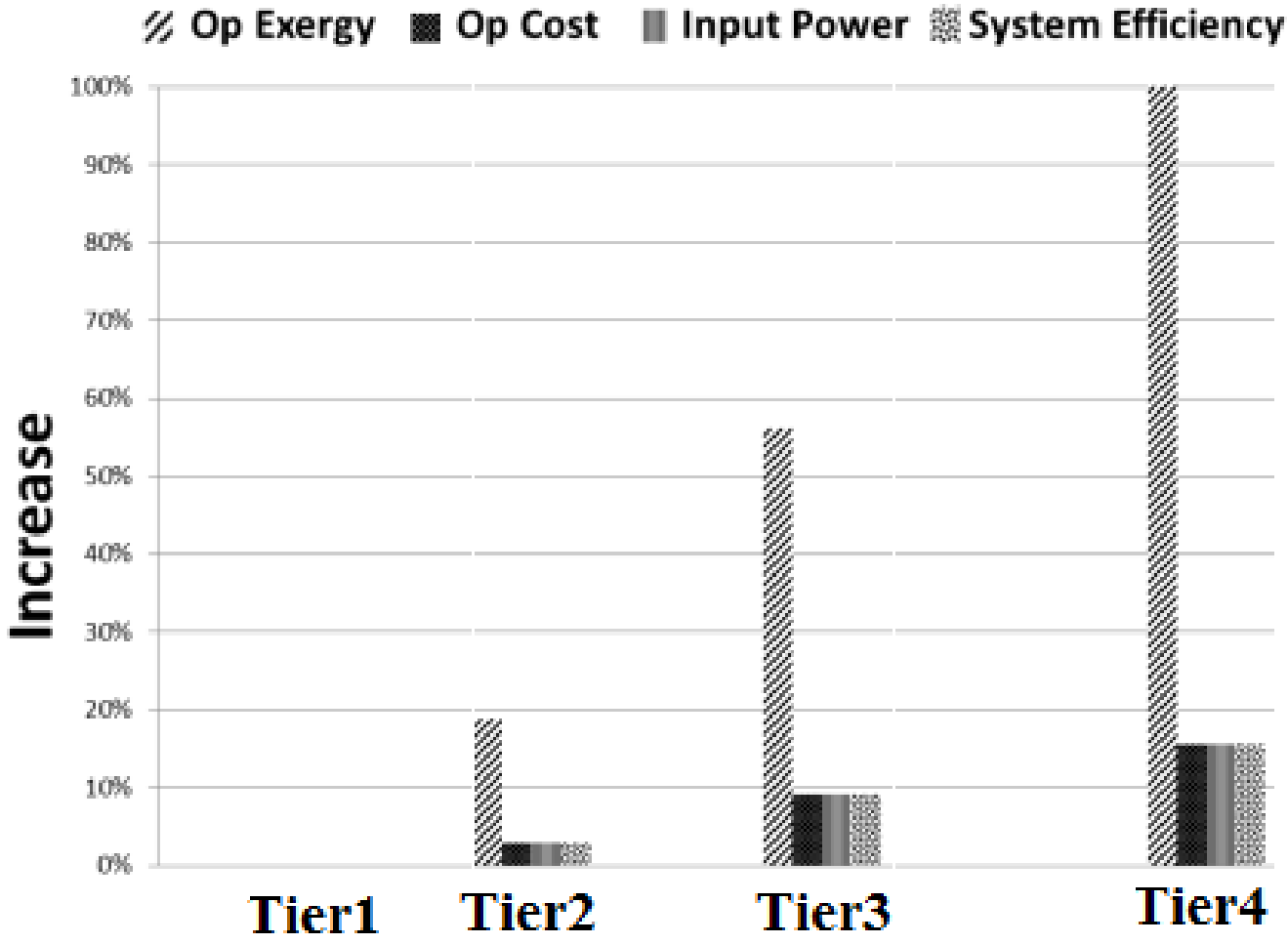



# Resultados

**Figure 11.** Comparison before and after PLDA- **D** execution

| Architectures | | em Efficiency (%) |
|---|---|---|
| | | 84.82 |
| Tier1 | | 84.82 |
| | In | 0 |
| Tier2 | | 81.99 |
| | | 84.4 |
| | In | 2.9 |
| Tier3 | | 77.02 |
| | | 83.98 |
| | In | 9 |
| Tier4 | | 73.43 |
| | | 84.83 |
| | In | 15.5 |



# Conclusões

- O PLDA-D aloca automaticamente de forma ótima os valores dos pesos em um modelo EFM.

- Para todas as arquiteturas estudadas os resultados com o PLDA-Depth foram sempre **melhores** ou **iguais** a arquitetura original.

# Incentivo aos Calouros : Publicações com o EFM

1. **João Ferreira** ; CALLOU, GUSTAVO ; DANTAS, J. R. ; SOUZA, RAFAEL ; MACIEL, PAULO . An Algorithm to Optimize Electrical Flows. In: IEEE INTERNATIONAL CONFERENCE ON SYSTEMS, MAN, AND CYBERNETICS, 2013, Manchester. Energy Efficient Systems, 2013.

2. ⭐ **FERREIRA, JOÃO** ; CALLOU, GUSTAVO ; MACIEL, PAULO . A Power Load Distribution Algorithm to Optimize Data Center Electrical Flow. Energies (Basel) JCR, v. 6, p. 3422-3443, 2013.

1. CALLOU, GUSTAVO ; **FERREIRA, JOÃO** ; MACIEL, PAULO ; TUTSCH, DIETMAR ; SOUZA, RAFAEL . An Integrated Modeling Approach to Evaluate and Optimize Data Center Sustainability, Dependability and Cost. Energies (Basel) JCR, v. 7, p. 238-277, 2014.

3. CALLOU, GUSTAVO ; MACIEL, PAULO ; TUTSCH, DIETMAR ; **FERREIRA, JOÃO** ; ARAÚJO, JULIAN ; SOUZA, RAFAEL . Estimating sustainability impact of high dependable data centers: a comparative study between Brazilian and US energy mixes. Computing (Wien. Internet) JCR, v. v, p. 1-34, 2013.

2. SOUZA, RAFAEL ; CALLOU, GUSTAVO ; CAMBOIM, K. M. A. ; **FERREIRA, JOÃO** ; MACIEL, PAULO . The Effects of Temperature Variation on Data Center IT Systems. In: IEEE INTERNATIONAL CONFERENCE ON SYSTEMS, MAN, AND CYBERNETICS, 2013, Manchester. Human-Machine Systems, 2013.

# Duvidas ou Sugestões?