How OCP affects the efficiency of a data center
What can we remove from the system?

Can we raise operating temperatures and have the servers survive?

Can we increase server delta T and relative humidity operational ranges to make the system much more robust and efficient?

Do we need a centralized UPS, PDUs, or chillers?

RESULT: OCP Data Centres  PUE 1.1

Traditional Enterprise Data Centres = PUE 1.8
Why 19 inch relay racks?

Module

Container
Why 19 inch racks... are not sacrosanct

Why accessible false floors in computer rooms?
Open Rack Unit innovations - Server fans “Cube Law”

40 mm Fans

80 mm Fans

EIA “U”

OCP “OU”

20th Century Dross removed by OCP:

- 2 x TOR Switches
- 4 x Pluggable optics
- 86 x PSU’s
- 208 x 40mm Fans
- 4 x AC Power Strips
- 86 x IEC rear power cords
- 120 x RJ45 rear patch cords

N+1 CRAC units
Access Floor
Cables in floor
Traditional Datacenter Design

Chilled water based cooling
Dual redundant UPS’s for power backup

Modern Datacenter Design

Eliminate Chillers and Cooling Towers

Modern Datacenter Design

Reduce facility cost and footprint by eliminating centralized UPS
Migrate to Distributed UPS within IT load
Smaller failure domain → Improved uptime

The Numbers...and impact on Europe
What recent improvements have you made to your data center’s energy efficiency?

- Improvements to address cooling costs are top focus for data center energy efficiency improvements.
- Energy reuse important strategy, sometimes overlooked.
- Optimizing compute efficiency limits need for additional cooling.
- Elements on the horizon: software to automate cooling controls, OCP equipment.
What plans do you have over the next 2 years to improve data center efficiency?

<table>
<thead>
<tr>
<th>Plan</th>
<th>% of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat energy reuse</td>
<td>22%</td>
</tr>
<tr>
<td>Use liquid heatsink cooling</td>
<td>22%</td>
</tr>
<tr>
<td>High voltage (400VDC)</td>
<td>11%</td>
</tr>
<tr>
<td>In-rack battery</td>
<td>11%</td>
</tr>
<tr>
<td>Designing chips for specific workloads</td>
<td>11%</td>
</tr>
<tr>
<td>Transition to 48V</td>
<td>11%</td>
</tr>
<tr>
<td>Running equipment in parallel</td>
<td>11%</td>
</tr>
<tr>
<td>Increased server density</td>
<td>11%</td>
</tr>
<tr>
<td>Increase use of free air cooling</td>
<td>11%</td>
</tr>
<tr>
<td>Install Containment Panels</td>
<td>11%</td>
</tr>
</tbody>
</table>

Source: IHS Markit

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Facebook’s Denmark data center will supply heat to city

Odense’s district heating will get 100,000 MWh of social hot air

September 08, 2017  By: Peter Judge

Facebook’s planned Danish data center will supply hot air to the district heating system of the nearby city of Odense, when it opens in 2020.

When the site is built, Facebook’s waste heat will be boosted by a heat pump, and delivered as hot water into a heating system run by local firm Fjernvarme Fyn. Odense is the third largest city in Denmark, with 175,000 citizens - and Facebook believes it will supply up to 100,000 MWh of energy per year waste heat could warm up to 6,900 homes.

Renewable energy

“At all of our data centers, we look to make our operations as sustainable as possible, but our ability to recycle heat from our servers is unique to our Odense data center,” says an announcement on the data center’s Facebook page (of course). “This was made possible due to our close collaboration with the local district heating company Fjernvarme Fyn and its existing district heating network.”

Data Centres used as heat generators

Higher exhaust air temperatures possible on OCP racks

Liquid heat transfer systems being hacked in OCP
15 Years and 350000 servers of Liquid cooling!!
- Octave KLABA Founder and Chairman OVH

https://www.opencompute.org/events/past-summits

Lenovo bets big on liquid cooling going mainstream, launches Neptune

Liquid cooling in the data center was usually reserved for supercomputing. Lenovo is betting that cooling techniques will go mainstream.

By Larry Dignan for Between the Lines | June 29, 2018 — 12:00 GMT (13:00 BST) | Topic: Data Centers
The Ecodesign Regulation on servers and data storage products

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: 2020-2030-2050
- Decrease in GHG emissions 20%, 40%, 80-95%
- Renewable energy 20%, 27->35%, 75-97%
- Improvement in Energy efficiency 20% 27->35% 41% (vs 2005-6 peak)
OCP Power Consumption Comparison

**Workload 0%**

- OCP: 46.3%, 48.0%, 49.4%, 52.4%
- Legacy: 80% (consistent across all inlet temps)

**Workload 100%**

- OCP: 18.1%, 18.9%, 19.1%, 18.7%
- Legacy: 100% (consistent across all inlet temps)

*Inlet Temp. (°C)*

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GOALS

- Wanted a new network architecture that offered quick development of new features, better resilience and robustness
- Make deployment more modular, cost and energy efficient
- Adopt automation to manage complexity
- Improve interconnect across data center sites, providing for better redundancy and transparency for workloads
- Improve density and maximize space utilization in data centers

NEW ARCHITECTURE

- Migrate from chassis based to fixed switch architecture
- Adopt disaggregated approach with switches from Edgecore and switch OS from IP Infusion

RESULTS

- 40% reduction in energy consumption
- Over 50% savings in space
- Move to 100G, ready for 400G
- Increased troubleshooting visibility
CERN: 29% less energy @ 80% utilisation

RISE: Energy studies with more than 1,500 OCP servers

Booking.com: 40% less energy compared to blades

https://www.opencompute.org/events/past-summits
Hyperscaler OCP hardware re-use

Enabled by the removal of gratuitous product differentiation

https://itrenew.com/
Communities are driving innovation

Data centers operators are looking to new open designs

There is real impact happening across Europe
....a thought for your day

If current OCP designs and practices were applied world-wide today the energy consumed by all the world’s data centres would reduce by more than 50%.

www.opencompute.org
THANK YOU

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Booking.com:  https://www.youtube.com/watch?v=1qIOptRGL2c&feature=youtu.be

SK Telecom:  https://www.youtube.com/watch?v=BBcFXAXXqRE&t=127s

Europe eco-design regulation:  https://www.youtube.com/watch?v=GwFMMPvAFSo&feature=youtu.be

OVH Advanced Cooling:  https://www.youtube.com/watch?v=_y1ELNs7B_k&feature=youtu.be

OCP Event Presentations:  https://www.opencompute.org/events/past-summits