HYPERSCALE
AT VERY SMALL SCALE
Øyvind Bakksjø / CTO / Arctic Circle Data Center
› Public cloud service provider
› **Edge Cloud:** Edge Computing + Public Cloud service provider
› Bringing the cloud to the data
› Designed for small, decentralized units rather than large centralized DC
› Self-service IaaS and PaaS for big data
› Based in Norway, run under Norwegian legislation
› Redundancy and availability designed into infrastructure and IT layer
› Designing our own infrastructure solutions, controlling the complete stack
What we use

- Open Rack v1 and v2
- Local Energy Store (LES)
- Leopard (server)
- Knox (JBOD)
- Networking gear is non-OCP
- Planned (Q2'18): Lightning (JBOF)
- OpenStack and lots of other open source software
Why we chose OCP

› Smart & efficient designs, ease of operation
› Open source with momentum always wins
› Piggybacking on hyperscale innovations
› Preparing for the future – improved economies of scale
› We’re small scale (now), but we build by hyperscale design principles
What hyperscalers do: Optimize!

- **Optimize hardware costs**: Avoid lock-in, enable supplier competition
- **Optimize energy efficiency**: Minimize AC<->DC conversions
- **Optimize cooling costs**: Allow running at higher-than-usual temperatures
- **Optimize operational costs**: Simplify maintenance & manual work
- **Optimize availability (uptime)**: Holistic approach (include IT & software)
How OCP aids in optimizing hardware costs

› Simplified hardware (e.g. no power supplies)
› Open specifications
  - avoid lock-in
  - make suppliers compete on price & time
  - mix parts shopped from different manufacturers
› Many manufacturers/suppliers of the same HW => shorter delivery times
› Open designs don't go obsolete; can order replacements / stay homogenous
Our experience purchasing OCP HW

Some challenges:
- Small customer => buy from small supplier
- Supplier is helpful, service-minded and professional, but have <5 items in stock
- Need more? Shipment from Asia; long lead times (~12W)
- Few customers to share shipping costs with => shipment is $$
- Newest designs not generally available for small customers
  - Order 100 000 units produced for you, no problem.
  - Moore’s law consequence: Not running on the latest CPU lines is a cost
Open Rack + Local Energy Store

Uncommon configuration outside of hyperscale world
- Difficult request for small-scale suppliers

In-rack battery solutions are $$$ in low volumes
- More expensive than centralized UPS
- Lithium batteries considered hazardous material
  => complicates shipping

Still an advantage for us:
- LES is not only about $$ for batteries, but also about reducing the failure blast zone, saving space, and simplifying your DC design
- Fits well with our holistic approach to redundancy and availability
- Our container-based deployment units have no space for a UPS room
What «Open» means

› Spec details certain parts of the design
  - Example: interface between server and bus bar
  - Will work: Server from manufacturer A in rack from manufacturer B

› Some things are not a specified interface. Implementations are free to differ.
  - Example: Interface between bus bar and rack
  - Equipment from different manufacturers is not necessarily interchangeable
Memorable experience: Buying rack and LES from different manufacturers

Open Rack specifies:
- Interface between servers and busbar: YES
- Interface between busbar, power/battery shelves and rack: NO
- Should be bought as a unit, but...

› Rack manufacturer #1: Doesn't produce battery shelves
› Rack manufacturer #2: Produces battery shelves, but requires particular switches & software for management
› Rack manufacturer #3: Produces battery shelves, but long rack delivery time

Solution: We bought racks from #1 and battery shelf from #3. Result?
Fitting a «vendor #3» bus bar in a «vendor #1» rack
Optimizing energy costs

› AC input to rack
› Single AC->DC conversion in power shelf
› DC on busbar
› All servers & rack HW get DC from busbar
AC delivery to rack – a peculiar case in Norway

Different power distribution systems exist:
- IT: Isolated Terra
- TN: Terra Neutral

Not dictated by spec, but in practice, OpenRack = TN
- No OpenRack power shelf manufacturer supports IT (yet)

If IT distribution on site: Transformer installation required
- Transformers can't be scaled with installation

Too large? Wasted capital
Too small? Must replace later with larger capacity requirements
- Not energy efficient

IT power common in Norway (legacy infrastructure) and Albania, Not a problem elsewhere!
DC delivery in rack – in practice

Generally works great - but:

› Non-OCP equipment in rack needs AC power
  - E.g. Top of Rack switches
  - Open Rack provides raw AC => LES of no use

› Our solution: We added a 19-inch rack for networking gear

› Bought extra in-rack (19-inch) UPSes
  - Small investment: Just enough battery for switches etc. (fraction of total power consumption)
Optimize cooling
- in practice

› OCP servers specified to operate with high-ish temperatures
› We are in Northern Norway... Cool climate!
› We use two-stage indirect free cooling via water
› We allow up to 35°C in cold aisle
› Works well for us!
Front-operated HW is great for small scale

- No need to go to back of rack
  - Hot aisle can be made narrow
  - Racks fit in standard industry containers. Great for easy transportation of our ready-to-deploy Edge Cloud units
Operations are a breeze

› **Tool-less design:** Change components in minutes without a screwdriver
› Hot-swappable components
OCP wish list

- Would like to see more proprietary products (e.g. switches) come in busbar-integrateable format
- Bus bar-integrated DC->AC converters to use LES as UPS for AC equipment
- Bus bar «emulator» for working with servers outside of rack area
- Rack power supplies for IT power (Norway and Albania would love you!)
How to make your small-scale OCP adoption a success

› Plan purchases well and place orders early
› Consider your existing power distribution
› Mix vendors only at interface boundaries defined in specifications
› Have a plan for dealing with a mix of OCP and non-OCP gear
› Pick a supplier with whom you have good chemistry