



Kenneth J. Patchett - Director West Region


Driven by a need to scale efficiently

Scale is a big problem

The problem is bigger than just one company or individual



It takes a community working together

OPEN Compute Project

The world is waiting.

facebook's scale

- **864 million daily active users on average for September 2014**
- **703 million mobile daily active users on average for September 2014**
- **1.35 billion monthly active users as of September 30, 2014**
- **1.12 billion mobile monthly active users as of September 30, 2014**
- **Approximately 82.2% of our daily active users are outside the US and Canada**



Complexity creates waste

Resiliency is better than redundancy

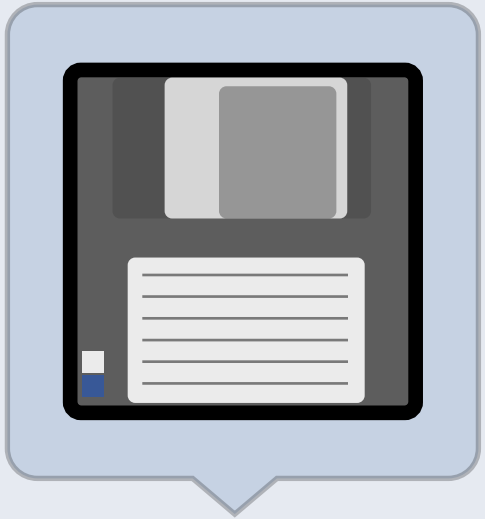
Good enough is not enough



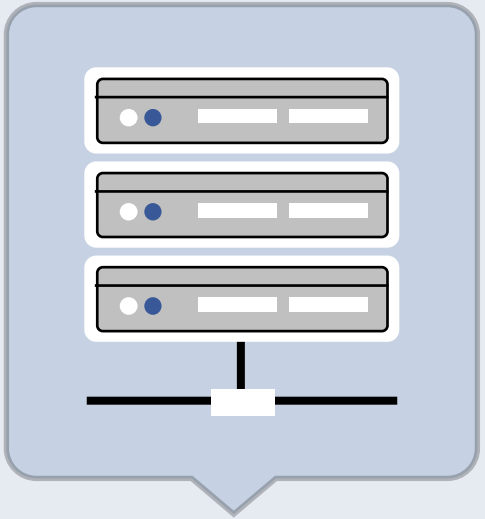


Complete Datacenter ecosystem

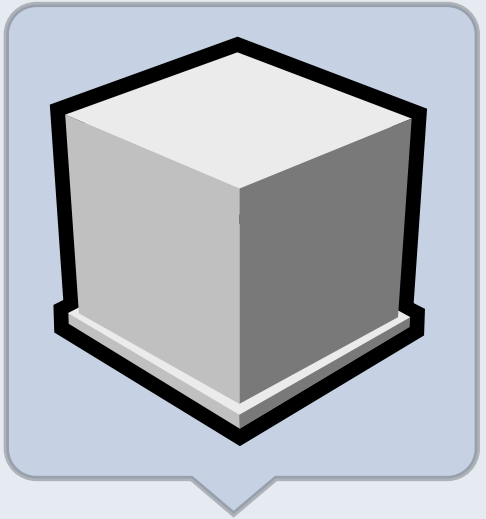
Focus on Efficiency



Software



Server



Data center

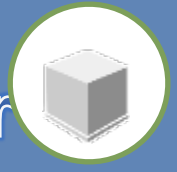
Software



Server & Storage



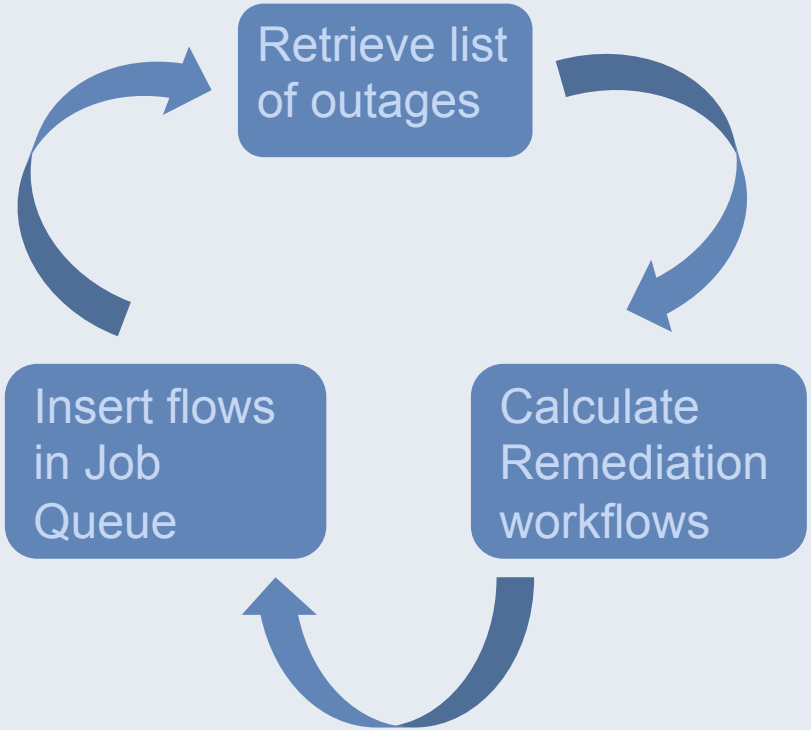
Datacenter

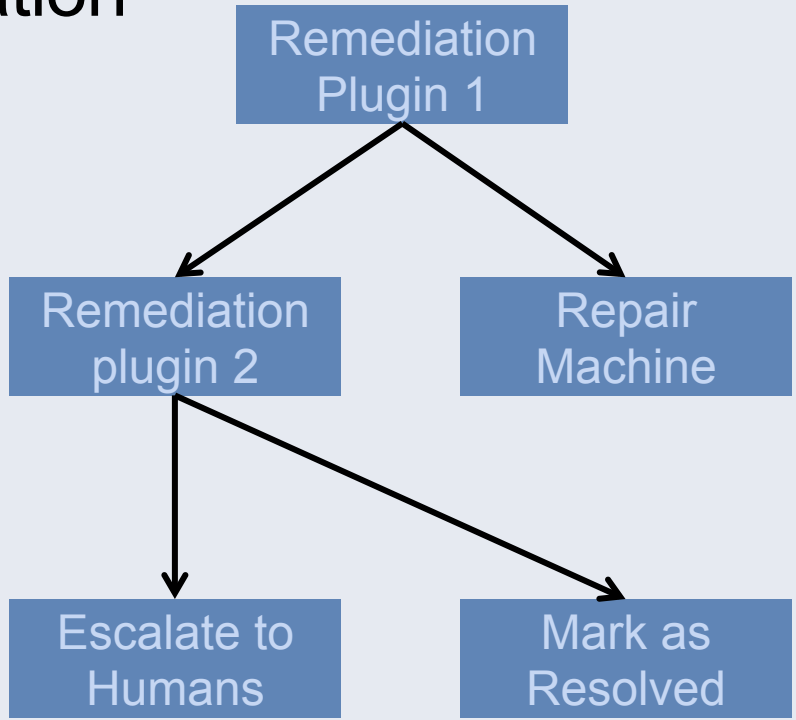


Datacenter tools and workflow

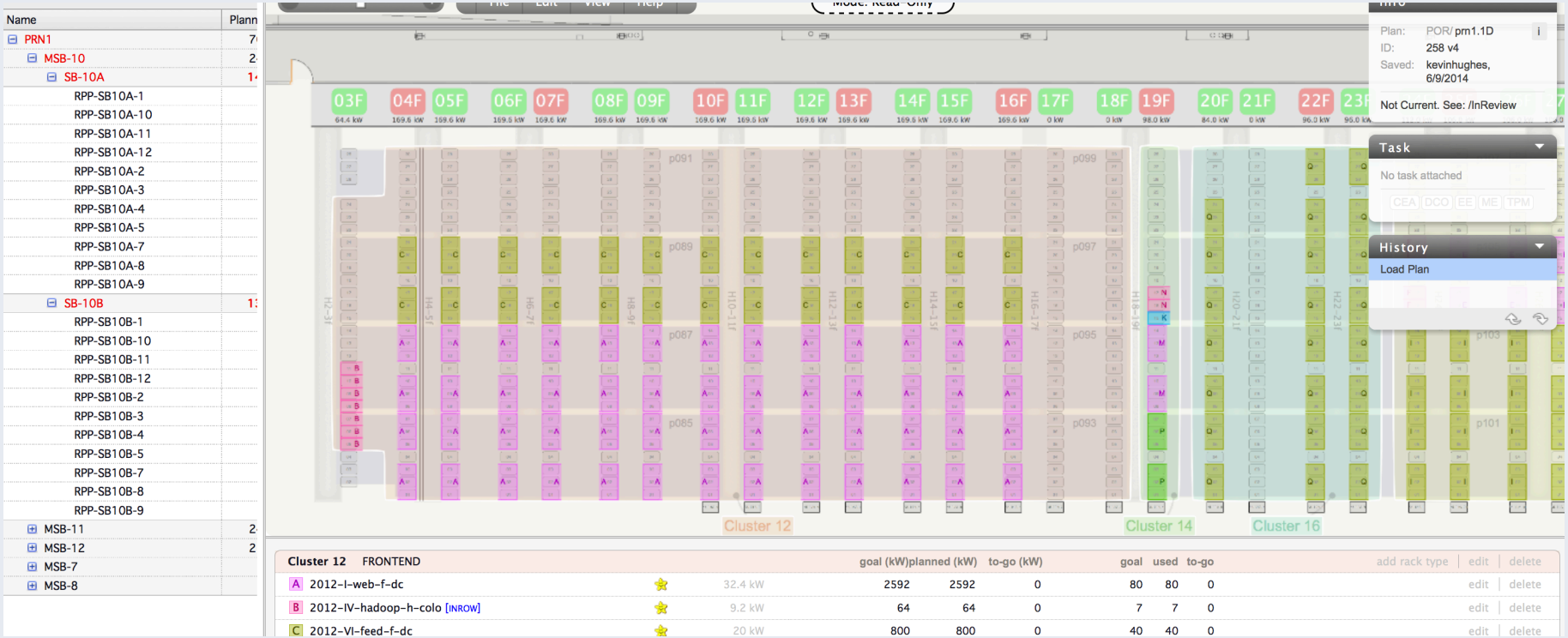
Continual improvements

FBAR
Self Healing and Auto Remediation





Cluster Planning and Datacenter maps



SORT / CI

Part Check-In

Inventory Transfer

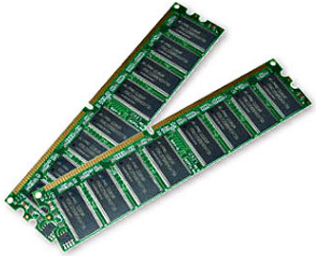
Dashboards

Scan at Swap Time

Failure Analysis

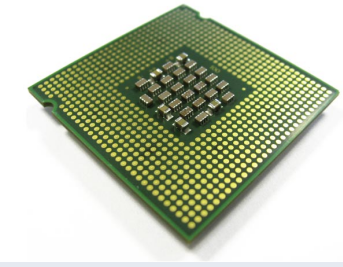
Shopping Cart

SLA Tracking

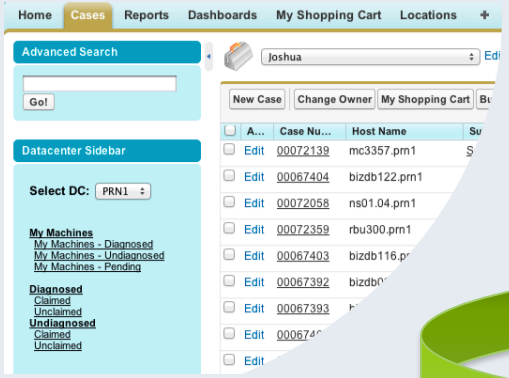




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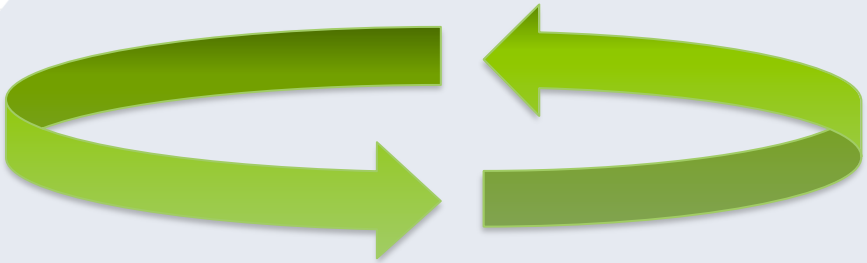


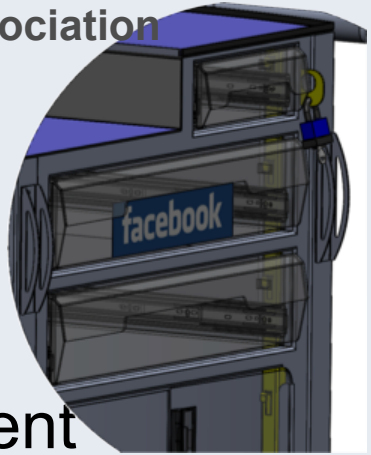
Integrated Repairs Workflow



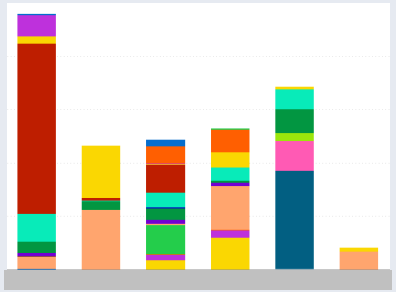
HDD Chain of Custody

- System of origin
- App Service –to-HDD Association
- Certification of Wipe



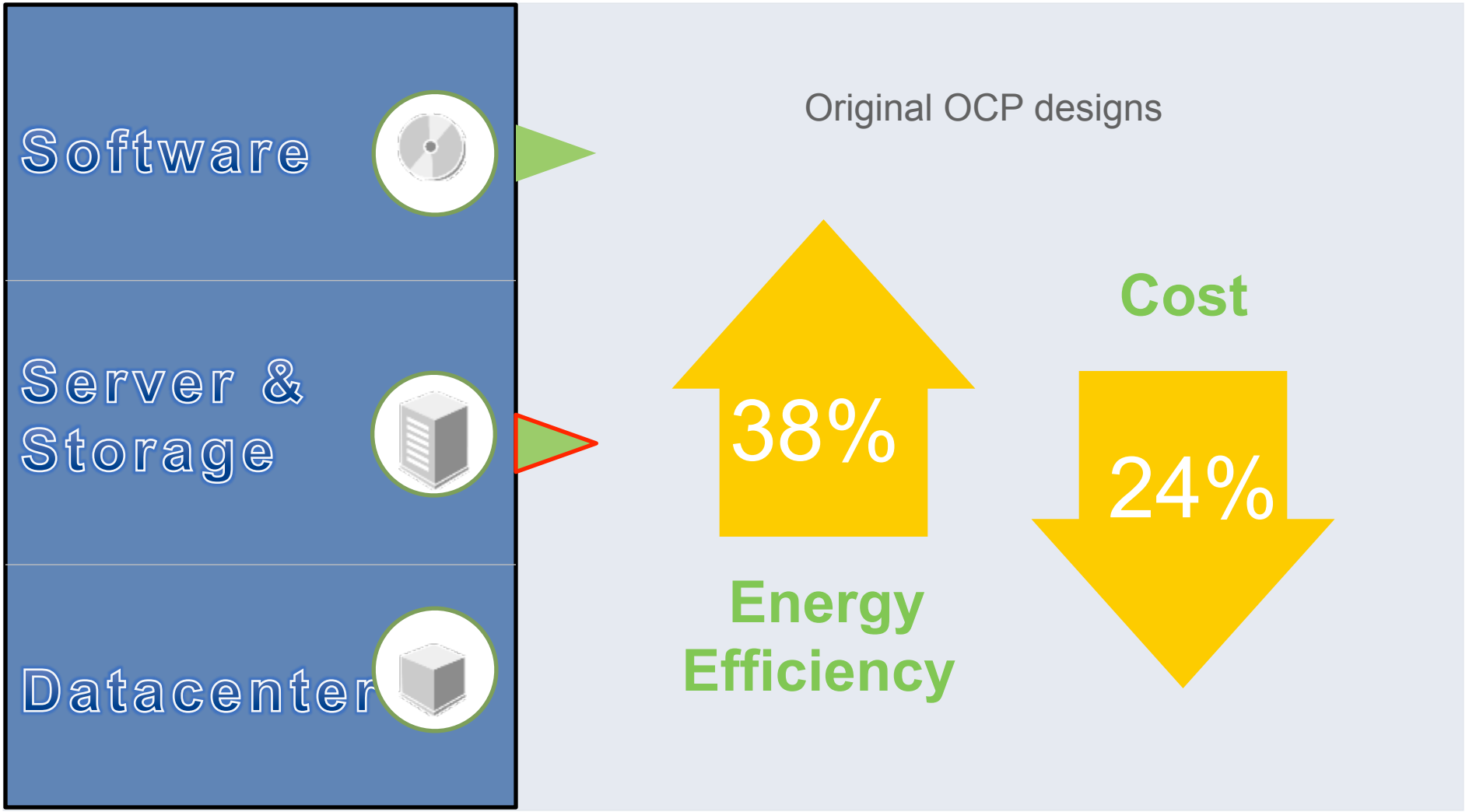


SORT



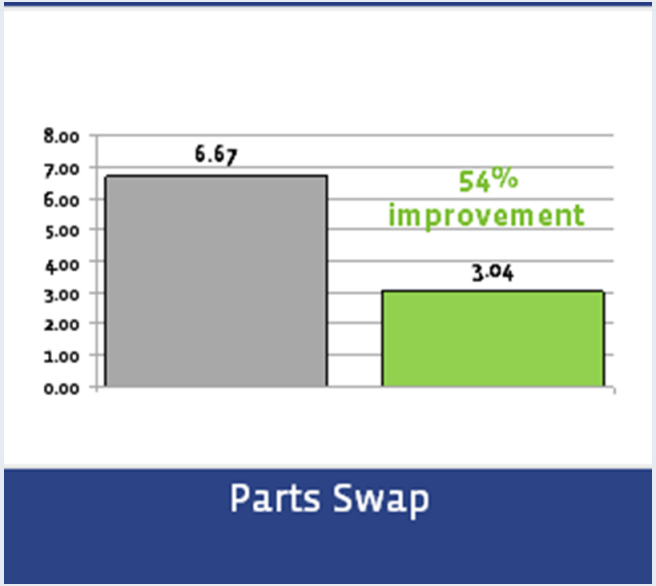
Spares Management

- Capture failed/new part SN
- Streamline Repairs
- Provide data for Analysis
- Eliminate Lost Parts

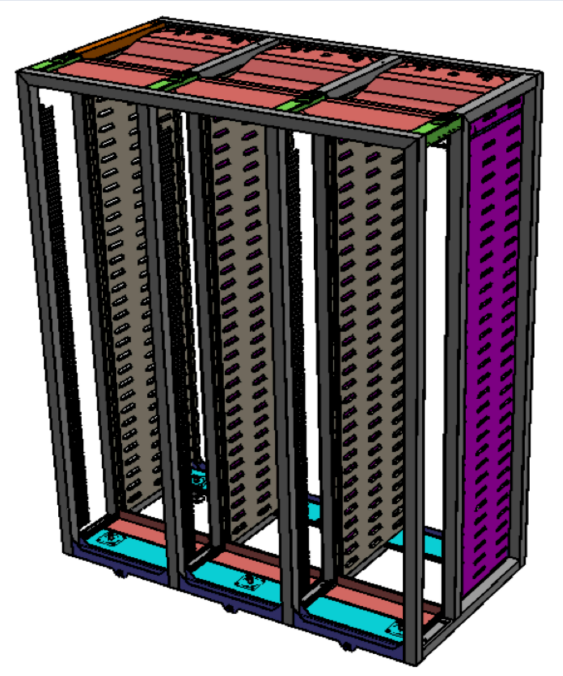

Software
Server &
Storage
Datacenter
Original OCP designs
38%
Energy
Efficiency
Cost
24%

Serviceability is a Must Have

- Influence server design to ensure best serviceability
- No tools needed to complete repairs
- Server must be front-of-rack serviceable
- Simplicity in design to allow for quick repairs



Freedom



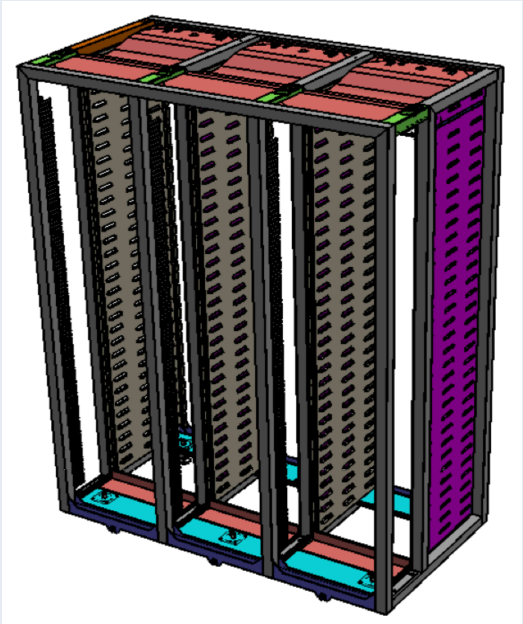
Triplet rack



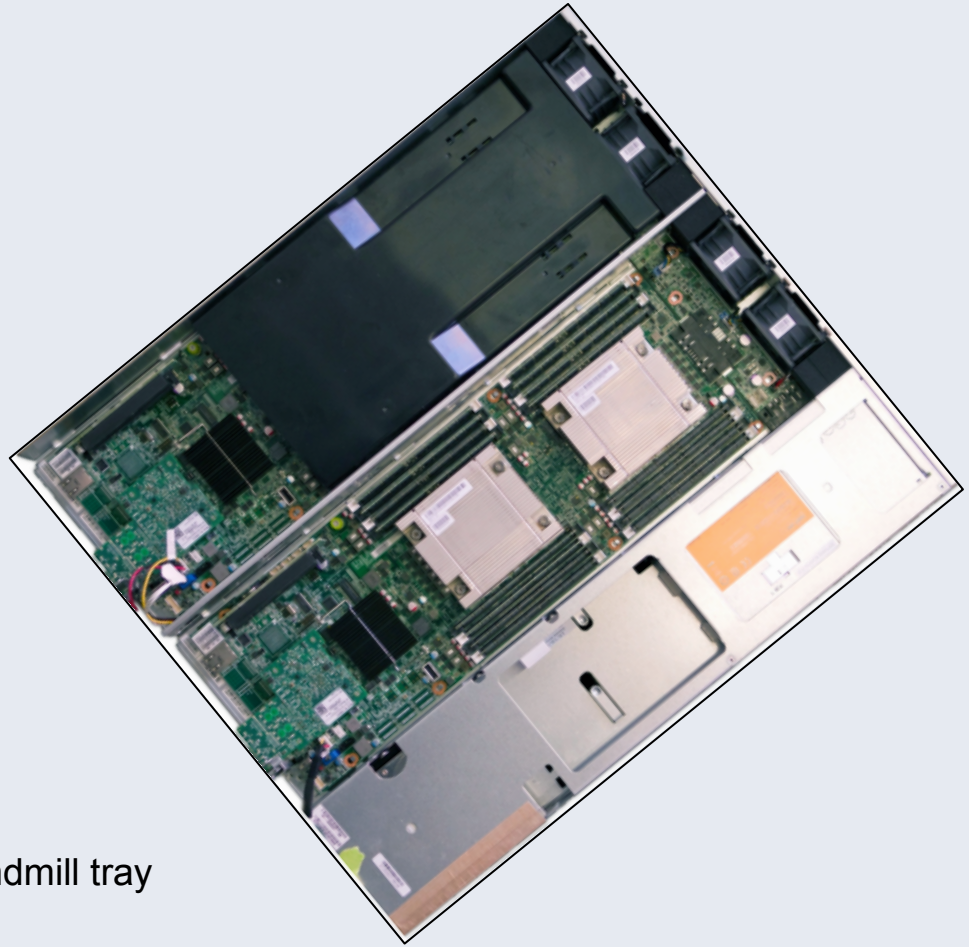
Freedom chassis

2010

Windmill



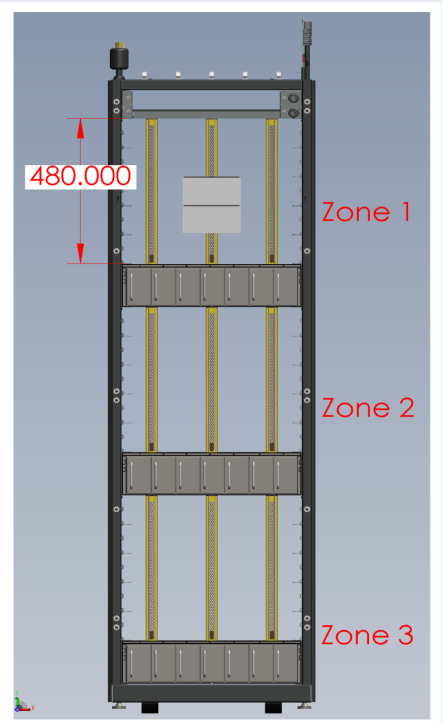
Triplet rack



Windmill tray

2012

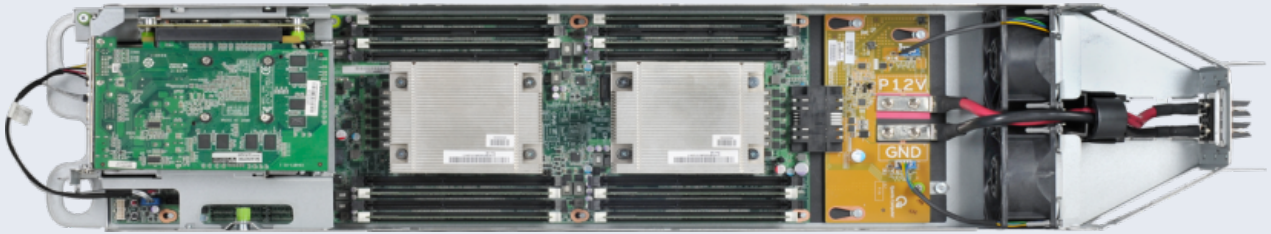
Winterfell



Singlet rack (OpenRack v1)

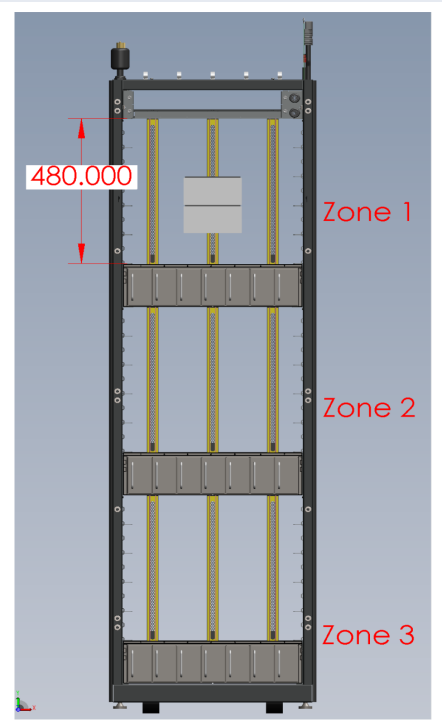
2013





Winterfell in tray

Leopard



Singlet rack
(OpenRack v1)

201 5

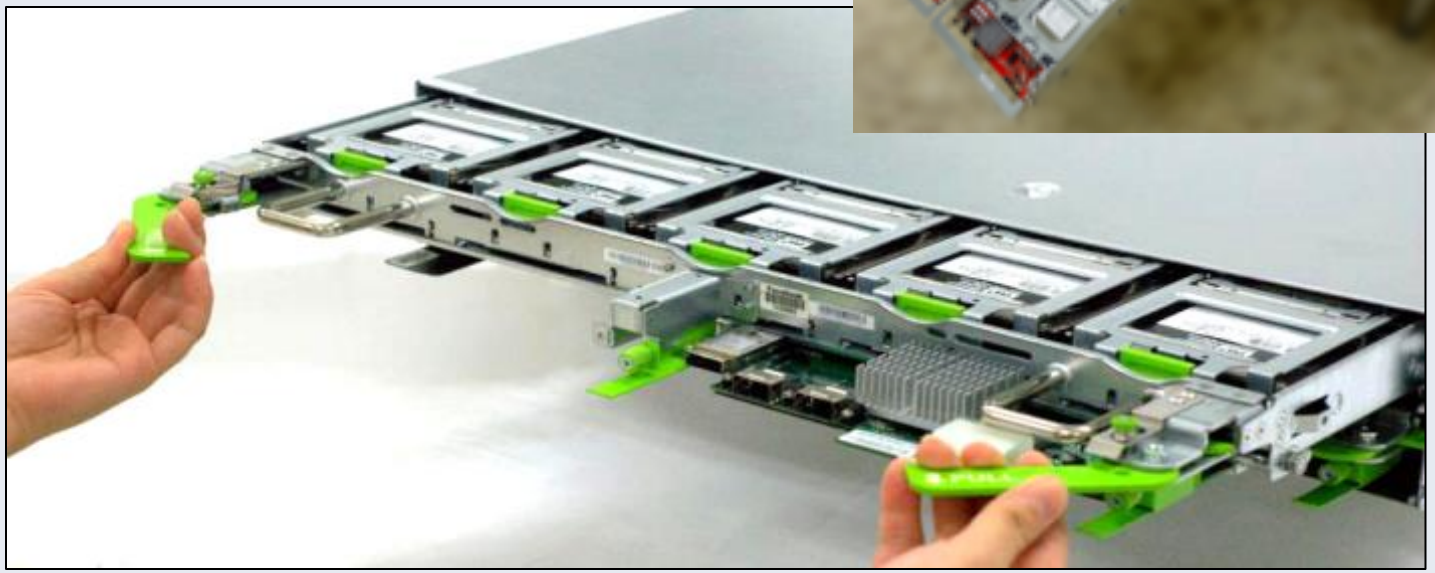


Leopard in rack

Open Vault

- Storage JBOD for Open Rack
- Fills the volume of the rack





Six Standard Rack Configuration types

Standard Systems	I Web	III Database	IV Hadoop	V Haystack	VI Feed	VII Cold Store
CPU	2 x E5-2680v2	2 x E5-2680v2	2 x E5-2680v2	1 x E5-2660v2	2 x E5-2660v2	2x E5-2660v2
Memory	32GB	144GB	64GB	96GB	144GB	144GB
Disk	Boot	High IOPS 3.2 TB Flash	High 15 x 4TB	High 30 x 4TB	Medium 2TB SATA	High 240 x 4TB SATA
Services	Web, Chat	Database	Hadoop	Photos, Video	Multifeed, Search, Ads	Cold Storage

Software

Server & Storage

Datacenter

Prineville, OR Data Center

Dashboard: PUE & WUE



Power Usage Effectiveness (PUE) **1.06**

Water Usage Effectiveness (WUE) **0.20** L/kWh

Humidity (Outdoors) **91%** /100%

Temperature (Outdoors) **28°** F /-2.2°C

Annualized Numbers — The chart above shows real-time PUE, WUE, temperature and humidity for Facebook's Prineville data center. The numbers to the right are the Prineville data center trailing 12-month PUE and WUE as of the end of September 2013.

PUE **1.08** TTM

WUE **0.49** L/kWh

Be Open

We are sharing dashboards that show real-time PUE (power usage effectiveness) and WUE (water usage effectiveness) at our data centers in Oregon and North Carolina. We'd previously been sharing PUE and WUE quarterly and are now increasing the frequency of that sharing through these dashboards.

Facebook Greenfield Datacenter

Our original Goal

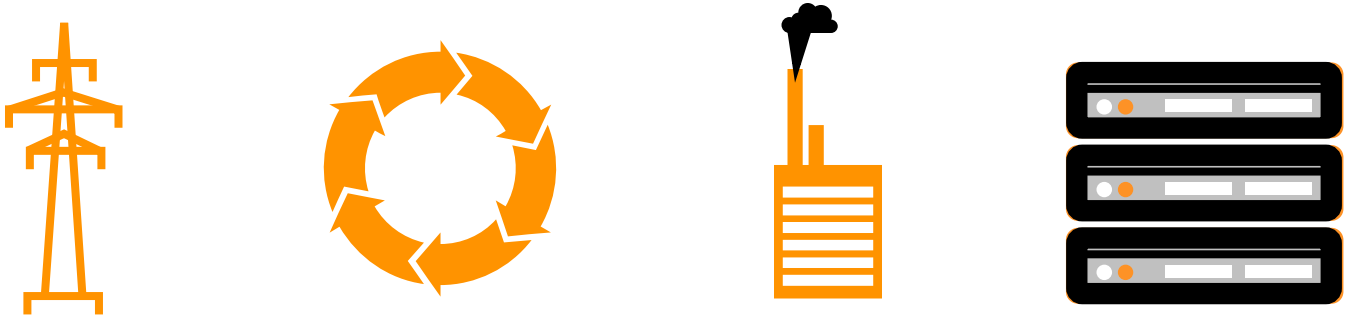
- Design and build the most efficient datacenter eco-system possible

Current Sites:

- Prineville, OR
- Forest City, NC
- Luleå, Sweden
- Altoona, IA

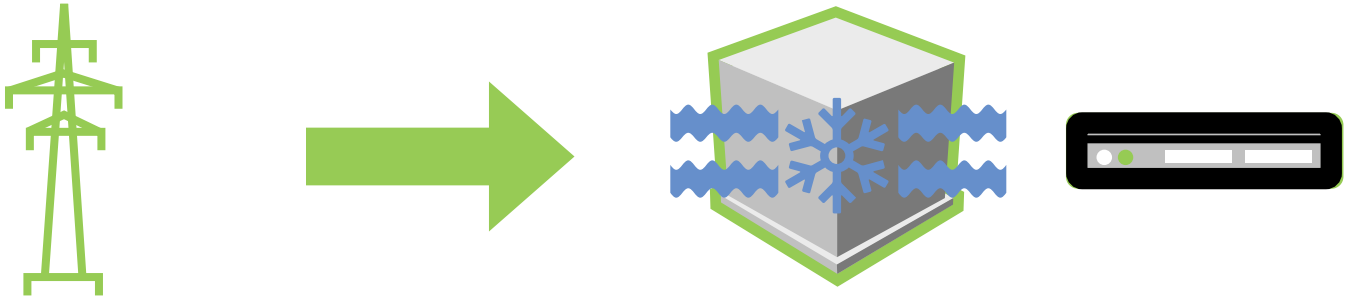


Industry Standard



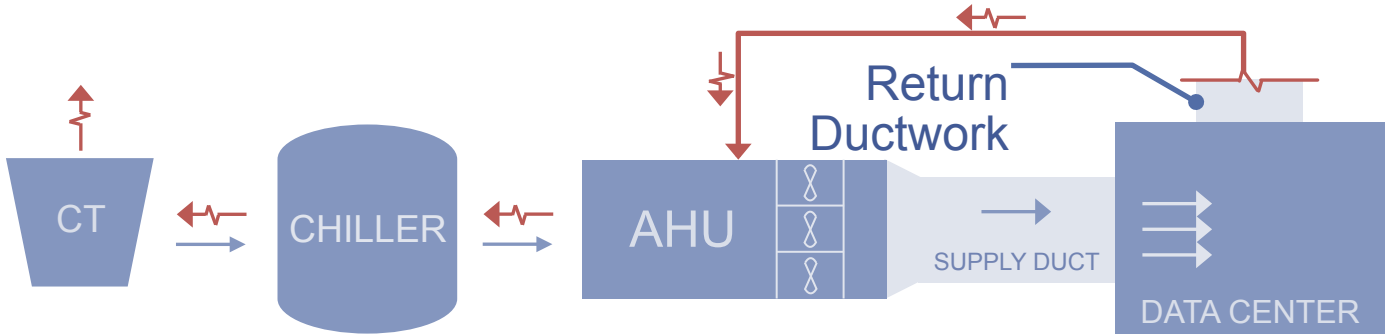
1.9
PUE

Open Compute Project

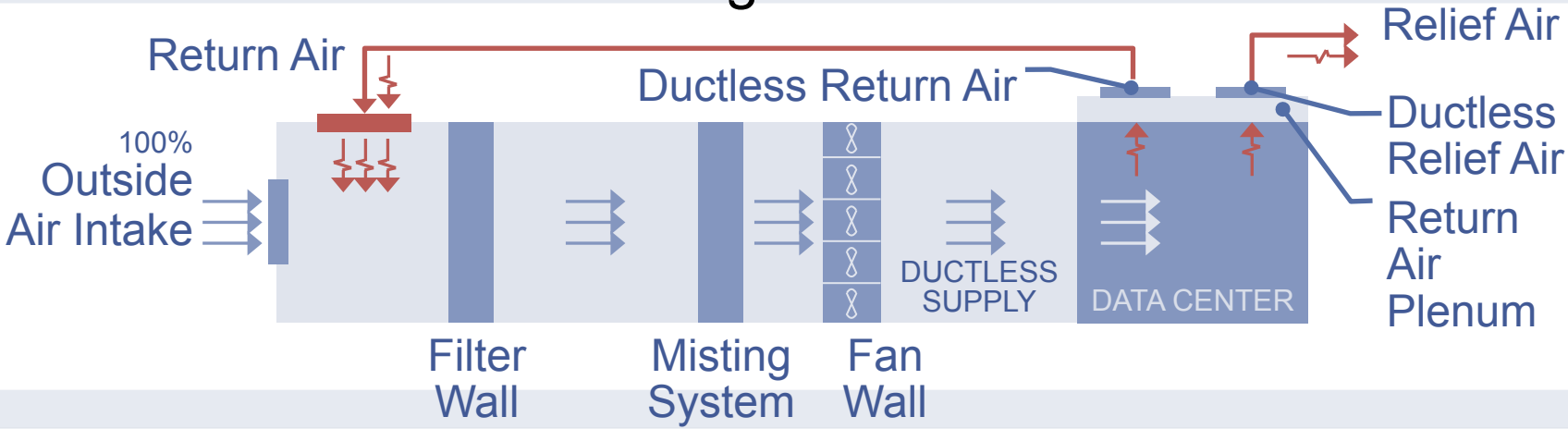


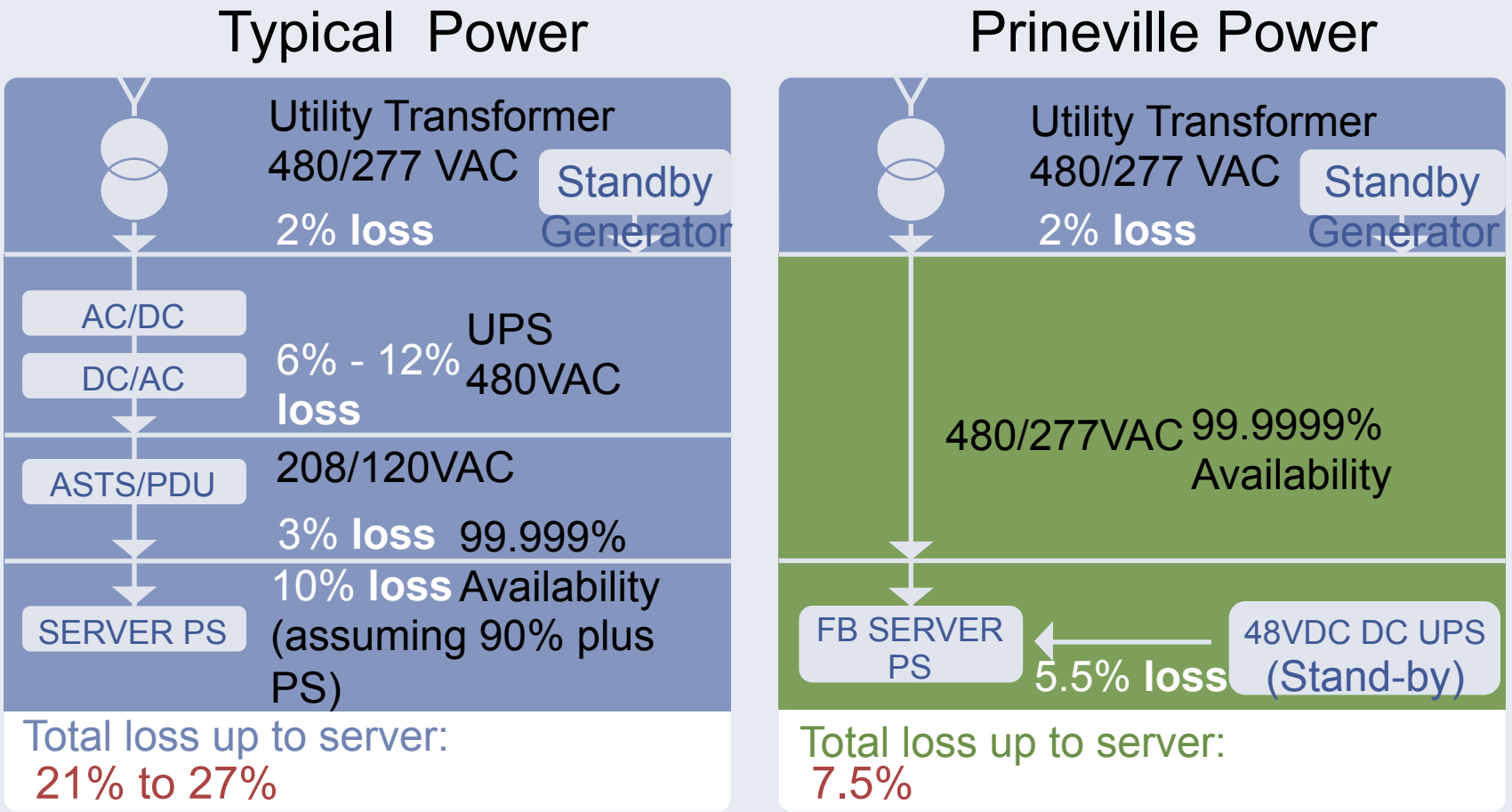
1.07
PUE

Typical Datacenter Cooling



Prineville Datacenter Cooling




Typical Power
Utility Transformer
480/277 VAC
2% loss
Standby Generator
AC/DC
DC/AC
6% - 12% loss
UPS 480VAC
ASTS/PDU
208/120VAC
3% loss
99.999% Availability
SERVER PS
10% loss
(assuming 90% plus PS)
Total loss up to server:
21% to 27%
Prineville Power
Utility Transformer
480/277 VAC
2% loss
Standby Generator
480/277VAC
99.9999% Availability
FB SERVER PS
5.5% loss
48VDC DC UPS (Stand-by)
Total loss up to server:
7.5%

Battery Cabinet

- Custom DC UPS
- 56kW or 85kW
- 480VAC, 3-phase input
- 45 second back-up
- 20 sealed VRLA batteries
- Battery Validation System
- Six 48VDC Output
- Two 50A 48VDC aux outputs



facebook

Let’s wrap it up

Complexity creates waste

Resiliency is better than redundancy

Good enough is not enough

Engage!

http://www.opencompute.org





