# *HVDC Innovation, XECHNO® Power & Fresh HVDC®*

## Energy Saving Technology for the Data Center

**Green Consulting Business Unit**
**Solution Business Division**

NTT DATA INTELLILINK Corp.

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# Problems facing data centers: Energy efficiency

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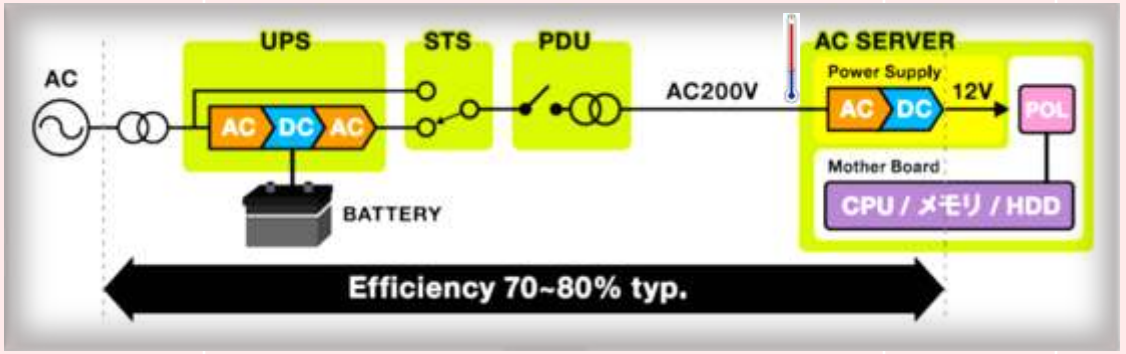
There are so many AC/DC and DC/AC converts in a data center.

Conversion causes power loss and dissipates heat, and requires more power to cool.

| Power Grid | Transformer | UPS | PDU | ITE ( e.g. Server ) |
|---|---|---|---|---|




AC → DC → AC → DC

***Energy ( Power ) Loss***

***More heat, more cooling***

# IT equipment are fundamentally DC powered

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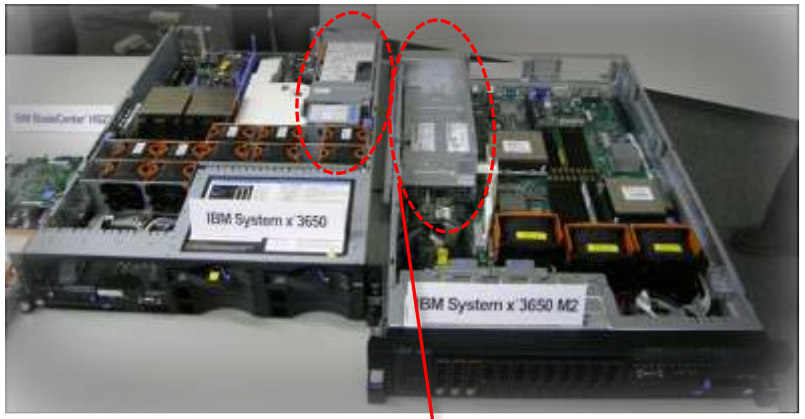
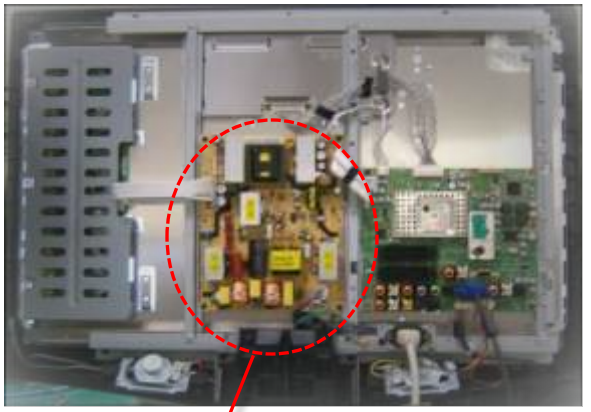
Most electric appliances have an internal power supply converting AC to DC.

Why not directly feed them DC power?



Power Supply AC DC

Power Supply AC DC

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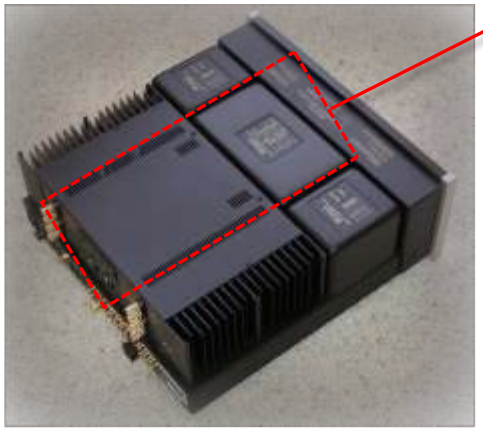
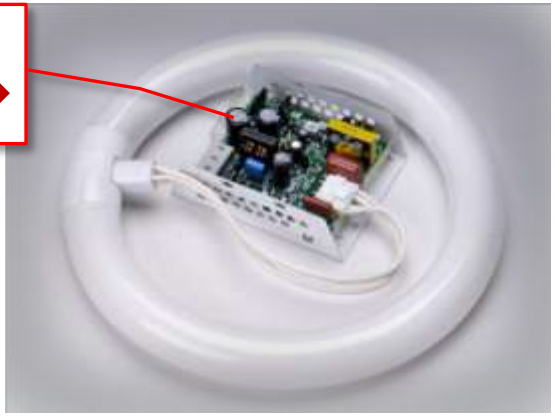
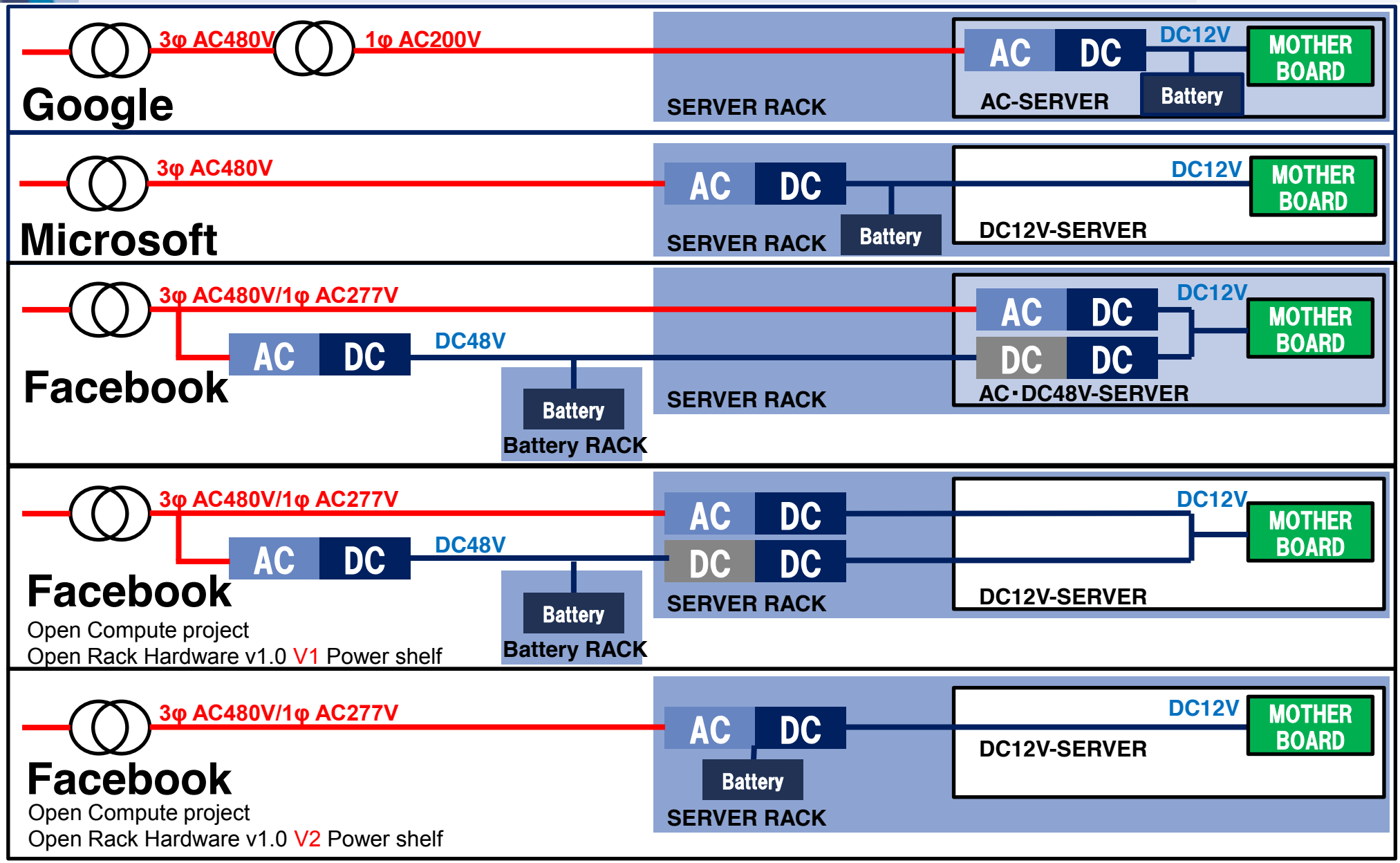


Power Supply AC DC

Inverter AC DC HF



# Trend: from UPS to DC+Battery



# Our proposition: HVDC and DC 12V ITEs

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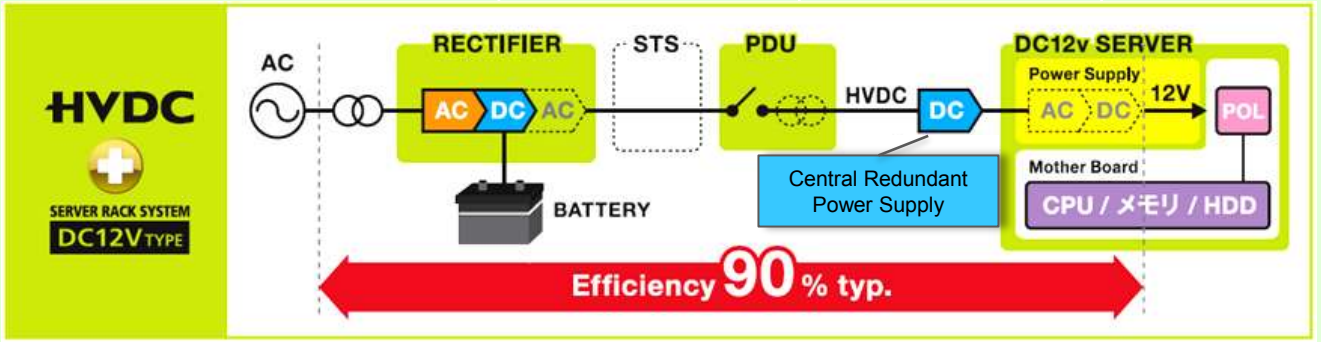
Our HVDC power system reduces AC/DC conversions between Grid and ITE.

Power loss is reduced approximately by 10-20%.

| | JRC Japan Radio Co.,Ltd. | | | NTT DATA INTELLILINK CORPORATION |
|---|---|---|---|---|
| | Fresh HVDC | | | XECHNO Power |
| Power Grid | Transformer | PS Rack | PDU | Server Rack |




AC → DC 340V → DC 12V

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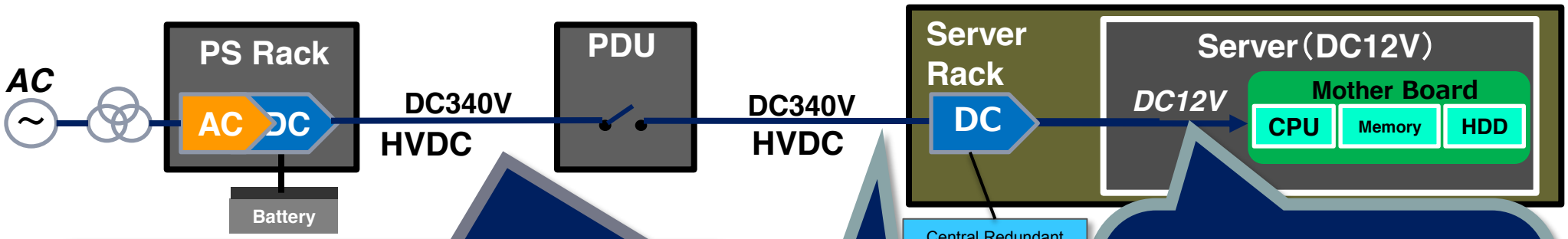
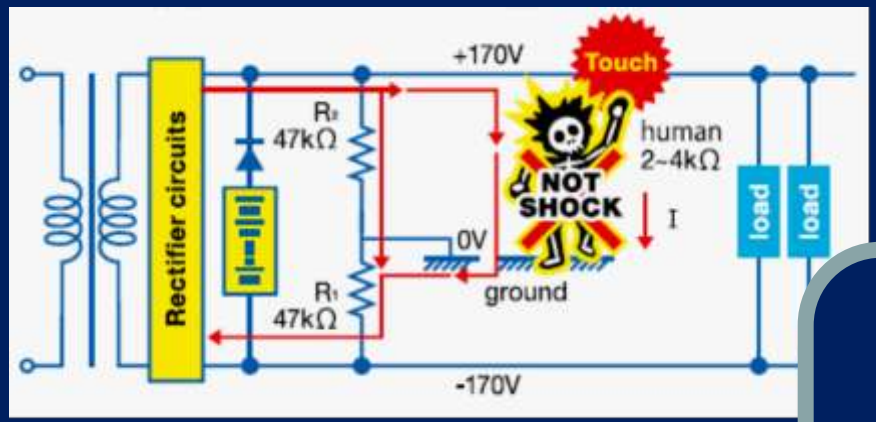
# Traditional HVDC pain points have been removed




## Key Technology : Middle Point Ground

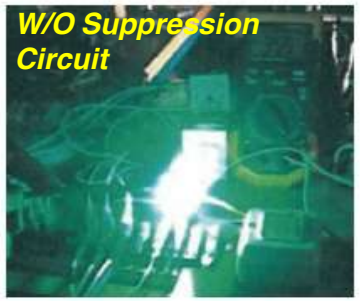



Current is limited within safety limit for human through high resistors of 47KΩ.

## Key Technology : Bus Bar

Less chance of fire

## Key Technology : Arc Suppression Circuit

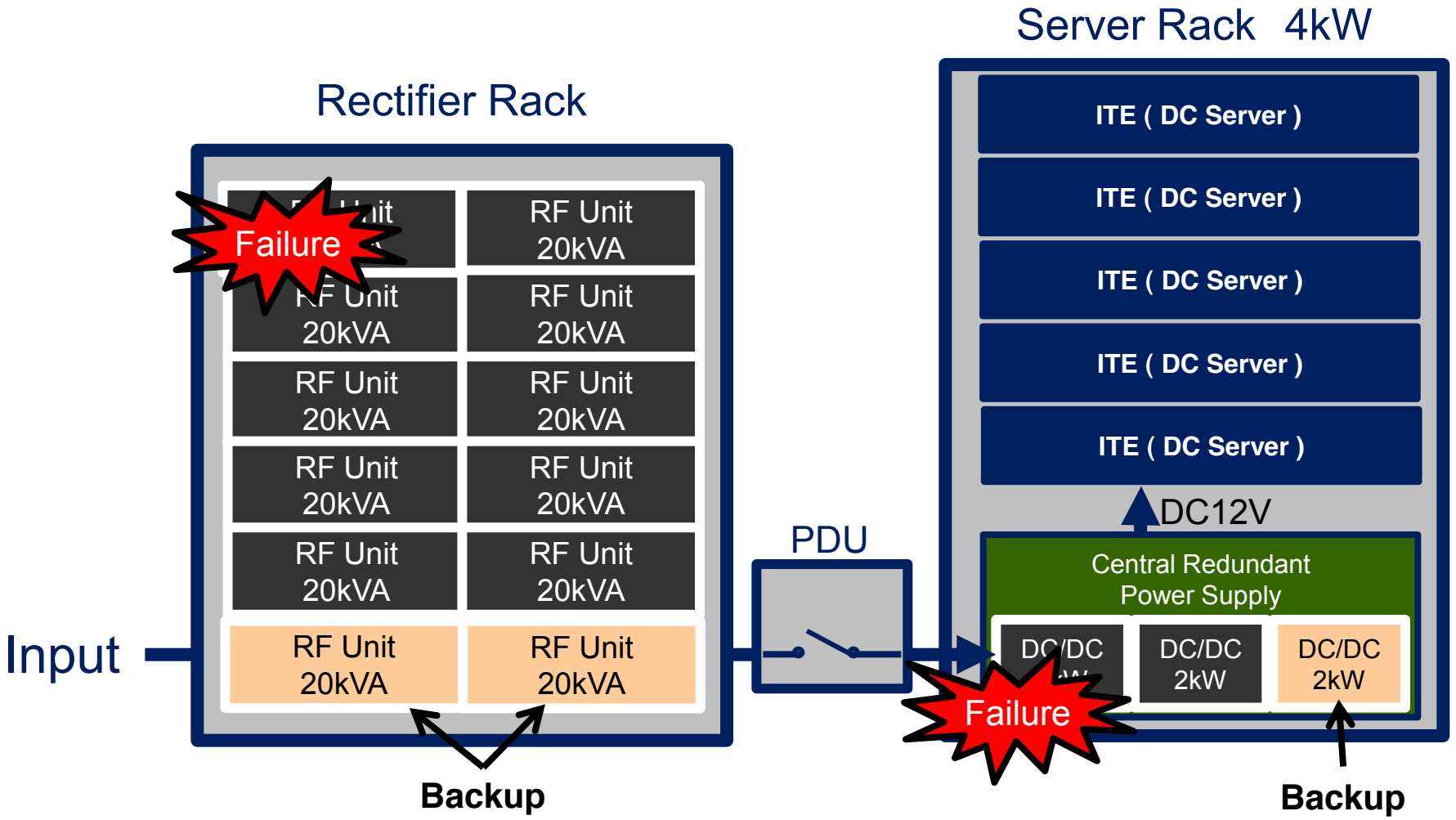




Resolved the arc discharge issue at the time of switch-on/off and disconnection.

# Reliability: redundancy

## Non-stop maintenance and expansion through N+1,2 redundancy



# Reliability: fewer failure points

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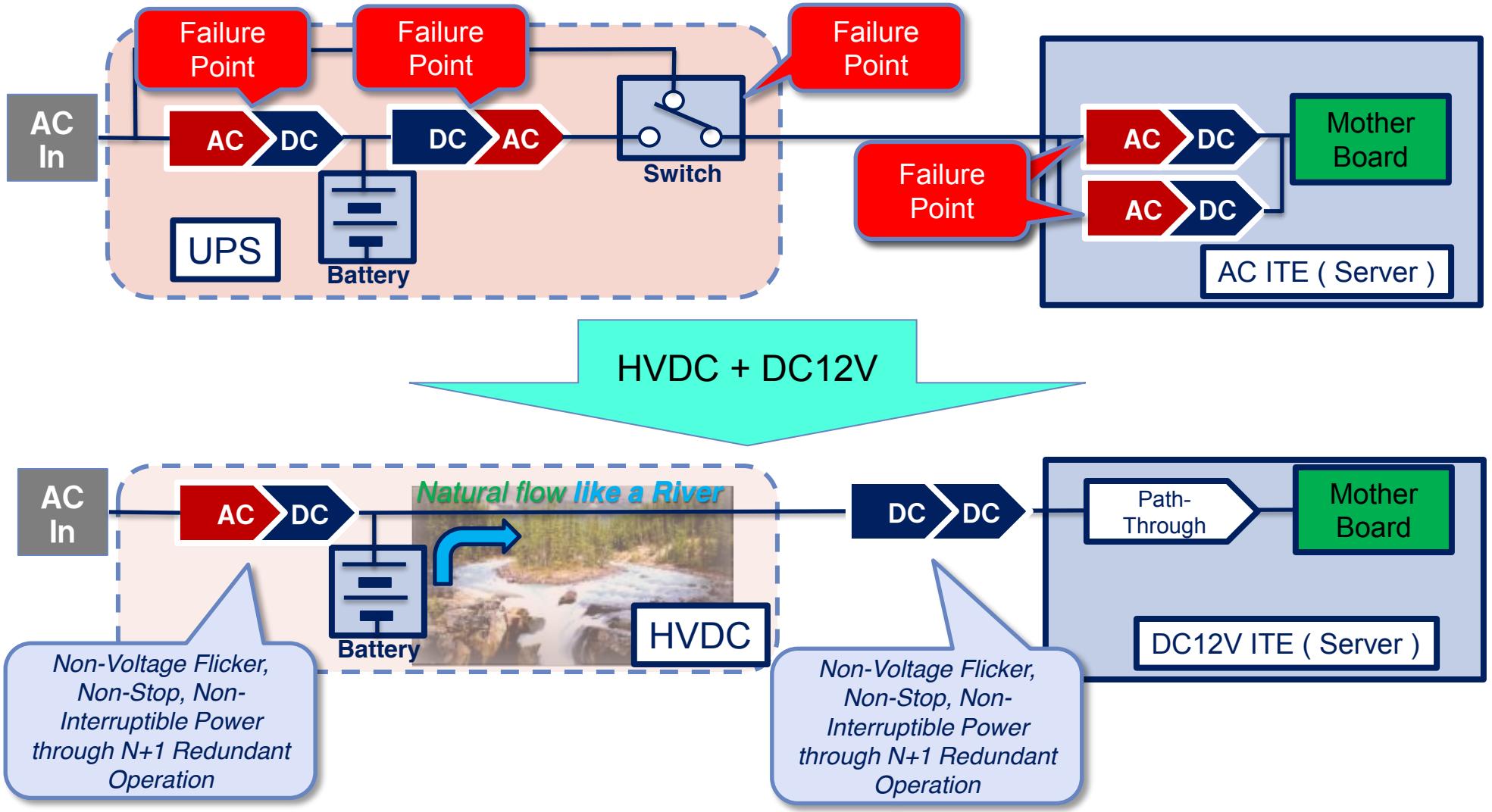
Simpler architecture = less component count and failure points.



# Pass-through box

A drop-in replacement for AC/DC power supply of conventional ITEs

- Only some protection circuitry
- No fan
- No liquid capacitor
- No need for certification
- Lots of space to add value
  - Battery
  - Sensors
  - ... and more

# Combining DC sources: HVDC + Solar + Battery

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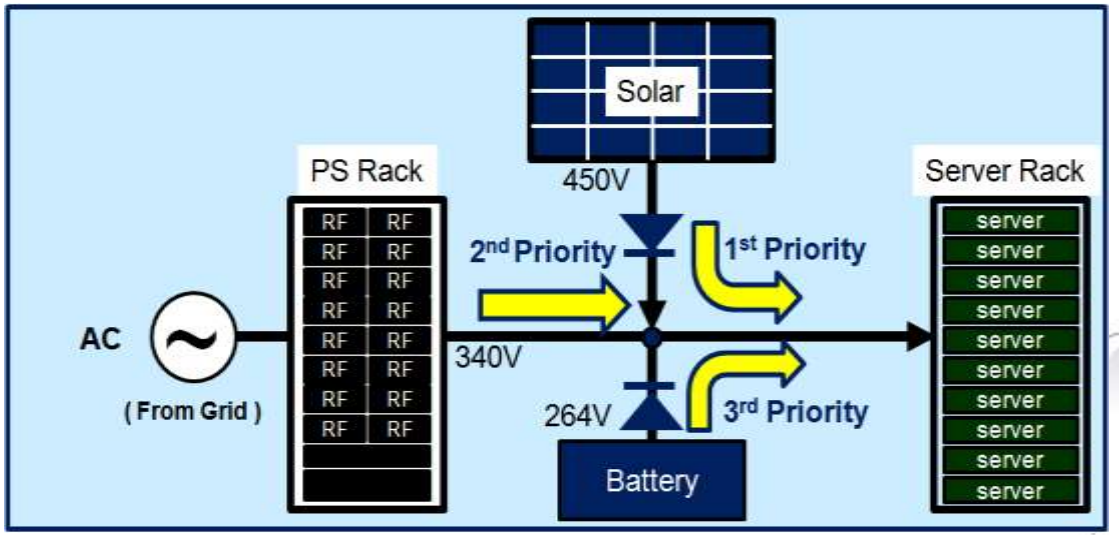
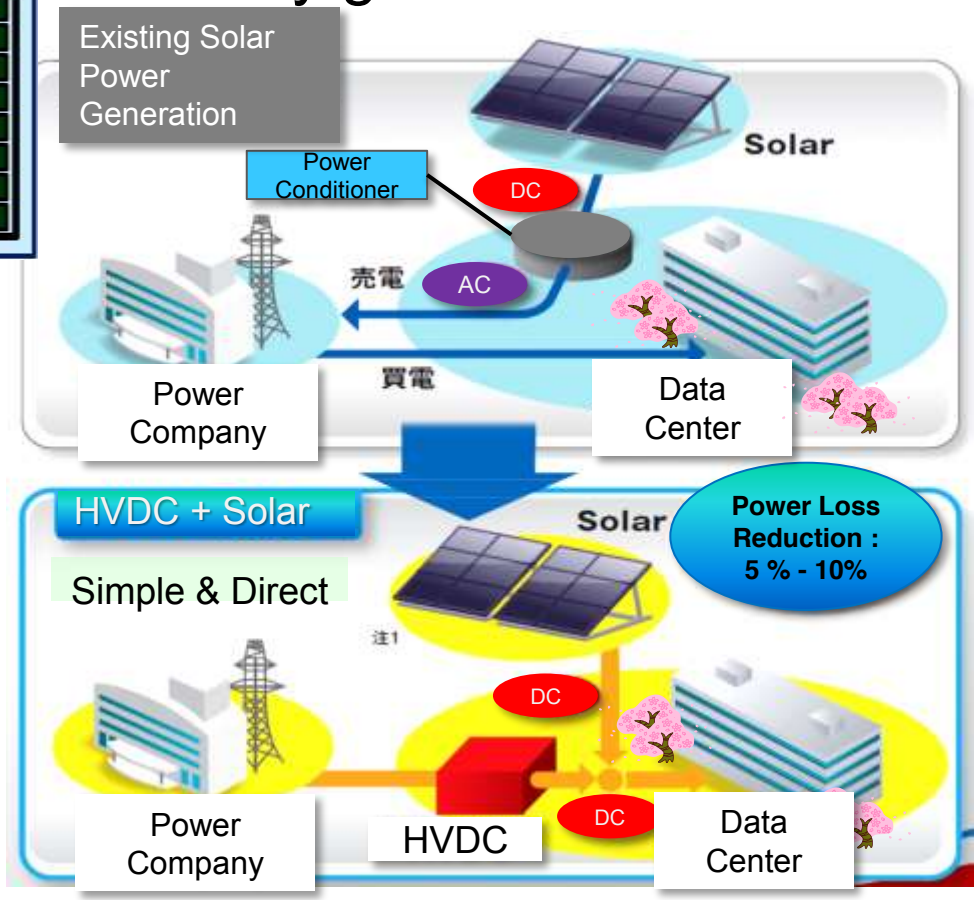
## No need for power conditioner (no MPPT)




## Locally generate & consume




## Our testbed

# Production use: Ishikari DC, Sakura Internet Co. Ltd.

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In service, March 2013
19 racks, 160 kW

# For greater ecosystem of HVDC

We support conventional equipment by “evangelizing” pass-through box.

What can we do to support Open Compute compliant equipment?

Conventional ITE ( DC12V )

Open Compute ITE ( DC12V )

# Discussion Points

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AC/DC

Any plan for experimenting with “up-front” AC-DC conversion for Facebook data centers (or Colo sites adopting OC servers)?
Can we collaborate?

DC/DC

(Any issues?)

Bus Bar

(Bus bar-midplane connectors: Simply a choice of which physical shape?)

ITE

Input voltage fluctuation tolerance: Can we standardize on it?

- Open Compute mobo: 12.5 Vdc within 10.8 – 13.2 range
- Conventional mobo: 12.0 Vdc within 11.4 – 13.2 range (±5%)

Protection circuitry: Is there an Open Compute spec?
Can we eliminate redundancy if any?

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