Refurnishing your Data Centre, part 1

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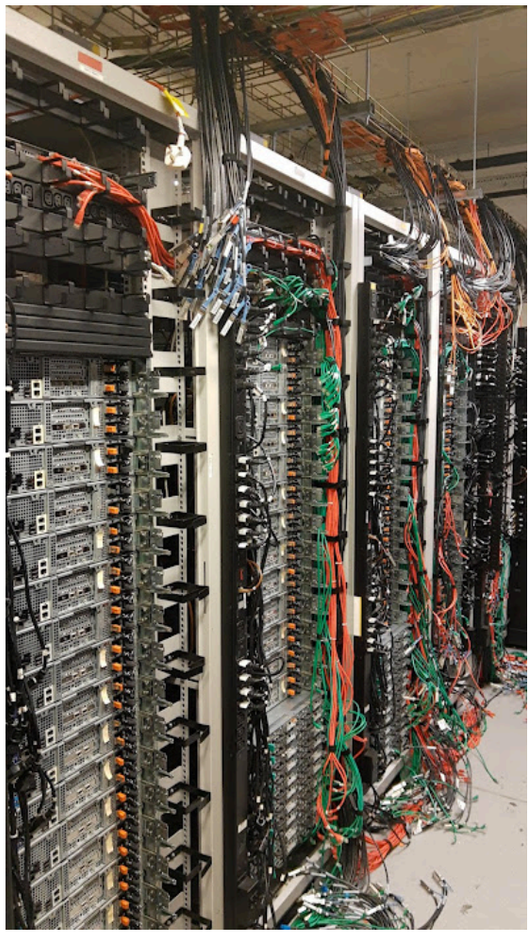


Still waiting for Procurement
Governance Approval.
Final plan subject to change

History

- Original facility built using funds from the Strategic Infrastructure Fund (hence the name SRIF room) and commissioned in ~2004.

- Built on a budget, with compromises and limited knowledge. Provided a 200KW facility over 22 racks on the 2nd Floor of half filled new Chemistry building. No raised floor, no hot/cold air containment, shallow depth, open racks.

- By 2018 having to rely on 2nd hand parts to maintain chillers. During covid all old units broke, no more spare parts, left with only 100KW of replacement, temporary chillers. (Soon to be 150KW)

- Power distribution needed to be replaced (heat damage).

- Was clear that >15 year old facility needed refurbishment.

Basic Plan

- Worked with ITSR (responsible for the room) to put together a business case for funding a refurbishment. Funding of overheads from grants was important part of justification!

- We're were already moving to APC racks, use APC PDUs/UPSs/ NetBotz monitoring system. Chose to go with APC hot air containment with in-row cooling using a water cooling loop. APC proven track record in data centre Infrastructure (low risk).

- Agreed to expanded the capacity of the room to provide for future growth (200 -> 390KW, 22 -> 39 racks).

- Obtained funding for significant part of final project from ITS.

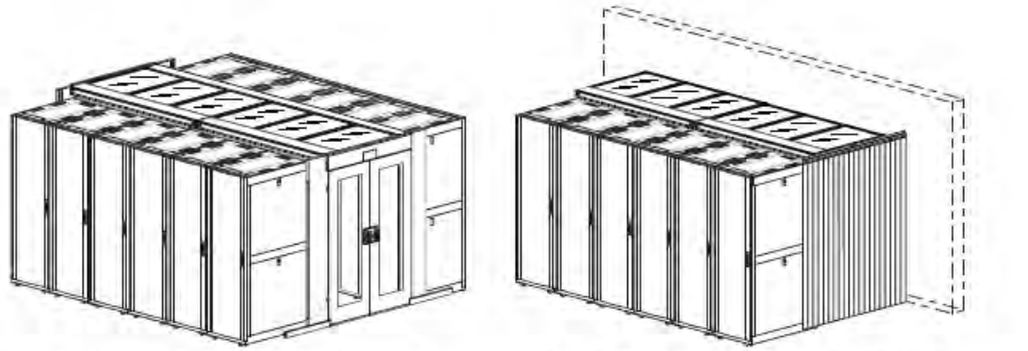
- Issue of how to cool the water. Need 390KW of cooling with redundancy.

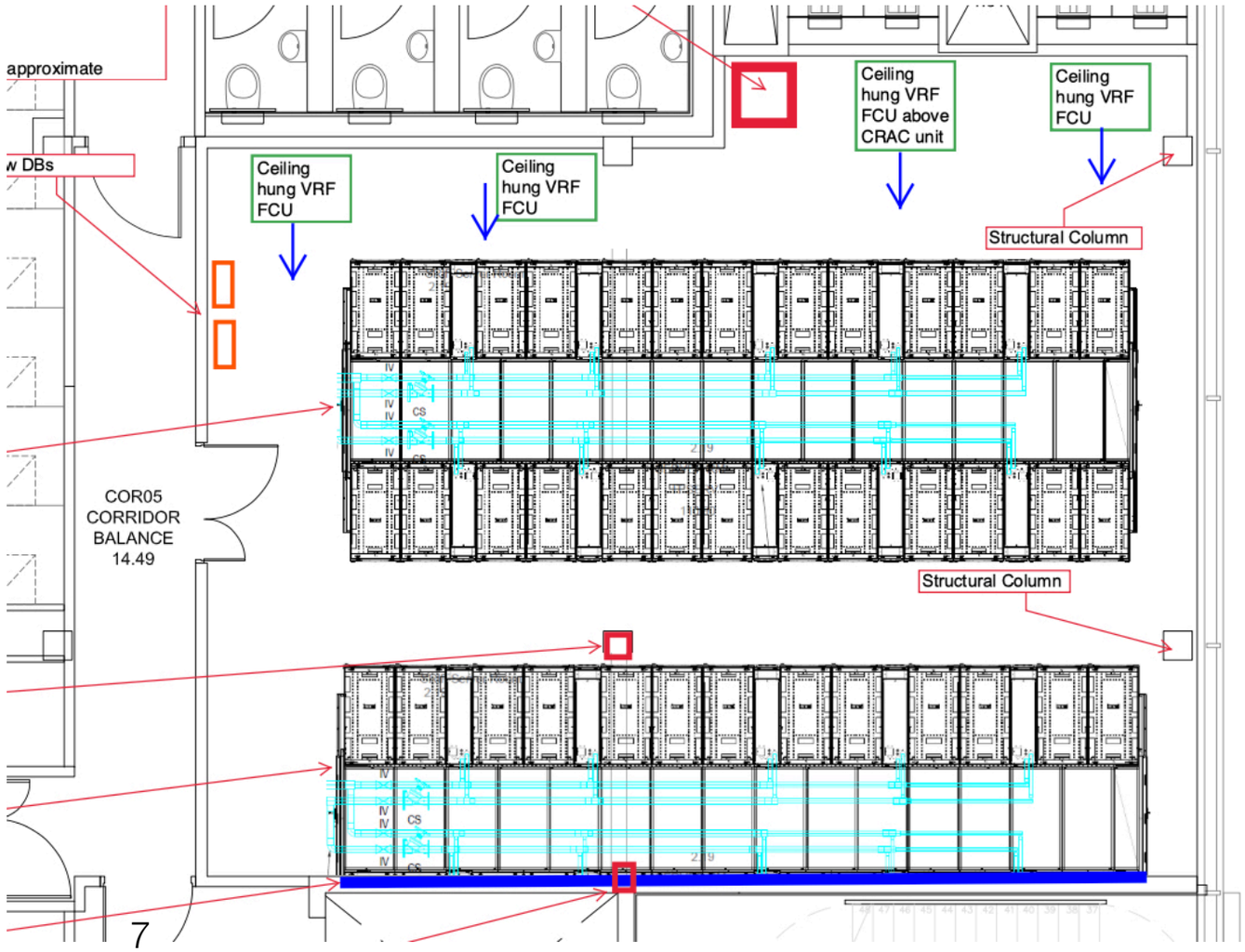
Basic Plan

- 10KW(average) per rack, 39 racks, 3 rows, dual 32 amps power feeds per rack (x2).

- Chilled water circuit. 4+1 in row cooling per row, 17C water in, 23C out. High level piping.

- 26C cold / 41C hot aisle air temperature!





In Room Work

- Keep: fire suppression system; burglar alarm; existing APC PDUs and racks; some air conditioning units.
- Rip out and replace: new floor (antistatic); redundant power to racks (A and B feeds); harmonic filters; cable trays, paint ceiling (bare concrete causes dust); more racks & PDUs ; Netbotz monitoring + data centre management system (linked to BMS).

This will require 4-6 weeks down time

Cooling Options

Building Chillers 2* 300KW (redundant pair)

Option 0: use building chillers

Insufficient existing capacity, ageing, expensive and long lead times to upgrade

Original 6 condensers providing 200KW cooling

Option 1:
Replace with four 150KW new chillers (N+1 redundancy)

Option 2:
Use heat pumps to produce “high quality” hot water (75C). Use in district heating system and dry air cooler.

Electrical substation (building has plenty of electrical power capacity)

Some Details

- Traditional chiller solution well understood, not discussed further.

- Water source heat pumps more efficient than air source but still require additional power to drive. Apx 80KW additional electricity for every 300KW high grade heat (23C->75C water) .

- District heating system for university used in several building on campus, will be extended to hall of residence. Winter heating important but summer hot water also needed.

- Reservoir tanks included in design to store hot water.

- 500KW Dry air cooler runs off the 75C water circuit and can be used all year round (otherwise limit to ambient air <13C).

Impact

- Numbers calculate form Government Green book (accepted source of appraise projects before and after implementation).

- Capital cost of heat recovery solution is £300K to £400K more than chiller based solution.

- Save 9,000 t.CO2e over a 15 year period.

- Reduce gas energy consumption by 3,500,000 kWhr per annum (whilst increasing electrical consumption by 350,000 kWhr per annum).

- Reduce overall energy cost by £1M to £2M over 15 years depending on energy prices (2020 vs 2022).

Time Line

- 115 Page tender document waiting to go live. Preselection of companies to lead project and APC specialists already done.

- Expect lead times (3 months) for some equipment.

- Work outside the room (Heat pumps, dry cooler, pipe work) can be done with out interrupting operations.

- Most work in the room will require shutdown 4-6 weeks.

- Expect new facility to be commissioned by May 2023 (after GridPP49 before CHEP).

Summary

- Took ~2 years to get from agreement in principle for refurbishment to fully formed project.

- Brining in specialised project management was vital to getting project into a fit and ready state. Will be vital to success of completed project.

- Final project cost is about twice original estimate. Mostly due to move to use heat recovery, robustness of solution, strip out of the room, Inflation.

- We get a much better DC (cooling but also power, capacity, robustness) for the next 15 years, PUE<1?