Problem Summary

The entire UCSB campus experienced a scheduled Southern California Edison utility power outage from approximately 6am to 12noon on Saturday, November 29, 2014. Despite preparatory work at NHDC, and NHDC and FM staff present on campus during the outage, NHDC failed to perform as planned in several key areas.

Most significant is the Cooling / HVAC failure. NHDC HVAC is fully automated and managed by the campus Johnson Control's MetaSys Building Management System (BMS). MetaSys has complete control over the NHDC Physical Plant. MetaSys is able to command Critical Cooling mode in which a maximum of 60 tons (approx. 200 kilowatts) of cooling is available from resources at NHDC while on generator power. This is sufficient to manage the current heat loads at NHDC.

COOLING / HVAC

NHDC hosts 48 occupied racks. 18 of 21 racks in the row 9 and 10 area experienced at-the-rack thermal shutdown when they reached 90° Fahrenheit server intake air. NHDC implements this at-rack power shutdown as a last resort failsafe to prevent equipment from excessive heat damage. Unfortunately most of the racks experienced failsafe shutdown after utility power was restored at 1210pm as NHDC automation attempted to restore cooling.

NHDC maintained 75° Fahrenheit ambient temperature until approximately 10am when CRAH1 (Computer Room Air Handler) failed and triggered the VESDA fire alarm system. CRAH1 was then disabled. Unknown at the time was that the MetaSys Network Automation Engine (NAE), located in a separate wing of NHDC, had local UPS but not generator power. Therefore the NAE was not available to alert staff to alarms, status nor to alter operations. This is a design deficiency.

When utility power was restored at 1210 pm, the NAE commanded Critical Cooling, but that was not the result. Instead FM staff forced a system reset at 1:30pm. Once reset, NHDC cooled down to normal temperatures within 15 minutes.

UPS POWER AND ELECTRICAL

One of our two UPS units, UPS2, failed to hold load when generator power kicked in, but did transfer load to bypass for generator power. Consequently, IT equipment supported by UPS2 did not experience a power outage. NHDC staff were able to bring UPS2 back online to support customer equipment. UPS2 partially failed load transfer testing in October and remediation work was performed Monday Nov 24. The Nov 29 failure was a different type of event.

NHDC's operational power is fed from multiple power locations, only one of which is generator protected. This design deficiency results in NHDC loosing lighting and the NAE in an actual power failure. This also means that our annual generator / UPS load testing does not simulate an actual power outage to the North Hall building.

COMMUNICATION TO NHDC SYSTEM ADMIN CUSTOMERS

NHDC staff onsite were fully engaged in responding to the events on the DC floor, which resulted in a lack of advisory to the customer email lists and status line we maintain for event reporting.
Communications were sent to customers at 1230 hours, but ultimately were incomplete as NHDC had not yet returned to normal operations. Additional communications were send to customers at

**COMMUNICATION OF NHDC STATUS TO CUSTOMER SERVERS**

The design firm for NHDC did not specify a Data Center Infrastructure Management solution. Given the mix of equipment present at NHDC, we were unable to locate a commercial solution which can monitor the installed systems and initiate phased shutdown of customer equipment. NHDC staff have designed and prototype automation and signaling systems to advise customers of status and the need to shutdown customer equipment. This system is not in production as it lacks developer support due to staffing changes and the restructuring of ETS.

**SUCCESSES**

- Despite the items noted above, the majority of customer systems – 30 racks worth – and the campus backbone equipment hosted were not affected by the outage.
- The NHDC UPS room’s redundant HVAC and MetaSys controls worked as redesigned post handoff to UCSB. As delivered, the UPS room was a critical single point of failure which would require a crash shutdown is a little as 15 minutes in the event of HVAC failure.
- The NHDC HVAC systems running on local controller autonomy continued to operate despite the loss of the MetaSys NAE. Had they not done so, much more equipment in NHDC would have required emergency shutdown.

**IMMEDIATE ACTIONS IN ADVANCE OF THE JAN 3, 2015 6AM TO 12 NOON SCHEDULED OUTAGE**

The following items being done to ensure that we do not experience the same failures. There is insufficient time available to us to significantly reconfigure and fully retest MetaSys automation, nor perform some of the other power related items. Those are covered in a subsequent section.

**COOLING / HVAC**

Ensure that all components of the MetaSys system are available during a power outage.

- NHDC, NOC and FM staff have reviewed the logs, plans and walked the locations to identify components – including the pathways to critical MetaSys servers located at the FM year – requiring generator power. FM will provide temporary generator power to the NHDC NAE located in NH 2139.
- NHDC management will request that FM assign a HVAC mechanic to NHDC specifically for the Jan 3, 2015 utility power outage.

Ensure that CRAH's are available to cool w/o regard to MetaSys programming, i.e. can be forced on manually.

- MetaSys control of the CRAH cooling valves has been bypassed by fully opening the CRAH cooling valves manually and turning off power to the valves.

**UPS POWER AND ELECTRICAL**
We are working with UPS support vendor to determine what happened with UPS2 and remediate by Jan 3, 2015 outage.

UPS support vendor will be on "ready-alert" for any problems on Jan 3, 2015.

**COMMUNICATION TO NHDC SYSTEM ADMIN CUSTOMERS**

- NHDC will add selected System Admins to our internal sensor notification email lists. These sensors were deployed by NHDC management post renovation due to concerns on MetaSys lack of mid-room temperature monitoring. However, these are more global in nature whereas a customer would be most interested in the environment at their rack.
- Additional NHDC staff will be engaged to provide specific customer communications during the Jan 3, 2015 outage.

**COMMUNICATION OF NHDC STATUS TO CUSTOMER SERVERS**

- NHDC is exploring granting SNMP read-only access at the rack power strip level to selected System Admins. This access would include temperature and potentially power loads.

**LONG TERM ACTIONS**

**COOLING / HVAC**

NHDC will reiterate the request for "manual override" capability to force cooling at NHDC. This access may require some coordination and specific rules of engagement with the campus fire marshal.

NHDC will coordinate with FM on the provision of a backup NAE within NHDC spaces, on generator power.

Once electrical feeds are reconfigured, NHDC will coordinate semi-annual "utility power failure" tests that will simulate a complete power loss to NHDC.

**UPS POWER AND ELECTRICAL**

Rewire / reconfigure NHDC electrical dependencies to ensure all critical loads (IT Equipment, Lighting, MetaSys, etc.) have generator power.

Once electrical feeds are reconfigured, NHDC will coordinate semi-annual "utility power failure" tests that will simulate a complete power loss to NHDC.

**COMMUNICATION TO NHDC SYSTEM ADMIN CUSTOMERS**

**COMMUNICATION OF NHDC STATUS TO CUSTOMER SERVERS**
ETS leadership will work to assign Enterprise System Integration developer resources to the prototype automation and signaling system, most likely post FSIP Phase 1 deployment. In the interim, NHDC management will consolidate current state into a specification for hand-off to ESI. This system includes categorization of hosted equipment as Non-Critical (NC), Customer Critical (C2) and NHDC Critical (C1) as described in the NHDC Service Description. Planned operation is to signal equipment for shutdown due to operational requirements in NC, C2 and C1 order. At present all customer equipment hosted is coded "NC" as NHDC can power and cool all installed equipment.

However, NHDC's design specification was that only 10% of potential IT load would be considered "critical" and have both UPS power and Critical Cooling available. The remaining 90% would be on filtered utility power only. Upon commissioning, NHDC Governance did not implement this structure, instead directing that all customers receive UPS power until there was no more available. The longer term categorization of equipment, or an increase in UPS and Critical Cooling capacity, is a topic for NHDC Governance / Advisory, which has yet to be reconstituted now that ETS exists.