

GCC Load-Shed

Invocation Process

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INVOCATION PROCESS

Background

The load-shed plan for the Grid Computing Center (GCC) has three stages of power reduction for Computer Rooms B and C (CRB and CRC), reducing computer power dissipation by 30%, 50%, and 99%. Whole racks of computers are to be powered down¹ as listed in another document. This document specifies the process through which the load-shed decision is made, communicated, and executed.

Soaker hoses were used during hot days last year to lower the temperature of the concrete pads under the condensers. We expect to operate without them after the removal of the berm behind the condensers. Pad temperatures mentioned below refer to actual temperatures.

The Facilities Operations Department (FOD) executes this process. They have wide latitude in doing so and will draw upon the experiences of past years and what happens in the upcoming hot season. The Availability Manager has responsibility for updates to this document, in consultation with FOD, stakeholders, and management.

Invoking the load-shed plan

The intent of making the load-shed planning before summer is to carry out the decision processes in as nearly deterministic a way as is sensible and prudent to do. Removal of the earthen berm behind the condensers will create a new operating environment. FOD and any other decision makers involved in the invocation process will adapt to new knowledge and balance determinism with agility.

Decision makers

FOD will make the decision whether to reduce power consumption in GCC CRB and CRC on workdays. When considering action or preparation for non-workdays they may consult with a larger group.

Information required

The following information will be used to make load-shed decisions

- The time of day and forecast temperatures and sunshine for the remainder of the day.
- If the following day is not a workday, the forecast temperatures and sunshine for the following non-workdays.

¹ As of April 2012, the 30% load shed plan has HPPC clusters in CRC reducing clock speeds to achieve power savings, rather than shutting down any machines.

- Current functioning of the CRACs, including any failures that may have already occurred.
- The temperature of the concrete pads under the condensers.
- The temperature of the computer rooms.

Decisions

The decision made on the basis of available information may be

- To do nothing.
- To give warning to service operators and stakeholders that load-shed may be called for later in the day, or on a coming non-workday.
- To direct service operators to reduce the load by 30%, 50% or 99% according to the agreed-upon list of racks.

Decision guidance

Decision makers will take into account new knowledge and unforeseen factors when making decisions. They are expected to exercise their expertise and not make decisions in a mechanical fashion. Barring unforeseen factors or new knowledge not reflected in an update of this document, a modeling of load-shed decisions might run as follows. It is worth noting that the rated operating conditions of the condensers extend to 95°F incoming air temperature. During 2011 they did operate up to 105° and 110°F.

If the condenser pad temperatures reach 115°F, or if one or more CRACs have failed and the pad reaches 110°F, load-shed will be invoked.

If the condenser pad temperatures reach 110°F before the expected peak heat of the day, and ambient temperatures are forecast to rise with continued sunshine, load-shed will be invoked.

If the forecast for an upcoming non-workday is high enough to expect pad temperatures of 110°F or more, based on the observed relationship among sun, ambient temperature, and pad temperature, a warning of possible non-workday load-shed will be issued.

If decision makers issue a warning of possible load-shed on a following non-workday, service operators, in consultation with their stakeholders, may choose to power down racks on the prior workday.

If load-shed occurs on some day and the weather forecast makes another load-shed seem likely to be needed the next day, FOD may offer service operators the option of powering up their affected racks overnight.

Notification

Notifications, including warnings, will be issued through the Service Desk, which maintains the contact information to reach service operators. On a workday, service operators will be expected to carry out the requested level of power reduction within 30 minutes of the Service Desk issuing that notification. On a non-workday, the target time interval is 60 minutes if warning was given on the prior workday, and 90 minutes otherwise.

FOD may cut power at circuit breakers if necessary, but this is only a last resort to preserve the computer room environment. It is expected that service operators will be able to carry out their power-down procedures, even if some miss the target time window.

Verification

Service operators will report their load-shed actions through the Service Desk. FOD will inspect results and/or measure power consumption.

Restoration

FOD will send through the Service Desk a clearance to resume full or partial operation. Some service operators may find it useful to have FermiGrid services restored² before they bring their own services up. Any dependencies or sequencing are up to the service operators to impose.

In the clearance notice, FOD will give its best guess at the likelihood of another load-shed the following day.

² The current power-down list has one FermiGrid rack left operating in all load-shed conditions.