CERN COMPUTER CENTER UPGRADE PLANS EXTERNAL REVIEW

CERN, 29 October 2002

Toni Cass IT/FIO presented the plans for the future CERN Computer Center upgrade in view of the LHC project requirements. The level of detail and quality of the documentation presented was excellent for the purpose of the review.

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Distribution:

All Participants,
Manuel Delfino, IT Division Leader
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Les Robertson, LCG Project Leader

1. Introduction

The Computer Center Upgrade Plans Review was held at CERN on 28 October 2002. The scope of this review is to evaluate the plans of the IT division regarding the upgrade of the Computer Center in view of the demands of the LHC project. No specific technical solutions are expected form that review. The main outcome of the review shall be to study the correctness of the strategy purposed to cope with the demands of the upgrade, and to point out possible aspects of the solution purposed that could be critical in the implementation of the solution.

1.1 Participants

IT Division :

Toni CASS, IT/FIO

Review Board:

Edwin Bringardner, PSINet
Jonathan Rodin, PSINet
Lluis Miralles, IFAE

ST Division:

Anne Funken, ST/EL
Isabel Bejar ST/DI

1.2 Agenda

14:00 Computer Upgrade Plans Presentation . Toni Cass.

16:00 Visit to the new computer room.

16:30 Questions and clarifications. All

No reviewers closed session was hold. It was agreed by the reviewers to held a meeting at PSINet facilities on the 5th December 2002, (10:00) to finalize the report. Drafts will be circulated meanwhile.

2. Matters Discussed

Reference to the excellent technical documentation is made below. For completeness the subjects discussed are recalled below without any detailed comments:

Requirements of the Offline LHC experiments computing
Consequences of the Hoffman review requirements. Computer Center Upgrade justification.
Proposed Solution
- Lay-out. Space discussion.
- Electrical power.
- HVAC
- Autonomy. UPS systems.
- Fire detection/suppression

Schedule
Cost estimation

3. Conclusions and Recommendations

It's assumed by the review board that the conclusions of the 2000 "Hoffman Review" are still valid. Those conclusions are the start point of the upgrade plans, significant changes on the estimations would made the plans no valid.

3.1 Computer Center Upgrade justification

The evaluation of the needs in order to plan the upgrade are based in the translation of CPU capacity, Disk storage, Tape storage, and Tape I/O bandwith to electrical power, and as consequence, in HVAC power, UPS capacity and space. So, an underestimation or overestimation of the electrical power needs for computing and peripherals has a multiplying effect on the final power needed, via the HVAC needs, and on the cost via HVAC and UPS capacity.

It was felt by the board that the approximation in order to find the equivalence between the functional requirements and the electrical power needed is too simplistic. A magic figure of 1 W/SpectInt 95 has been considered. The board recommends to conduct tests on a relevant sample of computers, working in the expected conditions, in order to correlate the electrical power consumption with the specific situations, mainly:

- CPU electrical power consumption versus benchmarking.
- Disks electrical power consumption versus I/O state or idle state.

The statistical study will help in confirming the assumption adopted or will provide valuable information to state a more exact one. On the other hand , to include the factor time and the type of load in the study , will help to find the optimal solution from the electrical point of view. Specially on the power co sinus and the load simultaneity factor.

3.2 Lay-out. Space discussion

The solution purposed, recovering the vault section at the basement, it's considered to be the most correct one. Leaving still open the possibility of adopting some of the other solutions considered, if more space will be required in the future.

3.3 Electrical Power

The solution purposed reflects the state of the art in electrical engineering, identifies the current critical components in the scheme (18Kv supply and 48 dc control system) and takes actions in order to solve them. It's considered adequate regarding the current evaluations of the loads. Studies on the evolution of the load versus time, specially at the start up of the systems, would give data enough to evaluate the worthiness of the implementation of a sequential start up control.

3.4 HVAC

The cooling air flow distribution on the computer rooms. Due to the height characteristics of both rooms, main room very height and vault room very low, a detailed study of the air circulation is mandatory to validate the assumptions on heat power extraction per square meter. The study should include simulation of the external weather conditions.

In the case of the main room, it seems the current air conditioning system could be improved by bringing the cold air closer to the thermal load. Now the cool air drops from the ceiling whereas hot air is as well pulled from the room via the ceiling. Bringing the cold air down closer to the thermal load via vertical piping and diffusing it more precisely and closer to the load using textile diffuser tubes could be a simple and effective way of better method of cooling.

For more details of one supplier's of textile tube air diffuser, go to this web page:
http://www.blowtex.it/index_eng.htm

It demonstrates applications of suspended textile tubes used to diffuse cold air from a central air conditioning unit over a large surface area such as your data center. These diffusers could be suspended from cables fastened to the walls and stretched across the room .Krantz air distribution systems could be used to bring the cold air from the room ceiling outlet points to the textile diffusers suspended just above the thermal loads.

In addition, the room's ceiling lighting could be removed from the ceiling and suspended at a level of 4 or 5 meters above the floor. This would enable easier access for changing fixtures. As well it would allow for providing the same illumination of the room while decreasing the number and power of the lamps used. This would contribute to reducing the heat load on the air conditioning system.

Presumably, the air conditioning capacity the machine room's system directs to offices forms part of the load on the genset as well. Separate split units or fan coil systems on a normal power circuit may be more appropriate ways to comfort air condition offices.

It's for special concern the planed use the current HVAC infrastructure, specially the chillers, assuming that not significant upgrade or repairs should be done. According to the information supplied, the current equipments are 30 years old, to expect that those equipments can stand at its current power capacity for the expected life of the upgrade, 50 years in total, it is not realistic. A deep review of the current state of the equipments and evaluation of their expected lifetime should be conducted in order to determine the actions to be foreseen.

Insisting the air conditioning systems be commissioned by a neutral third party, as well as awarding the maintenance to a service firm other than the contractor responsible for the installation will ensure the design specifications and criteria are met and faulty design or improper installation aspects are brought to light and addressed before the room's use will no longer permit rectification.

3.5 UPS system

There is a general consensus on the fact that the best technical solution regarding a UPS system, is the Rotary UPS solution, being it's main inconvenient its purchasing cost. Provides a clean sinusoidal curve. It removes spikes, drop outs, frequency problems to ensure critical loads receive conditioned power. An auto transfer mechanism does not provide this protection. Surges and other impurities are commonly associated with grid conditions during which the auto transfer mechanism will operate (storms, transformer station malfunctions, rolling blackouts etc.).

Due to the ".com" bubble implosion, Rotary UPS diesel genset are available at the present moment in the market with a very advantageous cost (two large containerized Piller UPS rotary diesel units are sitting in front of the former Digiplex Hosting Center in Meyrin). Self-contained containerized units require a simple concrete foundation to operate. All the operating elements are encased in the container. The units should be factory certified before transport to their new location. The presence of such used equipment in the market will not last for a long time, if the Rotary UPS solution is adopted the equipments should be acquired as soon as possible (i.e in the next two years maximum).

About the correctness of value of the power secured by the UPS system, it's fully depending of the considerations of point 3.1. A review of the loads to be considered critical it's advised. The HVAC control system shall be powered by the UPS system.

3.6 Fire detection/suppression

The solution and strategy purposed it is considered correct. The setting of the high sensitivity detectors it is anticipated to be difficult at the beginning of the exploitation of the system, experience shall cure that problem. A test on the vault room is recommended. On the main room is recommended to install the detectors on close to the top of the racks.

3.7 Schedule

The schedule presented it's seen extremely tight, if not unrealistic. It is of special concern the civil works phase, in particular the production of the technical specification prior to start the tendering.

3.8 Cost estimation

Taking in account the comments on the power needs (point 3.1) and the HVAC (point 3.4) the cost estimation presented shall be considered very cautiously. The total cost can change significantly due to those points.

No information on the basis for the estimation of the costs has been presented. It is highly recommended to ask "unofficially" for quotations on the main items in order to crosscheck the validity of the cost estimation, as well as delivery times. Maintenance shall be accounted in the cost.