

## **Meeting Minutes for the “High Density Data Center Committee” of the CFRT**

Meeting Date: 4/19/2004, 1:00PM

Location: Intel Corp., Santa Clara, CA

Hosted by: Bill Hammond of Intel's Enterprise Server Power-Thermal Strategy Group.

Bruce Myatt and Magnus Herrlin opened the meeting welcoming attendees and reviewing the agenda. Introduced was Intel's Enterprise Server Group

1:15-2:15pm "Microelectronics Heat Removal - Trends & Opportunities", by Ven Holalkere, Intel  
Ven has been developing future technologies for heat removal that are very applicable to the Data center environment for Intel based servers, out of it's Enterprise Server Group.

### ***Presentation Summary:***

Trends:

- Server density in racks: at about .5/u going to 2/u. Blade servers are being used as well.
- Server, application and performance growth will increase wattage/sqft.

Intel Initiatives:

- Intel is focussing on increasing performance per watt.
- Intel is looking at new rack topologies such as a dockable rack with hot swappable connections for servers. The rack having single point of electrical connectivity simplifying swapping and wiring. The rack would have local cooling/evaporator loops with heat exchanger on the outside of the rack. The system is simple, no external fans or pumps etc. CFM is the limitation for the air-cooling.

2:15-3:15pm "Power Management - System and DC Solutions", by Deva Bodas, Intel  
Deva has been working with DC operators and focused on developing Data center technology solutions for Intel based servers, out of it's Enterprise Server Group.

### ***Presentation Summary***

Current Situation:

- Exponential data and server growth.
- Performance increases including HD's, processors, etc.
- Shrinking form factor.
- Increased complexity due to business continuity and redundancy.
- Increased Total Cost of Ownership: \$1 of HW means \$5.50 of infrastructure.
- Flat IT budgets.
- Racks not fully used due to power and cooling issues. Nameplates used to allocate power.
- Components at same power/performance level regardless of workload.
- Current thermal and power monitoring is fractured and not integrated.
- Trend is towards “Modular Computing” dynamic resource sharing which would require: Auto-recovery, self-optimization, automatic power and thermal management.

To address this Intel Introduced:

- DB: Demand Based Server. Servers which allow dynamic use of power reduction by managing clock speed based on processor load.
- ACPC: Automatic Control of Power Consumption. An application allowing automatic threshold setting for servers racks and systems. Increasing rack utilization 2-3 times.
- EPTM: Enterprise Power & Thermal Manager. An application integrating all thermal and power management. Allowing complete power management and selective load management.

3:15-3:45pm "Survey Results and Open Discussion on DC trend capabilities", by Bill Hammond, Intel

Bill owns the Enterprise Server Group Power-Thermal Strategy development and is formerly the director of I/O Architecture, Server Mgmt, and Technology Development responsible for analyzing a variety of Data center trends.

### ***Presentation Summary***

- Average DC in the past is 65w/sqft or 3-4kW/rack. 200W is still a special case
- Most being built now are 100-150W/sqft, 5-8kw per rack. One at 500W/sqft exceeds the cost of a fab per sqft. Weight can be an issue.
- Questions: Is there an economic breakpoint to density? Hot Cold Aisles limited up to 200sqft?
- 50% of power is lost in distribution and cooling, another 40% of that is lost in PS's, fans etc.
- Only limited spot cooling is deployed most is still standard raised floor. It adds significant cost and space utilization is a big issue. No exotic cooling and resistance to water-cooling.
- Planning now in the 65-300W/sqft range. 200w/sqft average.
- IT is interacting with operations and facilities.
- Thermal issues are addressed in a variety of ways from sophisticated modeling to just a calculator.
- Limited evidence of economies of scale for power calculation and cooling. For example nameplate ratings are still used.
- Growing trend towards density. 1-2u servers selling well. Blades server sales beginning to ramp up.
- CFRT seems to represent an average customer DC customer base no extreme users such as drug research or financial modeling.

3:45-4:30pm CFRT Activities and Plans

CFRT HDDC White Paper Outline & Draft

CFRT Member Feedback and HDDC Committee Announcements

Close

### ***Presentation Summary:***

Announcement of May 20<sup>th</sup> CFRT meeting on "Distributed Generation and Electrical Distribution Monitoring".

Announcement of LBL's Energy Efficiency program. They are looking for study locations.

Locations get a report and efficiency recommendations. More info at [www.datacenters.lbl.gov](http://www.datacenters.lbl.gov)

Mangnus proposed the development of a white paper which present guidelines and standards allowing DC's to be upgraded over time. It would address end user heat related challenges in Mission Critical facilities and include a brief background. The target audience will be end-users. The committee will use the expertise in the room (the HDDC) for the paper and is soliciting input to this document from its members.

Outline:

- Heat density: Rationale for compact equipment and clustering. DC heat Density Trends. Equipment heat output trends.
- Practical Solutions: Short-term solutions for mature DC's transitioning to high average heat loads Long-term solutions for new DC's, criteria for going to high density 300-400W plus.

Comments:

- We need to include structural engineers as well as facilities organizations
- We need to develop IT guidelines for selection of power supplies. They are often not aware of efficiency options.
- We have a complete system that needs to come together including weight, seismic and structural issues. It's an integrated system.
- Bruce Myatt: Though the DC is the "encasement for the computer" we should focus on the power and thermal aspects for this paper.
- Deva Boddas: Its important for the air to get to the right places, hot spots etc. Cooling capacity on its own, is not necessarily effective. Measurement of the efficiency of the cooling system is important. The paper should incorporate best practices.

Next meeting will be in 3-4 months possibly at SUN.

Bruce thanked Intel and closed the meeting.