



SDRC

Cisco's Network to Users Business Unit in San Jose, California uses I-DEAS ESC software to design reliable Access Servers and keep their thermal engineering process on track.



Cisco Systems uses I-DEAS ESC Software to Keep Cyberspace Cool

Paving the Information Superhighway

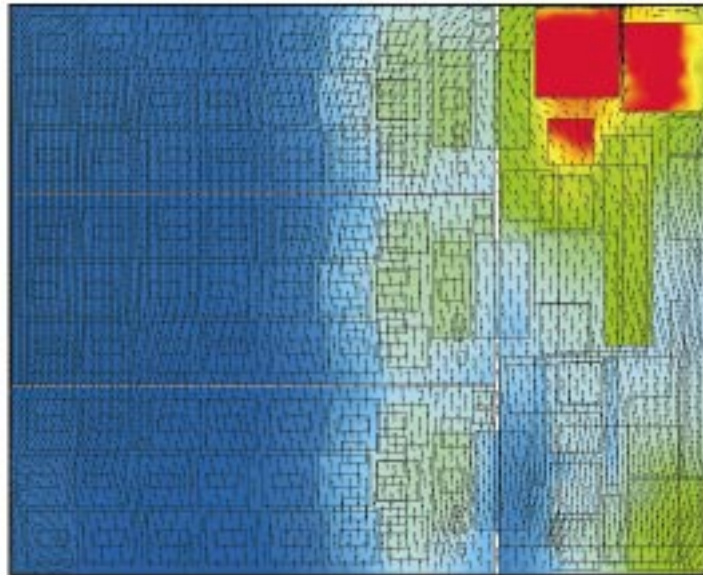
The Internet and corporate Intranets are evolving at an astounding rate. The World Wide Web, electronic commerce, and client/server networked applications are only the beginning of this business revolution. One of the most important capabilities that this revolution must deliver is access - anywhere, any time. Mobile users, users at remote sites, business partners and a host of others need network dial connections to get their jobs done.

Every day we count on access servers for global communications between desktops and mobile computers using dial-in analog and ISDN lines. Cisco Systems is a world leader in networking equipment that provide this service. No matter which lane of the information superhighway you drive down the chances are pretty good that Cisco has helped pave the road.

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Ariel Tang

Mechanical Engineer
Cisco Systems



With ESC's results post-processing engineers can display their results and quickly understand airflow as well as locate the hot spots in the enclosure. This image shows the fluid temperatures and flow velocities over the access server's system card.

Keeping the Thermal Engineering Process On-Track

Here's the challenge: provide the most access ports in the smallest package and keep the access modems cool. The market is constantly demanding higher modem port density in a rack mounted package making the Access Server the highest power density device that Cisco Systems design. The power and heat dissipation requirements are ever increasing with each new generation of server product. The thermal engineering challenge faced by Cisco's Network to Users Business Unit (NUBU) is daunting and I-DEAS ESC software helps them tackle it head-on.

Meeting this challenge effectively within a competitive design schedule is exactly what Cisco's engineers do. Design cycles usually do not exceed one year and can be as short as six months. With today's time-to-market pressure the traditional approach of building physical prototypes, testing, making modifications and re-testing is not an option. Cisco relies on I-DEAS ESC software to build digital thermal prototypes to simulate and optimize their product design. ESC is fully integrated with Cisco's 3D mechanical engineering design system IDEAS Master Series™ from SDRC. This means Cisco can seamlessly share design data between the engineering team and use the 3D design for ESC thermal simulation. This saves time and helps keep the thermal engineering process on track.

Cisco's NUBU Engineering is responsible for the design of the Access Servers. Part of this responsibility includes system and package level thermal simulation. Employing an easy-to-use thermal engineering tool like ESC is important since flow and thermal simulation is not an everyday event. ESC is used intensively on a project and it may be several months before the engineer needs to use it again. It

is essential that the software can be picked up and plugged in as if it were a daily task. Ariel Tang, Mechanical Engineer, explains, "I took the I-DEAS ESC one week training course, and for several months I didn't have a project that needed ESC. When the next project demanded ESC, within a week or so I was getting results I could use, and I wasn't working on it eight hours a day".



When NUBU needed to simulate a PC board for a next generation server, Ariel knew how to ensure success with the thermal design. She signed up for the next I-DEAS ESC training course, "I knew that I was going to need to use ESC for this challenging design", explains Ariel. "The course itself was easy, and the tutorials were fun, but when I went to use ESC for my own work, I needed help," recalls Ariel. Learning a new software package can be a challenge for any new user and both SDRC and MAYA were there to provide assistance every step of the way. Over the next two weeks she worked with a MAYA support engineer to help her build and solve her first ESC project. With the analysis complete, the design was sent for initial prototyping.



Cisco Systems NUBU designed three major access server products - the AS5200, AS5300 and the AS5800.

Cisco's engineers also need creative solutions to complex cooling problems. According to Onder Cap, Mechanical Engineer, "ESC is more reliable than using empirical rules-of-thumb that usually don't work in cases like this." An obvious benefit is being able to optimize designs early in the development stage. Onder continues, "ESC helps you understand the physics and eliminate ineffective design options before much time and money has been invested. It is a real time saver."

These time and cost savings really stand out in cases of board level analysis. "Once the board's electrical design is complete, it is very difficult to change component placement" explains Ariel Tang. To do so would mean a complete electrical re-analysis; a luxury Cisco cannot afford due to time-to-market demands. Therefore, it is essential that the thermal design is sound before it is sent for prototyping. With I-DEAS ESC software this can be done easily and effectively.

Access Servers Demand Reliable Cooling

Cisco Systems NUBU Engineering is responsible for three major access server products: the AS5200, AS5300 and AS5800. Each has its own set of thermal specifications. The AS5300 was completely simulated in ESC, and it remains the most reliable server of its class in the market today.

Electronic components must operate within acceptable temperature limits or the system reliability suffers. Cisco constantly strives for better customer satisfaction so when it comes to judging thermal performance, engineers pay close attention to the thermal simulations that Onder and Ariel present. With I-DEAS superior post-processing features, they can plot air patterns and temperature profiles, making the physics easily understood by all involved in the design. "Stating that

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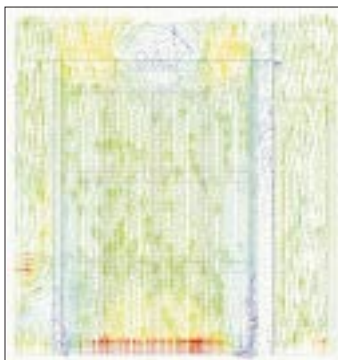
Onder Cap

Mechanical Engineer
Cisco Systems

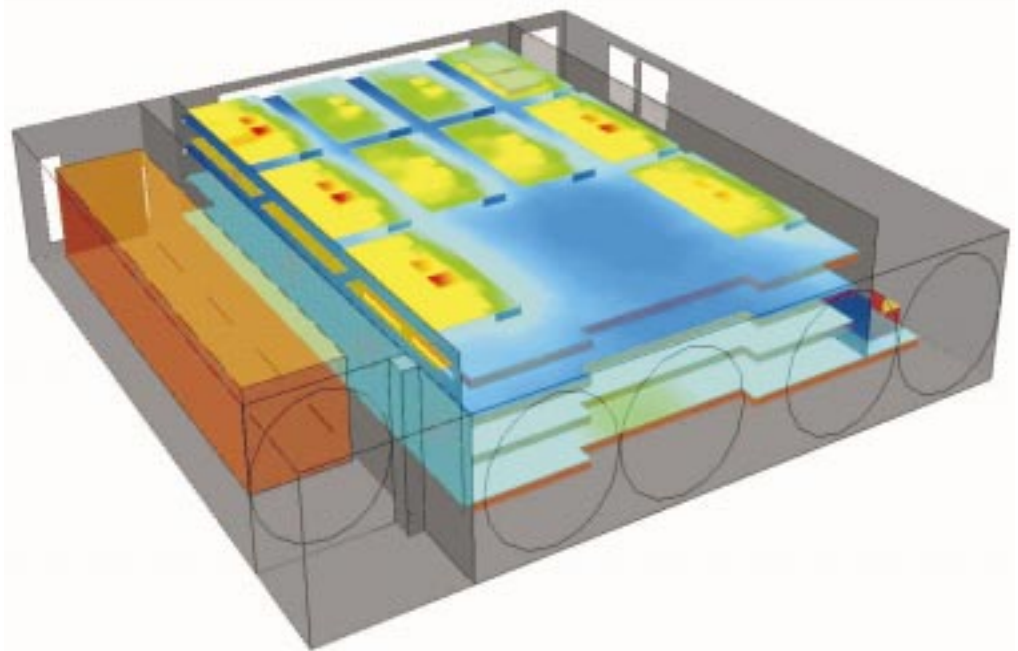
the board temperature is 28°C above ambient means something to me, but it may mean nothing to another engineer or product manager. With ESC you can show them, and then it makes sense." This helps make the engineering process more collaborative and involve the entire product development team in the process.

The engineers at Cisco Systems need results they can count on, and they need them quickly. Since physical prototyping is expensive and testing is time consuming, the engineering trend at Cisco is to test with digital simulation. "You can prepare your model and run it overnight. ESC does the job for you while you are sleeping," Onder states. "I know from my experience that with ESC I will get within 10% accuracy of physical test models." With complete control over the analysis models, modifications can be done quickly and efficiently. Models with 30000 elements modeling airflow, convection, conduction and radiation effects can take less than 45 minutes to solve. Mock-ups and weeks of testing can be completely eliminated. A final physical prototype is built and tested, but done only at the end of the design cycle for verification.

With ever growing heat dissipation requirements, software and hardware engineers alike rely heavily on the expertise of the mechanical packaging engineers. With ESC's ability to model any geometry, quickly make model changes and unique features such as thermal couplings and mesh assembly, Onder is pleased that it is part of his thermal engineering process.



These images show the board and component temperatures and air flow through the AS5300 access server enclosure. ESC helps the engineer understand the thermal behavior of the system and optimize the thermal performance.



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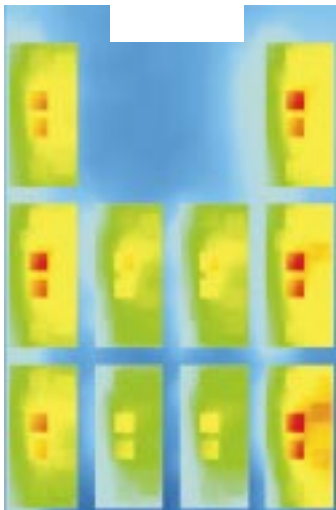
SDRC and MAYA Deliver a Complete Thermal Solution

The workload placed on mechanical designers can sometimes be overwhelming. Business demands and delivery cycles must be met. SDRC and MAYA understand this and support their customers to help them get their job done. Cisco Systems has taken advantage of this by outsourcing some of the system level analysis to MAYA.

Cisco was concerned that the AS5300 packaging design would not be adequate for cooling the higher heat dissipations in their next generation server. MAYA went on-site to Cisco's San Jose facility to help investigate the system cooling. Within a week, MAYA performed the analysis and presented the results. MAYA then worked with Cisco to alter the packaging design. The placement of cards was modified, the backplane was shifted, the vent size was increased, and the airflow was improved. Later, a design change was made and the power requirements were increased another 30%. Cisco called MAYA and asked if they could investigate further. Results were obtained almost immediately. "Within about 2 months of the project start we had a working prototype with experimental data that matched the ESC results to $\pm 5^{\circ}\text{C}$," recalls Onder.

Success from Concept to Final Product

ESC has proven to be an efficient and reliable tool at Cisco Systems. From concept to final product design, Cisco's highly skilled mechanical engineers have come to depend on it. ESC is becoming the thermal design, analysis and simulation tool of choice at Cisco. They recently acquired additional licenses to meet usage demands. As Onder Cap states, "It would definitely benefit the whole company if every mechanical design engineer at Cisco knew how to use I-DEAS ESC thermal simulation software." Working together with SDRC and MAYA, Onder is confident that Cisco's customer requirements and their design schedules will continue to be met.



SDRC

Structural Dynamics Research Corporation

World Headquarters
2000 Eastman Drive
Milford, Ohio 45150
Tel: 513-576-2400

European Headquarters
Milford House, Priory End
Hitchin, Hertfordshire SG4 9AL, England
Tel: +44-462-440222

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