

LUND

PERFORMANCE SOLUTIONS

WHAT YOU NEED TO KNOW. WHEN YOU NEED TO KNOW IT.



Capacity Planning Methodology

Taking Performance to the Next Level

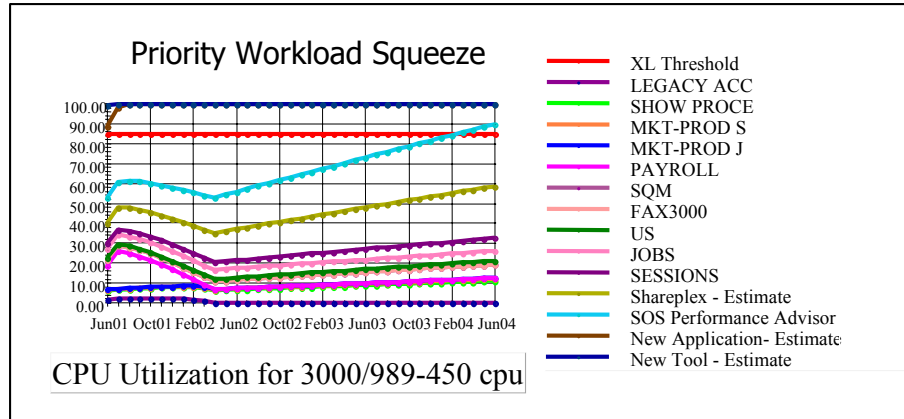
Kate Billera

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Capacity Planning

- The Lund Methodology
- Examples of recent projects and approaches



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Before You Begin

- **Understand** your environment
 - Know what five applications **MUST** complete at the sacrifice of all others
- **Understand** your objectives
 - Know what you hope to accomplish and what questions you need to answer

As a system manager or administrator, understanding your environment encompasses knowing vital applications, knowing the needs of your users and development team, and knowing the capabilities and limitations of your operating system and third party software.

In addition, understanding your objectives when approaching capacity planning will help you develop the essential questions to be answered by your analysis.

Is there an upcoming hardware lease renewal? Is there a concern about processing bandwidth for the holiday season? Is there anxiety regarding an imminent merger or the addition of users or processes? These questions can become the objectives of your capacity planning analysis. When our hardware lease expires next summer, should we purchase our current equipment, re-lease the same equipment, upgrade to a refurbished box, or move to new technology? Will we be able to manage the processing expected for the holiday order season? Will we be able to manage when our users are doubled in May?

Answering the Tough Questions

Winter Registration 2001 – Impact of Web Implementation

The first concern to address is the 2001 Winter Registration. The question was asked, "What is the impact of the web implementation on the current system?" The web08 and web09 workload groups combined to represent over 50% of the CPU utilization during the web test study period. This increase is significant over the previous utilization seen on this system. The level of this utilization likely caused a phenomenon known as priority workload squeeze, which is further explained in the Workload Increase section of this report.

Accommodating the Web Implementation

The second concern was whether the current system would be able to accommodate the heavy processing load of the full implementation of the web registration processing. The current 969/120 system will likely be able to handle the fall registration, however due to plans to implement additional web process and to open online registration to other student groups (juniors and, sophomores), a future upgrade is in order.

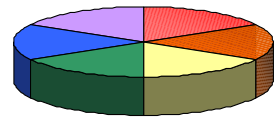
The main concern voiced centered on the CPU bandwidth for the online registration processing. As a result, multiple price performance points were selected to accommodate a 3 plus year return on investment. There are several models with similar HP assigned Relative Performance Statistics. However, based on the expected growth, expansion needs, and a desire for 64-bit architecture, we have selected the following HP e3000 models for review in this capacity plan.

One option might include a CPU upgrade to the 969/120 lifting the system to a model 969/220 providing additional CPU bandwidth. A second option would be to upgrade to a 989/200. The 989 model is already employing 64 bit technology allowing a maximum memory configuration of 8 gigabytes. Finally, the current "A" and "N" Class solutions offer the latest in HP technology.

Meeting the objectives and goals of the Capacity Planning analysis in your environment requires that you identify the purpose of the report and specifically answer the questions at hand.

Methodology

- Statement of Assumptions
- Baseline of Activity
- Projected Growth over 3 years
- Costing of Performance Upgrades
- Scaling of Projected Solutions
- Timing of the Implementation



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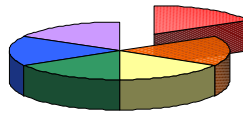
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This is the way Lund Performance Solutions approaches Capacity Planning. This is our Methodology. Let's drill-down to each of these areas in some greater detail.

Methodology – Statement of Assumptions

- Lund Assumptions
 - Sets foundation upon which analysis is conducted

- Customer Assumptions
 - Goals of the report
 - Growth, maintenance costs, methods for running your environment



- **Assumptions**
 - Costing
 - Baseline
 - Growth
 - Scaling
 - Timing

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Lund Assumptions

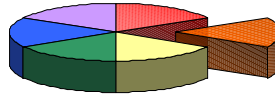
- Lund is not engaged in hardware sales. Any hardware upgrades recommended are based solely on an understanding of the environment and the applicable industry standards and are not influenced by an alliance with or direct association as a hardware seller/reseller.
- Lund uses both modeling and linear techniques in the capacity planning process and uses workload formulas for all of the major resources to extrapolate the performance of a system under increasing pressure.
- The system information and acceptance of the analyzed time slice were based on data provided in the customer profile and interviews as completed by an authorized representative of your organization. It was determined that the time slice selected was representative and typical activity of the utilization levels desired for the purpose of analysis on behalf of this report.
- The report provides recommendations based on the environment seen **only** on the specified system as it existed on the date of the study.

Customer Assumptions

- Quantify why are you doing a cap plan? Quantify goals of report?
- Quantify growth, maintenance costs, methods for running your environment.

Methodology – Baseline of Activity

- First and most important decision
- Base projections on small window
- Identifying the utilization level
 - Average, Peak, or Combination
- Identifying the appropriate season
 - Year, Month, Week
- Identifying the granular time period
 - Day, Time slice



- Assumptions
- Costing
- **Baseline**
- Scaling
- Growth
- Timing

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Setting a Baseline is the first and most important decision in the capacity planning process.

The Baseline is the foundation for Capacity Planning projections.

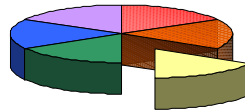
These projections are based on a small window of data.

In your environment is it more appropriate to project from an average day's utilization, from peak utilization such as month end, or from a combination of the two offering a balance between month end or the holiday season and every other day of the year.

- After you have characterized the utilization from which you will project, you must select the Year, Month, Week to use in determining your sample.
- After the appropriate year, month and week have been identified, the granular time period must be identified.
- The last step in setting the baseline involves choosing a time slice that is representative and suitable in your environment and that meets the objectives set forth for your analysis.

Methodology – Projected Growth

- Quantifying Growth over three years to justify the Return on Investment
- Using modeling techniques with Forecast Capacity Planner™
- Using linear techniques with Performance Gallery Gold™ and Microsoft Excel



- Assumptions
- Baseline
- **Growth**
- Costing
- Scaling
- Timing

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Projecting growth involves quantifying growth in the technology utilization in your company and is not simply a reflection of the growth of your company as a whole.

Your company may not anticipate outstanding growth, but management has decided to no longer outsource your payroll processing. That will not affect the growth rate of the company, but it will likely have a significant impact on your system environment.

We take a snap shot of how you are today and model it into the future as a forecast of utilization using percentages extrapolated from trending or other company statistics.

Methodology – Costing of Performance

- Addressing low, medium and high budget options (when available)
 - Low - Board upgrade
 - Medium - Refurbished box
 - High - New Technology



- Assumptions
- Baseline
- Growth
- **Costing**
- Scaling
- Timing

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Once you have determined the growth rate(s) to project, then you need to determine the CPU options to use in your forecast.

Address the question of an upgrade from a three point price performance perspective. Looking at the benefits of new systems specifically with regard to maintenance costs and ROI.

Low board upgrade within the same box allow you to spend fewer upgrade dollars on hardware, however there are still software upgrade costs and often scaling issues to consider

Medium a refurbished box allows you to enter the upgrade arena with a lower cost, high quality solution option, however this solution is subject to availability in the refurbished market

High new technology is never a bad option to research, however it might not always meet the requirements of management and company policy

Methodology – Scaling of Solutions

- Selecting the capacity comparison options
 - variable sizes
- Phased approach to implementing new hardware options



- Assumptions
- Baseline
- Growth
- Costing
- **Scaling**
- Timing

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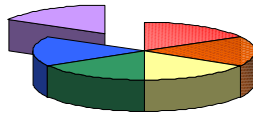
Scaling of solutions involves identifying multiple models based on price performance that meet with the criteria outlined by the objectives.

Scaling is the stage when you would determine whether there is a single box, simple solution for upgrade and expansion absorption in your environment or whether you will need to employ a phased implementation to a solution.

Scaling is the stage when you make decisions to ensure that your system environment has room to grow within in the tier and can upgrade further to accommodate your future growth as needed.

Methodology – Timing of the Implementation

- **Planning** for capital appropriations
- **Planning** for budget cycles and budget requests
- **Planning** the significant event itself



- Assumptions
- Baseline
- Growth
- Costing
- Scaling
- **Timing**

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Timing is everything. Planning makes timing easier.

Laying out the plan of when to do the analysis, when to submit the Capital Appropriation Request, planning the significant event itself and realizing that it is possibly a long window for implementation are all part of Timing the Implementation.

There are issues of budget cycles and forecasted expenses. Business decisions that are often overlooked until the dollars are needed fall into this stage.

Examples

Standard – 15%

Latent Need

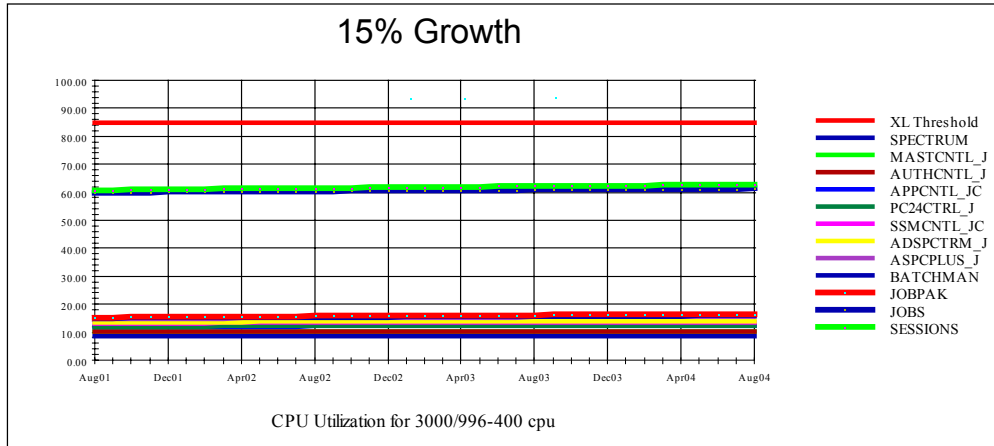
Merger of Multiple Systems

Trending

2-system Solution

Examples – Standard: 15%

Growth Description	Estimated CPU Growth Percentage
Expected potential growth in the following year	15%
Increase due to software upgrade (September 2001)	3%



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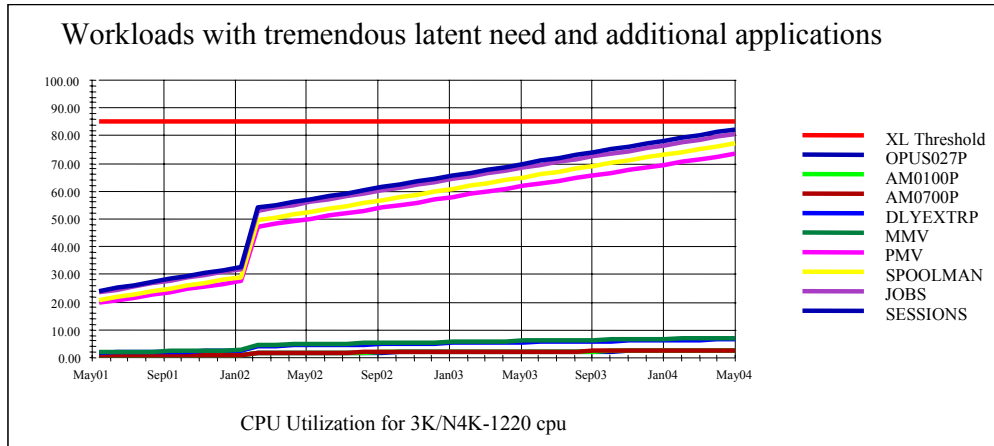
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If you are unable to quantify the growth rate, choose three percentages to use in projecting and project all three workload increases separately. This will give you an understanding of multiple possibilities and responses to growth.

- **Aggressive** 15%
- **Conservative** 10%
- **Backed off** 5%

Examples – Latent Need

Growth Description	Estimated CPU Growth Percentage
Latent need	60%
Expected potential growth in the following year	10%
Addition of applications and data sets	75%



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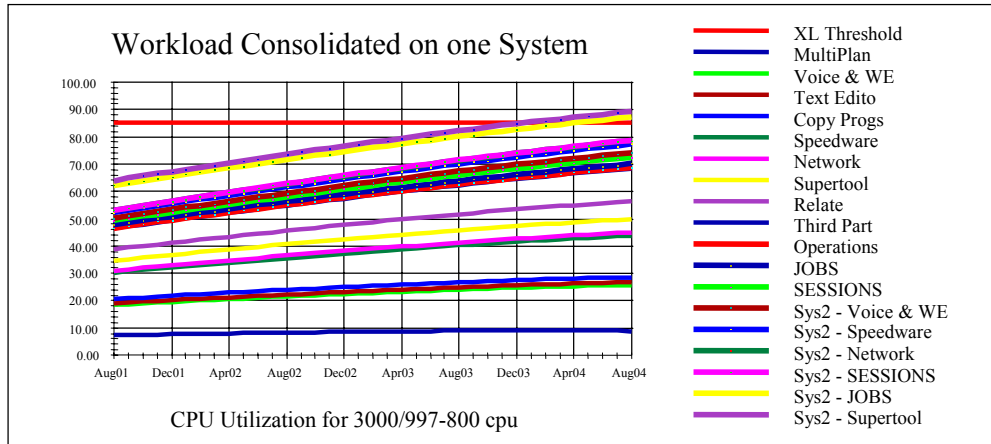
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This system was over utilized already and peaked at 100% a majority of the time. They experienced huge delays in batch processing. This leads one to ask, “How much do I need to catch up to today’s needs?” This is the first step to identifying Latent Need.

Latent need is defined as bandwidth needed to accommodate current processing requirements.

Examples – Merger of Multiple Systems

Growth Description	Estimated CPU Growth Percentage
Estimated Company growth affecting System 1	20%
Estimated Company growth affecting System 2	20%
System 2 current load	15% *



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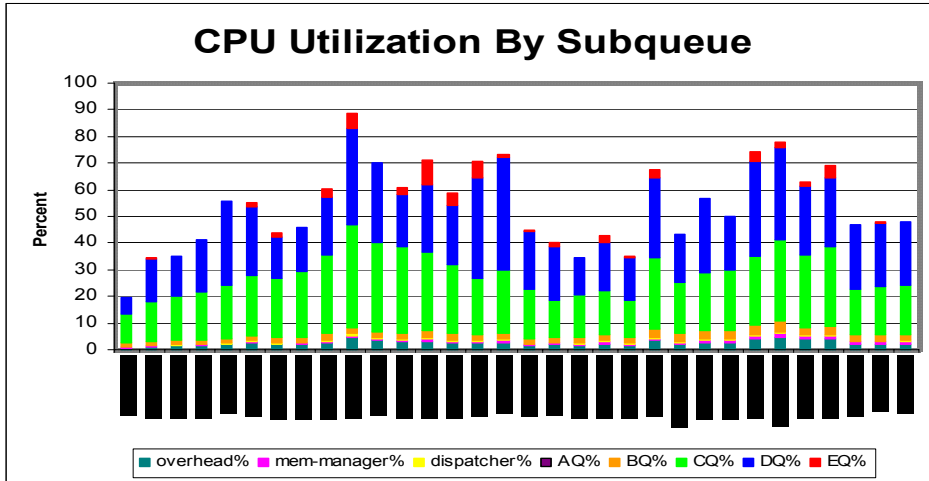
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The workload on these two systems was split and then we forecasted for them to be recombined. After performance tuning methods were applied to the larger system, the bandwidth was freed for the workload groups that had been migrated to the second system. This forecast projection illustrates the combined workload from System 1 and System 2.

Consolidation feasibility is quickly becoming a standard in capacity planning as the industry appears to be moving toward processing centralization.

Examples – Trending

Growth Description	Estimated CPU Growth Percentage
Expected potential annual growth	10%
November 2001 growth for holiday season representation	10%



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Trending allows you to utilize past data to determine fluctuations and an expected growth rate.

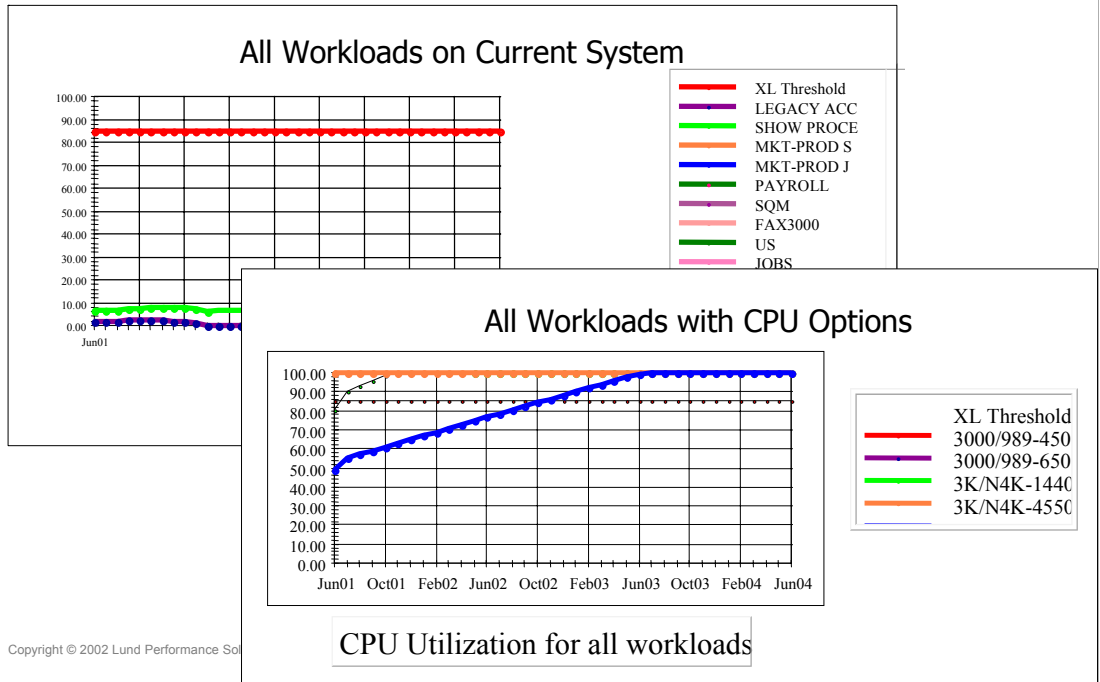
The example above shows trended utilization. We projected an average of 10% growth per year for the next 3 years. Where does that 10% figure come from? After speaking with the company representatives, we determined that the 2001 holiday season was expected to yield utilization that was between 1999 and 2000, showing improvement over 2000.

They, in turn, had the opportunity to take their average orders processed data and overlay it on top of the CPU utilization data to show the correlation between the two datasets. 10% was the figure determined to be most representative.

The correlation of business/financial data and processing environment data makes Trending a very valuable tool in capacity planning and business decision making.

Trending validates the future projections and allows you a measure of assurance as you look ahead to things to come.

Examples – Two System Solution



The example above was a situation where a single box solution was not an option. A 989-450, an N4000-1440, and a 969-650 (2 CPU upgrade) all would not work.

This is an example of why it is important to know your company's requirements for ROI. This projection is based on a 3-year Return on Investment.

In this case, even the largest box available N4K-4550 didn't yield 36 months before hitting the threshold. We offered a two-box solution and a phased implementation. At the time MPE/iX 7.0 power patch 1 was not available and the four-processor box was not on the market.

The phased implementation included plans to incrementally add the processing while migrating first to a single N4000-1440 in tandem with the existing box, and then upgrading to the N4000-4550 when it became available.

Capacity Planning (in review)

- Understand your environment
- Know your objectives before you begin
- Methodology
 - Assumptions
 - Baseline
 - Growth
 - Costing
 - Scaling
 - Timing