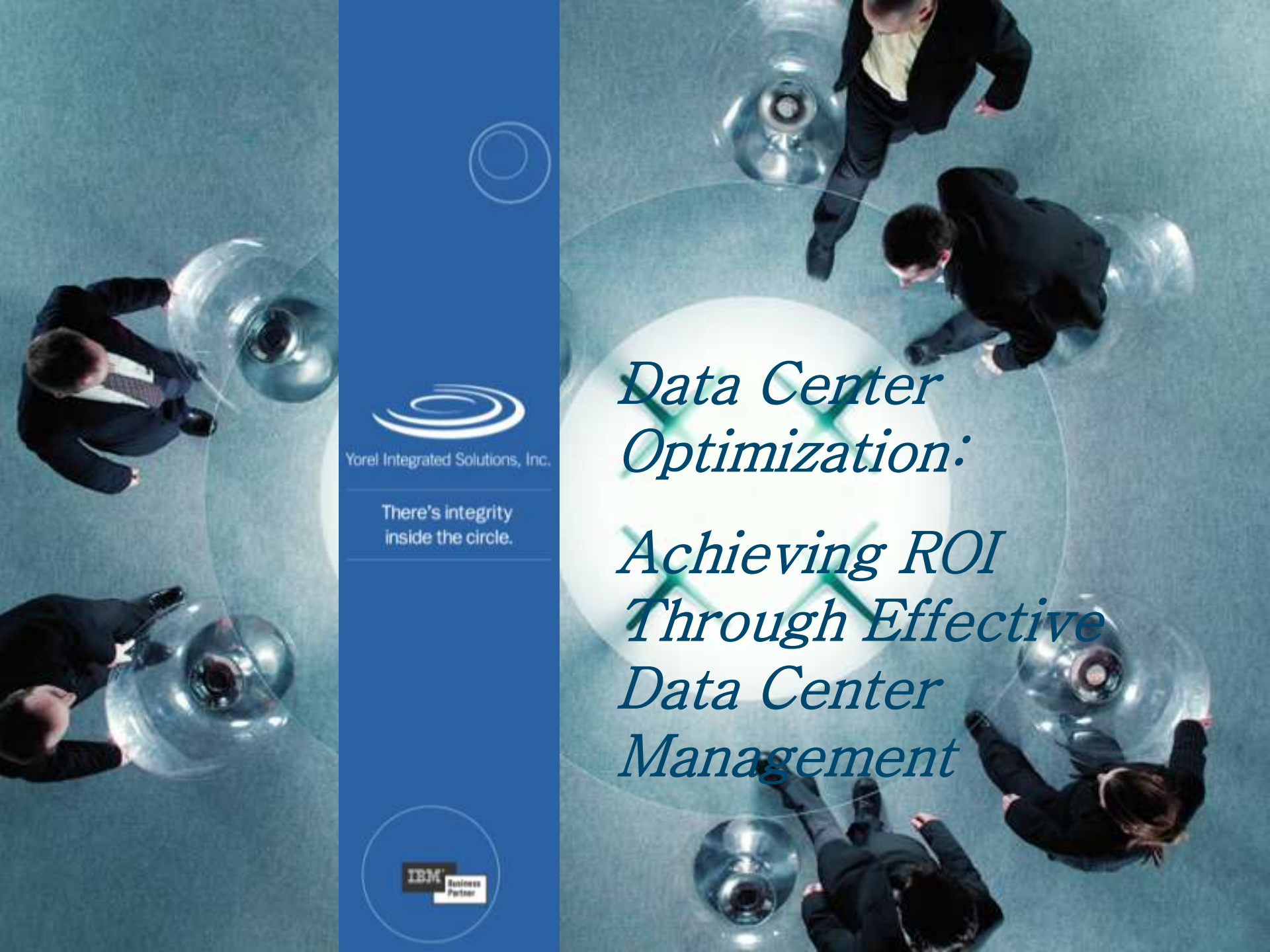
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IBM Business Partner
Data Center
Optimization:
Achieving ROI
Through Effective
Data Center
Management

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Customer Quotes

- *"You are unbelievable, no one has ever discussed these topics with us before". Director of IT, County Government*
- *"We are recognized in most national meetings we attend as always leveraging leading edge technologies and implementing best of breed solutions. However, you have blown me away on what we have overlooked in our data center." National Retail Chain*
- *"We have talked and have engaged with many IT solution providers but no one integrates the way Yorel does" Manager of IT, State Government*

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Today's Challenges

Improved

- *Availability*
  - *Redundant cooling capacity*
  - *Parallel power delivery*
  - *Power generation*
- *Adaptability*
  - *Future proofing the facility*
  - *Capacity Planning*
- *TCO*
  - *More cooling per kW consumed through warmer air return*
  - *Effective Business Process*
  - *Change Control*
  - *Less Down Time*
- *Cap-Ex*
  - *Lego block approach*
  - *Right sizing*
  - *Accuracy in purchasing*
- *Op-Ex*
  - *Efficient cooling design*
  - *Higher UPS efficiency*
  - *Effective use of man power*

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The Four Principles of Effective Data Center Design

- *Adaptability*
- *Scalability*
- *Redundancy*
- *Modularity*

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Effective Design Techniques

- *Cooling*
  - *Perimeter Vs. In-Row Cooling*
  - *Humidification*
  - *Controlled Environmentals*
  - *Monitoring*
  - *Redundancy*
- *Power*
  - *Reliable Power Distribution*
  - *208 vs. 120 Voltage*
  - *Redundancy*
- *Space Management*
  - *Effective use of Space*
  - *High Density Vs. Not*
  - *Air Flow Management*
- *Power Generation*
  - *Disaster Recovery*
  - *Business Continuity*
- *Data Center Business Process*
  - *Hardware Life Cycle Management*
  - *Change Management*
  - *Command Center Possesses*

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The Beginning: Thermodynamics

The First Law (1): Energy is Conserved in a closed system:

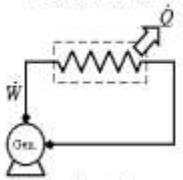
- *The net flow of energy across some system is equal to the change in energy of that system*
- *We usually consider work and heat flow as the two kinds of energy*

The Second Law (2): The Law of Entropy:

- *It is not possible to extract heat-energy from a reservoir and perform work without creating waste heat that does no work.*
- *The amount of disorder increases*
- *Things tend toward a state of randomness (this is not the same as chaos)*
- *You can not go from a disordered system to an ordered system without inputting the second law)*

Example:

We can do this



100% of electrical energy converted to heat by pushing a current through a resistive element.

We can not reverse that process to do this:

- *In the course of doing the original work we have increased the disorder to the system by heating it. In no way can we recover work of that this disordered system without putting energy into the system.*

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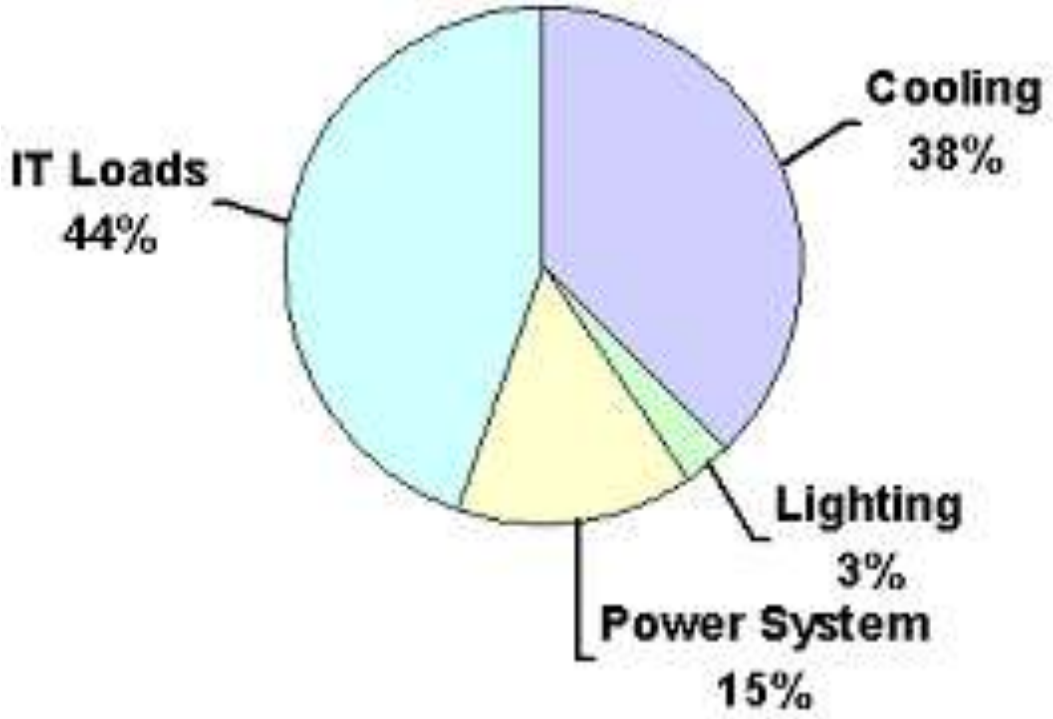
Key Concerns: Power Draw Break Down



Cooling equipment power consumption is a large contributor to the electric bill
More CRACS = More electrical consumption

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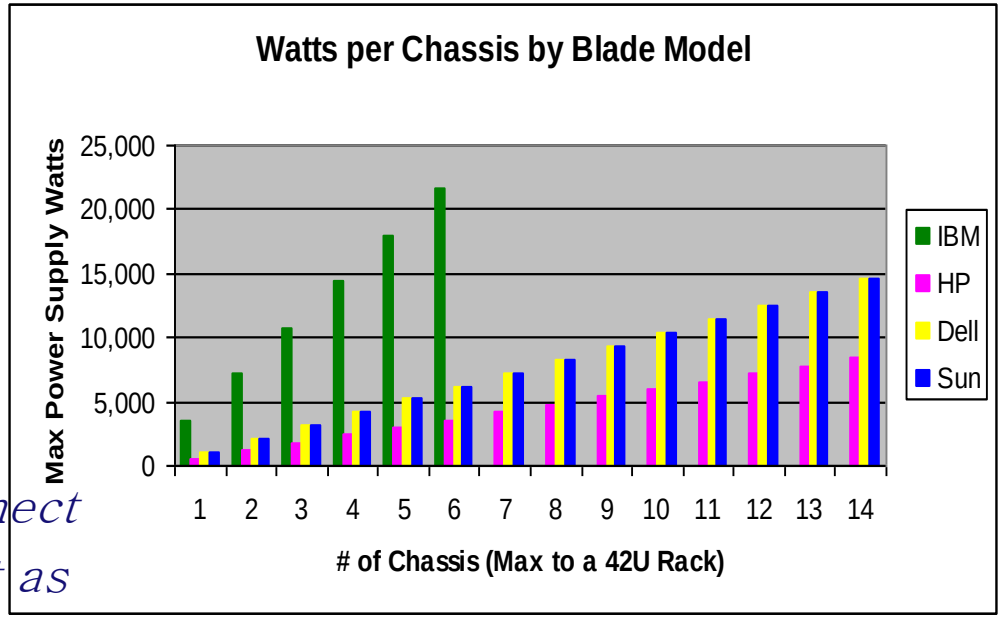
Key Concerns: Increasing Power Draw

High density trends

- *Blade/1U servers*
- *Compaction*
- *IT refreshes*

Current limitations

- *Raised flooring*
- *Heat removal disconnect*
- *Facilities Refresh not as fast as IT refresh*



Continued requirement to do more with less

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Fluid Dynamics: The Secret to Managing Heat

- *Fluid mechanics is one of the oldest and richest branches of mechanics and applied physics. Fluid mechanics has been studied (formally or informally) since the beginning of recorded history. We are literally immersed in fluids, our bodies are primarily water, and we simply cannot live without air and water. Not only are fluids and their complex physics of general interest, but it is widely recognized that fluid mechanics is an essential part of the comprehensive design and manufacture of nearly all modern machinery, structures, and devices.* ***And, yes, even the design of your computer requires some form of cooling and the manufacture of its chips requires a proper understanding of fluid flow.***
- *http://www.fluidmech.net/ Source: Cambridge University*

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Key Concerns: Basic Function of the Heat Sink

Heat Sink Operation can be described as follows:

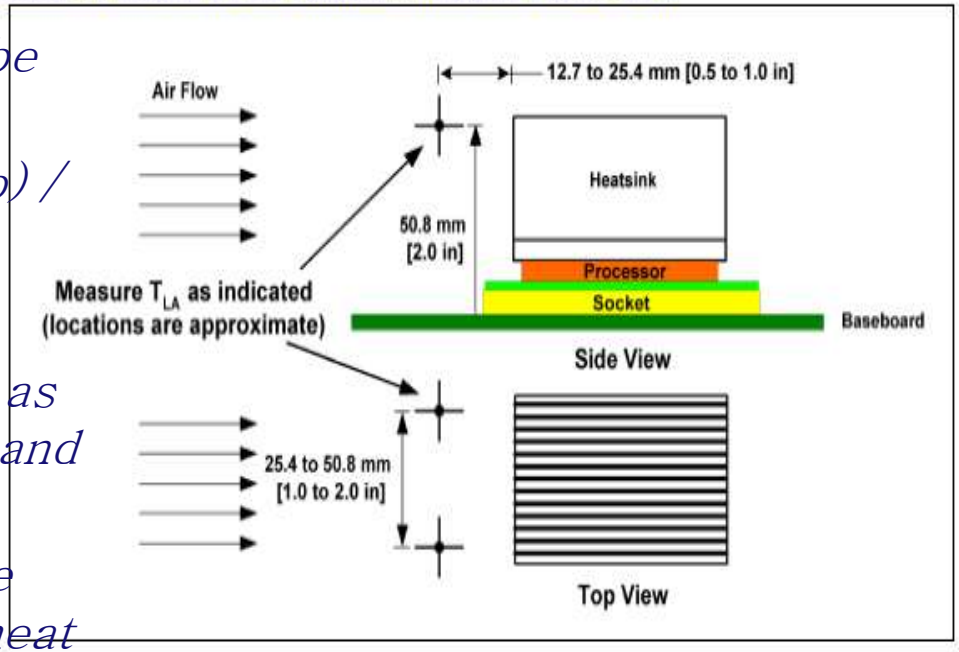
*KW = (X * CFM) (Y*Temp) / (Z *Surface Area)*

KW = Kilowatt

Temp = Air Temperature as impacted by Humidity and Pressure

Surface Area = The shape and dimension of the heat sink

Figure 5. Locations for Measuring Local-Ambient Temperature (Not to Scale)



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What is the Manufacturer Saying

A simple evaluation of the temperature of the air entering the fan heatsink can provide confidence in the system's thermal management. For boxed Intel Pentium 4 processors, the testing point is at the center of the fan hub, approximately 0.3 inches above the fan. Evaluation of test data makes it possible to determine if a system has sufficient thermal management for the boxed processor. Systems based on Pentium 4 processors 2.80 GHz (and below) should have a maximum expected temperature of 40°C in the maximum expected external ambient (which is typically 35°C). Systems based on Pentium 4 processors 3 GHz (and above) should have a maximum expected temperature of 38°C in the maximum expected external ambient (which is typically 35°C).

DISCLAIMER: The following Temperature Conversion tool is not intended for use in engineering, architecture, or software design. It is only provided as a convenience for Intel customers. **This tool is provided "AS IS," and possibly with faults. INTEL DISCLAIMS ALL WARRANTIES REGARDING THE TOOL, INCLUDING, WITHOUT LIMITATION, ALL WARRANTIES AS TO ITS ACCURACY OR UTILITY.**

35 C = 95 F

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What is the Solution?

Sound design, coupled with a holistic view of the data center remains the only effective solution.

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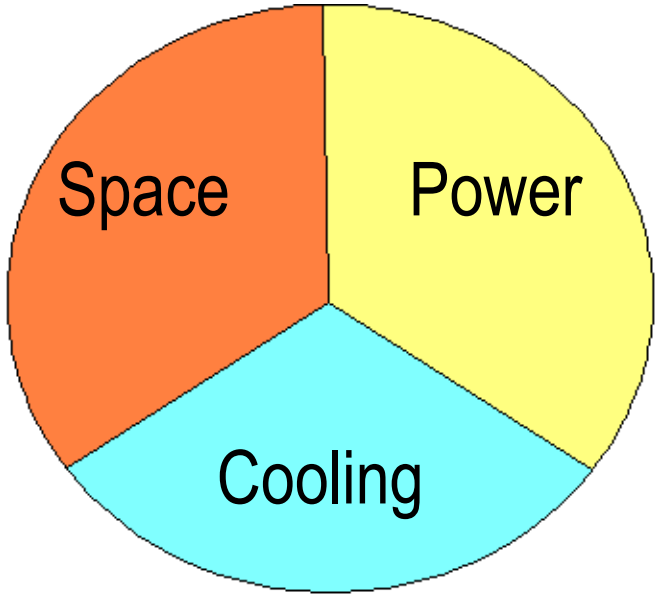
Utopia: Space, Power and Heat in Balance

Demands	Racks	KW/Rack
Space	10	5
	Tons	HVAC->KW
Cooling	15	51.18
	KW	KW->Tons
Power	50	14.65



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Key Decisions Result in Effective Design

- *When the target density per rack is defined then the subsequent design decisions can be made easier if the data center is viewed as an integrated system.*
- *No particular segment of design as it relates to Space, Power or Cooling can operate efficiently when left out of balance.*
- *When unbalanced Op-ex and Cap-Ex outlay is increased.*
- *Data Center floor space is the most expensive square footage in any business.*
- *Maximizing systemic design efficiencies can reap*

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Things to Keep in Mind

- *Manufacturers require between 90 – 160 cfm per KW of heat loss.*
- *Manufacturers temperature profiles are expecting inlet temperatures of 72 degree's.*
- *Humidity has a significant impact on cost effective cooling.*

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Key Markers for Success in Data Center Design

- To reduce data center area and Total Cost of Ownership:

Ignore physical size of IT equipment **and** **Focus on *functionality per watt***

- Above 4 kW per rack – power has a greater effect than size on both area and TCO

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Recap: Four Factors for Success in Data Center Design

- *Adaptability*
- *Scalability*
- *Redundancy*
- *Modularity*

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The Business Challenge?

- *What is stopping my business from having a more reliable and cost effective data center infrastructure?*
- *What are the steps I need to take to get from here to there?*
- *Who has the ability to design a solution that can meet my immediate tactical needs and increment those steps into a strategic solution in the future?*
- *Who can I trust with my most complicated problems?*

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The Business Solution

- *Allow Yorel Integrated Solutions to perform an onsite assessment to provide root cause analysis and to suggest strategies to avoid unforeseen challenges.*

- *Give Yorel Integrated Solutions the opportunity to review and discuss your strategic IT imperatives and identify synergies between the data center infrastructure, processing power, network architecture and mass storage.*

- *Allow us to demonstrate why our customers believe we are the trusted advisor they have come to rely on.*