Request for Information

Data Center LAN Switching

Date issued: August 6th, 2010

Response due: September 10th, 2010

Network Computing

Ashton, Metzler & Associates

Leverage Technology & Talent for Success

1.0 INTRODUCTION

GOAL OF THE REQUEST FOR INFORMATION (RFI)

Ashton, Metzler & Associates (AM&A) and Network Computing have created this RFI to gather information that will help them to better educate IT organizations on the choices they have as they evolve their data center LANs. This RFI is based around a real enterprise IT organization that is referred to in this RFI as SmartCompany. The scope of the RFI, however, has been expanded somewhat from just the SmartCompany environment so that it also encompasses the needs of the vast majority of Global 2000 IT organizations.

RFI GUIDELINES

Background on the expanded SmartCompany environment, as well as detailed information about SmartCompany's current network, as well as its constraints and requirements are found in Sections 2 through 4 of this RFI. The Respondents are asked to provide input on four scenarios. Section 5 contains a high level description of those scenarios. The RFI also contains a set of questions. The Respondents are asked to provide complete and specific answers to all the questions. While detailed product documentation can provide valuable background information, a set of standard documentation in which the answers are embedded will not be considered a satisfactory response to this RFI.

Vendors may include partners' products in their network design proposal as long as those partners are clearly identified.

CLARIFYING QUESTIONS

Vendors may submit clarifying questions at any time during the RFI process. If a clarifying question results in a sustentative change to the RFI, that change will be made known to all of the vendors.

CONTACTS

The vendors should email their responses to this RFI as well as any clarifying questions to:

Jim Metzler
Ashton, Metzler & Associates
jim@ashtonmetzler.com

Mike Fratto
Network Computing
mfratto@techweb.com

As part of their response, vendors should indicate a single point of contact for any subsequent communications.

RFI Response Due Date

Responses to this RFI are due no later than **September 10, 2011.**

Responsibility for RFI Response Costs

The respondents will be fully responsible for all costs of development and submittal of their response to this RFI.

Confidentiality and Ownership of Proposals

As noted, AM&A and Network Computing have created this RFI in order to gather information that will enable those two organizations to better educate IT organizations on the choices they have as they evolve their data center LANs. As such, the information provided by the respondents to this RFI should not be confidential.

2.0 BACKGROUND

FOCUS OF THE RFI

The focus of this RFI is the data center LAN for SmartCompany. This includes all of the network elements (e.g., switches and routers) up to and including the NICs in the servers. It does not include networked storage devices, nor does it include separate devices intended to provide security; e.g., firewalls, IDS, IPS. It also does not include any separate optimization devices; e.g., WAN optimization controllers, application delivery controllers.

SmartCompany has one hundred and twenty five sites in the Americas, Europe, Asia, Japan, Africa and Australia. The major data centers are located in the US, with a data center located in Europe. There are several manufacturing sites in the Americas and Europe.

SMARTCOMPANY'S DATA CENTER VISION

SmartCompany wants to build a dynamic data center-computing infrastructure that can provide each application and network service with the required resources even as the demand for each service fluctuates dynamically. SmartCompany envisions an end state in which the demand for infrastructure resources can be met with the instant-on, real-time delivery of virtualized network services.

DEPICTION OF SMARTCOMPANY'S CURRENT NETWORK

Figure 1 depicts the overall network architecture for SmartCompany.

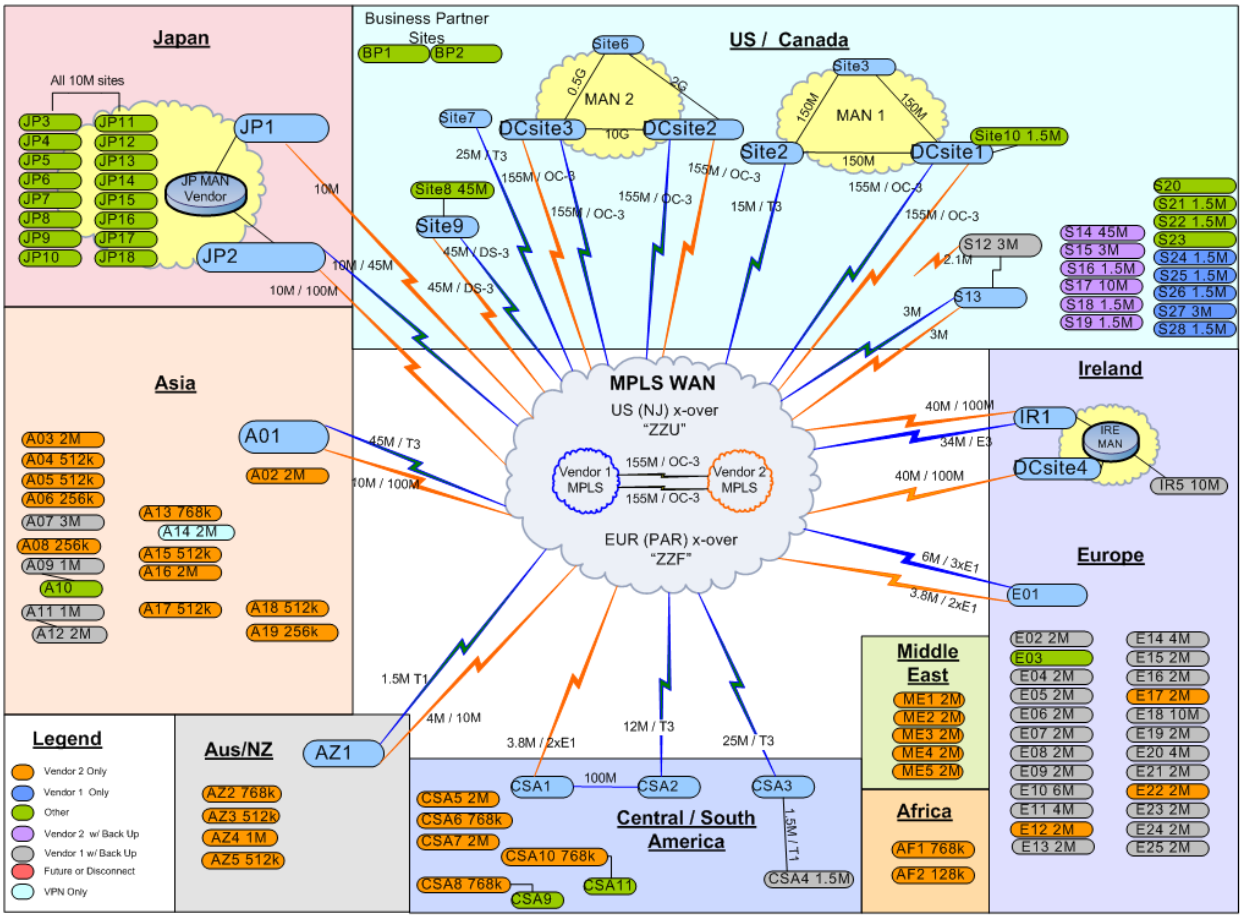

Figure 1: SmartCompany's Overall Network Architecture

Because they have grown by acquisition, SmartComany does not currently have a consistent data center LAN design. For example, in some cases they implement a two-tier design and in some cases a three-tier design. In some instances they connect their servers directly to an L3 chassis; in other instances they connect servers to L2 switch stacks; and some data centers combine both approaches depending on the bandwidth needs of the server.

Figure 2 shows the design of the data center referred to as *DCsite1* in Figure 1.

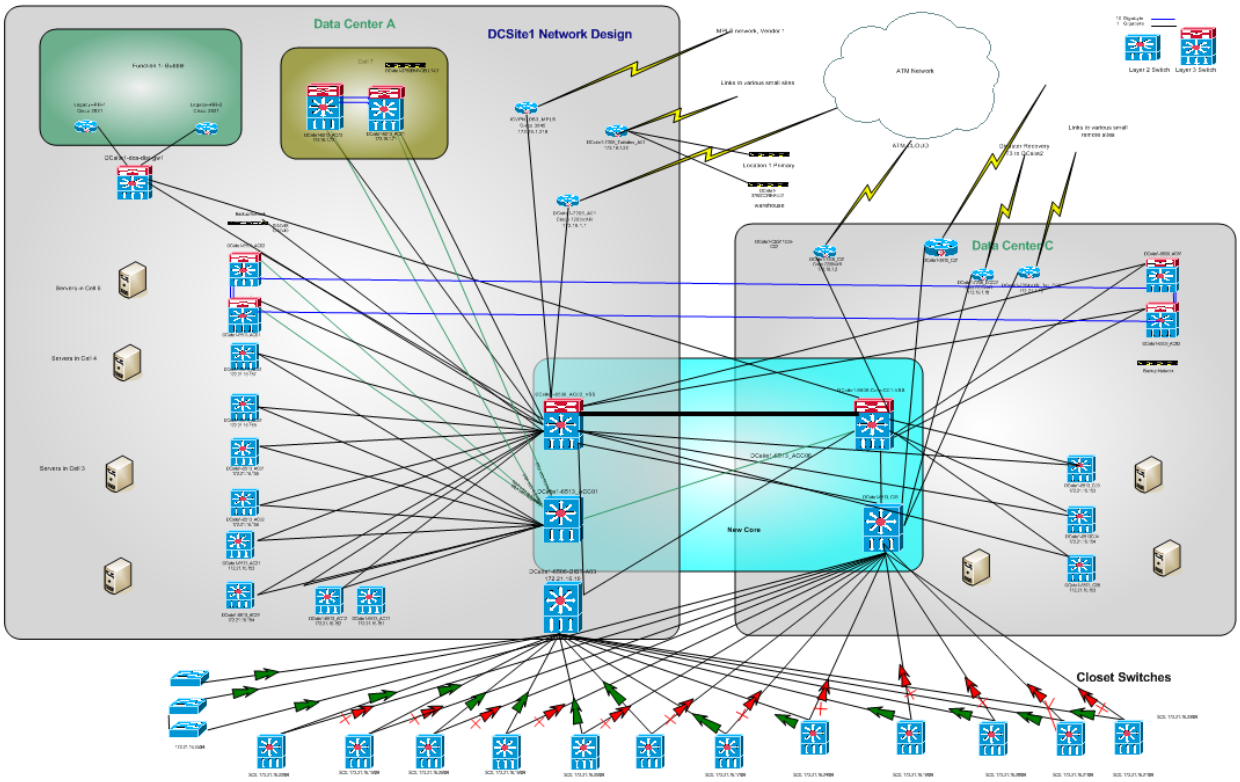

Figure 2: The Dcsite1 LAN Design

3.0 DETAILED INFORMATION ABOUT SMARTCOMPANY'S CURRENT NETWORK

HIGH AVAILABILITY

- SmartCompany's data center networks are designed to have no single points of network failure.
- The largest exposure within a data center is the singly attached servers. Individual business units decide how the servers are attached.
- As a general rule there are redundant switches, redundant routing paths, redundant power, PDU, UPS, external power sources (where possible), separated fiber paths for infrastructure links within data centers (where possible), separated fiber paths for infrastructure links between on-site data centers (again, where possible)

CURRENT SWITCH AND ROUTER PLATFORM

- The current network vendor of choice is Cisco. This includes:
  - Cisco 6500, 3750; some older Cisco equipment still in use.
  - Cisco 7204/6VXR and ISR's (3825/3845).
  - The standard network operating system is IOS. SmartCompany does have significant pockets still using CatOS and Hybrid mode
- There are roughly twenty 65xx devices in the DCsite1 LAN, none of which need to be preserved on a going forward basis.

APPLICATIONS

- SmartCompany's primary applications are SAP, Financial, Manufacturing, Clinical and Product Data Management (PDM). PDM is SmartCompany's most bandwidth intensive application.

BANDWIDTH REQUIREMENTS

- Core Sites / Data Center sites bandwidths
  - There are two 155 Mbps links into the DCsite1 data center.
- Remote Sites:
  - Varies significantly by remote site population and function.
  - Remote site bandwidths vary from 128K (very few, mostly small warehouses) to 100M (Japan remote sites), based on cost, availability and complaints.
  - Typically the bandwidth is between a single T1/E1 and multiple T1s/E1s
  - SmartCompany's goal is to keep medium term bandwidth utilization below ~75%

Operating Systems

- Linux: 1%
- Unix other than Linux: 26%
- Windows: 73%

Servers and Server Virtualization

- There are approximately 1,200 servers in the DCsite1 data center.
- SmartCompany is committed to increased server virtualization. Power constraints, however, are a major impediment to SmartCompany's ability to increase their use of server virtualization.
- SmartCompany currently uses VMware exclusively for server virtualization and that will likely continue.
- Critical applications must run on physical servers.
- The primary blade server vendor is HP.

Routing Protocols

- SmartCompany uses BGP in the WAN and a combination of EIGRP and OSPF in the LAN.

LAN Bandwidth

- SmartCompany does not currently have any 10 Gbps interfaces into its servers.
- The existing server interfaces typically run at either 100 Mbps or 1 Gbps.

Network Management

- SmartCompany's primary network management solution is the CiscoWorks suite.

Further detail on the DCsite1 data center is shown in the following table.

Physical server Number and O/S	Packaging	Virtualized?	SAN?	LAN
75 Unix	Rack mount	no	FC	Single GbE
165 Unix	Rack mount	no	FC	Dual homed GbE
60 Unix	Rack mount	yes	FC	Dual homed EtherChannel 2 GbE per channel
300 Windows	HP Blade Server	no	FC	Dual homed GbE
75 Windows	HP Blade Server	yes	FC	Dual homed EtherChannel 4 GbE per channel
275 Windows	Rack Mount	no	FC	Dual homed GbE
150 Windows	Rack Mount	yes,	FC	Dual homed EtherChannel 4 GbE per channel

Note: all servers have access to NAS. There are on average 4 VMs per vserver

4.0 CURRENT CONSTRAINTS AND REQUIREMENTS

Below is a list of some of SmartCompany's concerns and requirements relative to its current and future network design:

- The transport of storage data to backup systems is constrained by the current data center and storage infrastructure data links and backup devices.
- SmartCompany has significant concerns about its ability to accomplish incremental backups within the week. It is also difficult to do a full backup on the weekends.
- SmartCompany has significant concerns about its ability to do a major restore in a timely fashion
- SmartCompany wants no growth in its IT resources (e.g., people and budget) or at worse, the growth in IT resources should be lower than the overall growth of the company.
- SmartCompany's IT organization is receptive to the adoption of 10G ports if their implementation can be shown to constrain the equipment sprawl in the data center as well as to minimize the growth in power required and the growth in maintenance costs.
- SmartCompany wants to be able to better accommodate VM snapshots and VMotion requirements both within its data centers as well as between its data centers that are connected by a MAN.
- SmartCompany is receptive to the consolidation of similar equipment (i.e.: network switches and storage switches) within its data center.
- SmartCompany's storage requirements have been growing at the following rates:
    - 43%/year for primary storage
    - 30% per year for backup storage
    - 12% per year for archive storage
- SmartCompany is interested in virtualizing the desktops of the majority of its 25,000 employees.
- In part because SmartCompany is in the healthcare industry, it is subject to myriad security regulations. SmartCompany is also subject to PCI compliance. As such, SmartCompany needs a network infrastructure that provides robust security.
- As part of the SmartCompany data center vision, SmartCompany would like to reduce the complexity of its data center LAN.
- SmartCompany needs to support a large and growing amount of real time IP traffic, including voice, traditional video and telepresence.

5.0 SmartCompany Scenarios – A High Level Description

This RFI requests the respondents to respond to four scenarios. One of these scenarios, referred to in this document as The Greenfield Design Option, requires a complete design. As the name implies, The Greenfield Design Option is for a greenfield data center LAN to replace the existing data center LAN. None of the other three scenarios requires a complete design.

Scenario #1a: The Greenfield Design Option

One possibility is that SmartCompany would implement a greenfield data center. If SmartCompany did this, the data center needs to be in production on July 1, 2011. In the next section of this RFI, the respondents are asked to design a data center LAN for this new data center based on the basic parameters of the current data center, the constraints and requirements described in the preceding section, as well as SmartCompany's data center vision. They are also asked to respond to a set of specific questions about their proposed design.

Scenario #1b: The Evolution of the Greenfield Design Option

The respondents will also be asked to indicate how the data center LAN that they are recommending that SmartCompany implement in July 2011 would likely evolve by July 1, 2013. For each step of that evolution, they will be asked to describe how that step helps SmartCompany to meet the constraints and requirements described in the preceding section, as well as SmartCompany's data center vision.

Scenario #2a: The Migration Option

The respondents are given the option of suggesting a data center LAN to be in production by July 1, 2011 that is based on an evolution of SmartCompany's existing data center LAN toward what the respondent designed for the greenfield option. For each change that the respondent makes to the existing LAN, they will be asked to describe how that change helps SmartCompany meet the constraints and requirements described in the preceding section as well as SmartCompany's data center vision.

Respondents should submit a response to scenario #2a only if they feel that the evolution of SmartCompany's existing data center networks is a viable approach to reaching SmartCompany's data center vision.

Scenario #2b: The Evolution of the Migration Option

If the respondent responds to scenario #2a, they will be asked to describe how the data center LAN that they recommended for July 1, 2011 will likely continue to evolve by July 1, 2013. For each step of that evolution, they will be asked to describe how that step helps SmartCompany to meet the requirements described in the preceding section as well as SmartCompany's data center vision.

6.0 FORMAT OF THE RFI RESPONSES

The vendors are requested to format their answers as outlined in this section. In particular, the response should first address The Greenfield Option (for both July 1, 2011 and July 1, 2013) and then The Migration Option - for both July 1, 2011 and July 1, 2013.

SCENARIO #1A: THE GREENFIELD OPTION – CIRCA JULY 1, 2011

The respondent is asked to provide a description of the proposed LAN's logical and physical topology. Include in that description an identification of the key architectural and design characteristics of your proposed Greenfield Option design circa 2011. In addition, identify how these characteristics help SmartCompany to realize its data center vision and to respond to the current constraints and requirements that were previously identified. For example:

- How does the design enable the instant-on, real-time delivery of network services?
- How does the design address the virtualization of servers?
- What security functionality is embedded in the network vs. being provided by an external device?
- How does the design enable SmartCompany to better perform backups?
- How does the design reduce complexity?

The vendors are also asked to provide specific responses to the questions listed below. Any boilerplate material should be contained in an appendix. If lengthy boilerplate material is provided as an answer to a specific question, the determination will be made that the vendor did not answer the question.

SCENARIO #1A: QUESTIONS

The answers to the questions should not be longer than 1-2 paragraphs in length.

OVERALL DESIGN

- Identify the major assumptions that you make as part of creating this design.
- In your network design, what is the rationale for the number of switching tiers? Which technologies and standards are in each tier?
- Does the design support full utilization active/active of all network links and if yes, what technologies or standards are used?
- Does the design support lossless Ethernet and if so, what technologies or protocols are used to provide lossless Ethernet? What is the role of layer 2/3 QoS marking for signaling traffic prioritization?
- How does the design implement high availability and load balancing features across redundant paths?
- Does your proposed design include overprovisioning of any links, blades, or switches? If yes, what is the maximum oversubscription defined by an overall ratio such as 4:1, as well as the number of inbound links by type to outbound capacity, such as 4 10Gb ports outbound for 48 1Gb port inbound. If the proposed design is considered lossless, how does oversubscription come into play?
- How does the design support the dynamic creation and movement of virtual machines?
- What role, if any, do the location protocols play in the design? What location protocols are supported?
- How is Fiber Channel supported in the overall design?

TECHNICAL AND PRODUCT QUESTIONS

- How are MAC table sizes handled per switch tier? Are MAC tables shared/replicated between nodes as a logical switch or are MAC tables specific to each switch/router node?
- How many network operating systems, or versions, are in your proposed design?
- What is the maximum number of VLANs that the proposed design can support?
- What are the recommended physical interface cabling between servers and switches and between switches/routers?
- Describe the per port/per switch buffer capacity and how it is used to manage congestion in the network. How does the buffer usage support lossless Ethernet (if lossless Ethernet is supported in the design)?
- Is link aggregation supported server-to-switch and switch-to-switch? What is the maximum capacity of an aggregated link? What protocol or technology is used?
- Describe the integration points for the switched/routed network and hypervisor management system and network management systems.
- What integration points (API, SDK, and services) are exposed for external systems to integrate with the

switching/routing infrastructure?

Achieving Design Goals

- Under 75% load conditions, what is the estimated end-to-end delay and jitter (network ingress to network egress) in your proposed design? How does the design support that claim?
- What is the backbone capacity of the network? How does the design support that claim? What is the migration path from 1 Gb to 10Gb to 40 or 100Gb?
- What is the maximum port count and port density at the edge of the network? What is the maximum port count and type for inter-switch (core) traffic?

Storage Networking Support

Describe the design's support for networked storage via Fibre Channel, FCoE, iSCSI, and/or NAS. Where the design supports network convergence via FCoE or iSCSI, describe the technologies employed to minimize latency and packet loss (e .g., cut through L2 switching, lossless Ethernet, Data Center Bridging, etc.). Indicate which switching tiers and switch models used in the design support these technologies. Also describe whether any converged network adapters used in the design offload protocol processing from the physical and virtual hosts. If FCoE is supported, is multi-hop FCoE support available? If not, when?

Blade Server Integration

Is the proposed LAN design compatible with blade server packaging of physical servers? If so, how can blade server switches and fabric extenders be accommodated within the design described above? For which vendor server chassis do you have blade switches?

Green Design

Relative to your proposed design, what is the typical and maximum power consumed by the switch (in Watts):

- For each 1 Gpbs port
- For each 10 Gbps port

What functionality is there in your proposed design to minimize power consumption?

Hypervisor Switching Support

Describe the design for switching traffic among Virtual Machines (VMs) on the same physical server. How does this design provide visibility and control of this intra-VM traffic? What is the best eventual location for virtual switching at the edge of the SmartCompany data center LAN: The hypervisor virtual switch, the distributed virtual switch, the SR-I/OV adapter, or the edge virtual bridge (EVB)?

Impact on the IT Organization

How will your proposed design impact SmartCompany's network, storage and server teams? In particular, does the design change the headcount required? Does the design require new skill sets? ? If so, what changes are required and why?

InfiniBand Support

Under what circumstances do you recommend InfiniBand as a specialized cluster interconnect to be deployed as an additional switching fabric for the data center? When will Ethernet be able to offer a low-latency cluster

interconnect that is fully competitive with InfiniBand?

Provisioning Automation

A fully dynamic data center requires an integrated and automated approach to managing the configuration of server, storage and network resources. Describe the recommended approach and the necessary/recommended tools for achieving this with the proposed design.

As part of your answer, describe how the proposed design facilitates VM migration among physical servers. Can a port profile (including QoS, ACLs, and firewall settings) be attached to a VM so that network switches can be automatically reconfigured to support VM migration within the data center? What technologies are supported that facilitate VM migration among geographically dispersed data centers?

Network Management

Describe the proposed network management tools and systems. What integration point are available and what network management systems have been integrated? What new management challenges are created by the network design you propose and what additional tools or changes in tools are recommended for managing the proposed network design?

Scenario #1b: The Evolution of the Greenfield Option

Indicate how the data center LAN that you recommended in response to scenario #1a would likely evolve by July 1, 2013. As part of your response, indicate:

1. How are the legacy infrastructure components (e.g., switches and routers) supported as the design that you submitted in response to option #1a evolves? Alternatively, if they are eliminated, when are they eliminated and why?

2. Each change that you suggesting be made to the design you submitted to scenario #1a as well as the timeframe for that change.

3. How that change helps SmartCompany to meet the constraints and requirements described in the preceding section, as well as SmartCompany's data center vision. For example, your July 1, 2011 greenfield design may not include functionality such as standards-based lossless Ethernet. However, given the likely evolution of those standards, your July 1, 2013 design may evolve to include this functionality. If that is the case, in your response you should indicate why you are including lossless Ethernet; e.g., which constraint or requirement does it address? How does it better enable SmartCompany to achieve it data center vision?

4. How each change impacts SmartCompany's network, storage and server teams. In particular, does the change the headcount required? Does the design require new skill sets? If so, what changes are required and why?

In addition, the respondent is referred to the sub-section of this RFI that is entitled Scenario #1a: Questions. The respondent is requested to answer as many of these questions as make sense and to do so in the order that they are listed in that sub-section. For example, one of the first questions in that sub-section is: "In your network design, what is the rationale for the number of switching tiers? Which technologies and standards are in each tier?" If as part of your response to this scenario you have changed the number of tiers, or added any new

technologies or standards into the existing tier, you are asked to respond accordingly to the question.

SCENARIO #2A: THE MIGRATION OPTION

The respondents are given the option of recommending a data center LAN design to be in production by July 1, 2011 that is based on an evolution of SmartCompany's existing data center LAN toward the LAN design that the respondent suggested in response to scenario #1a. If the respondent decides to not provide a response to scenario #2a, they are requested to state why that is the case. For example, does the respondent believe that it would be riskier or more costly to evolve the existing data center than it would be to create a new data center and cut over to it?

As part of your response, indicate:

1. How are the legacy infrastructure components (e.g., switches and routers) supported in this design? Alternatively, if they are eliminated, why are they eliminated?

2. Each change that you made to the current SmartCompany data center LAN

3. How that change helps SmartCompany to meet the constraints and requirements described in the preceding section, as well as SmartCompany's data center vision. For example, your July 1, 2011 greenfield design may not include functionality such as standards-based lossless Ethernet. However, given the likely evolution of those standards, your July 1, 2013 design may evolve to include this functionality. If that is the case, in your response you should indicate why you are including lossless Ethernet; e.g., which constraint or requirement does it address? How does it better enable SmartCompany to achieve it data center vision?

4. How each change impacts SmartCompany's network, storage and server teams? In particular, does the change the headcount required? Does the design require new skill sets? If so, what changes are required and why?

In addition, the respondent is referred to the sub-section of this RFI that is Scenario #1a: Questions. The respondent is requested to answer as many of these questions as make sense and to do so in the order that they are listed in that sub-section. For example, one of the first questions in that sub-section is: "In your network design, what is the rationale for the number of switching tiers? Which technologies and standards are in each tier?" If in your response to this scenario you have changed the number of tiers, or added any new technologies or standards into the existing tier, you are asked to respond accordingly to the question.

SCENARIO #2B: THE EVOLUTION OF THE MIGRATION OPTION

If you provided a design in response to scenario #2a, describe how that design will likely continue to evolve by July 1, 2013. As part of your response, indicate:

1. How are the legacy infrastructure components (e.g., switches and routers) supported as the design that you submitted in response to option #1a evolves? Alternatively, if they are eliminated, when are they eliminated and why?

2. Each change that you made to the data center LAN that you proposed in response to scenaro #2a.

3. How that change helps SmartCompany to meet the constraints and requirements described in the preceding section, as well as SmartCompany's data center vision. For example, your July 1, 2011 greenfield design may not include functionality such as standards-based lossless Ethernet. However, given the likely evolution of those standards, your July 1, 2013 design may evolve to include this functionality. If that is the case, in your response you should indicate why you are including lossless Ethernet; e.g., which constraint or requirement does it address? How does it better enable SmartCompany to achieve it data center vision?

4. How will your proposed design impact SmartCompany's network, storage and server teams? In particular, does the design change the headcount required? Does the design require new skill sets?

In addition, the respondent is referred to the sub-section of this RFI that is entitled scenario #1a: Questions. The respondent is requested to answer as many of these questions as make sense and to do so in the order that they are listed in that sub-section. For example, one of the first questions in that sub-section is: "In your network design, what is the rationale for the number of switching tiers? Which technologies and standards are in each tier?" If in response to this scenario, you have changed the number of tiers, or added any new technologies or standards into the existing tier, you are asked to respond accordingly to the question.

COMPARISON: GREENFIELD VS. MIGRATION

What are the pros can cons of the your proposed response to scenario #1a (The Greenfield Option) vs. your response to scenario #2a (The Migration Option).

DYNAMIC DATA CENTER DESIGN CRITERIA

Other than evolving its data center LAN along the lines outlined in this RFI, what other steps should SmartCompany consider relative to achieving its vision of a dynamic data center computing infrastructure?

SUPPORT OFFERINGS

Please summarize your support offerings (do not cut and paste the support offerings and contracts here. If you want to add them, please attach as an appendix). Be sure to highlight tiered offerings, contact hours, equipment replacement times, and escalation times.

PARTNERSHIPS

Describe the relevant partnerships in the areas listed below. State how long they have been in place, any goals or milestones that have been achieved, and the future roadmaps. These can be partnership programs that your vendor hosts or partnership programs that you participate in (specify which). These are not industry standards groups like IETF or IEEE.

- Data center orchestration
- Network management
- Virtualization product integration

- Storage area networking
- Security, risk management, governance
- NICs

ROADMAPS

Please describe roadmap features that are expected to be completed in your products in the next 24 months. Give specific details, not vague promises. For example, what are your plans for multi-path bridging? What are your plans for supporting 40 and 100Gb? What are your plans for providing better support for lossless Ethernet? What are your plans for better supporting virtualized computing? What new technologies do you see on the horizon and what are the benefits? This is your chance to talk about roadmap items and your company's vision of data center networking *in detail*

PRICING

For any and all equipment that are part of any design that you suggest in response to this RFI, provide **LIST** pricing for 1 each of the components used in the RFI design. We are NOT looking for a grand total. Please include all purchasable components and recommended upgrades. Also, include software licenses and software license upgrades. Please use the table below as a format. You can provide this in the Word document or as a separate spreadsheet.

- The Primary component column defines what the product is (router, switch, chassis, etc).
- The Sub-Component column defines the sub-component (router blade, switch blade, license).
- The Product Name column defines the Product Name (what you call it).
- The Model or Part Number is the specific model or part number. This will help readers differentiate components.

The list price is the list price for the component.

If the equipment has sub components, please nest them under primary component. For example, the first entry "Router" has no sub components so the "Sub Component" field is left blank. The second entry "Chassis Switch" does have sub-components, so define each sub component. *Only list components or subcomponents that have a price attached to them.* For example, if the component includes two power supplies as part of the list price, don't list the second power supply.

Primary Component	**Sub Component**	**Product Name**	**Model or part number**	**Price**
Router		Super router	SR-1000	5,000
Chassis Switch	Chassis	Super Chassis	CS-5834	5,000
	10Gb Uplink	Dual Port 10Gb mezzanine	10Gb-UL	500
	Advanced Switch License	Advanced Switch Software	ASS-1000	4,500
Top of Rack Switch		Super ToR	ToR-4500	1,000