



**Industrial Automation & Control Practice**

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# Industrial Networking



## ABSTRACT

Network capability is a key performance indicator (KPI) for a rapidly growing number of industrial, transportation and infrastructure operations. This is true for every region of the world, every scale of facility in these markets. Network switches are installed to support network integration and network management across enterprise and real-time control environments, and across ecosystem partner networks. In these functional roles, network switches represent extraordinarily important investment decisions.

The industrial market definition includes the full range of discrete factor and process plant environments such as: automotive parts and assembly, bulk and specialty chemicals, electronic components and assembly, food and beverage, and others. The transportation market definition includes a number of applications within the four walls of a number of infrastructure facilities, including: mass transit stations, air transport/baggage handling facilities, rail and other ground transportation depots. Infrastructure included a number of water/wastewater management plants, electric power generation/transmission and distribution and renewable production/management facilities.

Respondents represent a mix of operations and information technology executives. Their operations cover the United States, Europe and key Asian markets.

### What Drives Investment in Network Switch Solutions in Industrial, Transportation & Infrastructure Markets?

During the past five years, VDC Research has tracked a number of significant changes in investment drivers and patterns for industrial, transportation and other infrastructure operations. Chief among these changes was a renewed focus on real-time access to real-time information across departments, facilities and enterprises. This focus was acute with respect to *existing* sources of information.

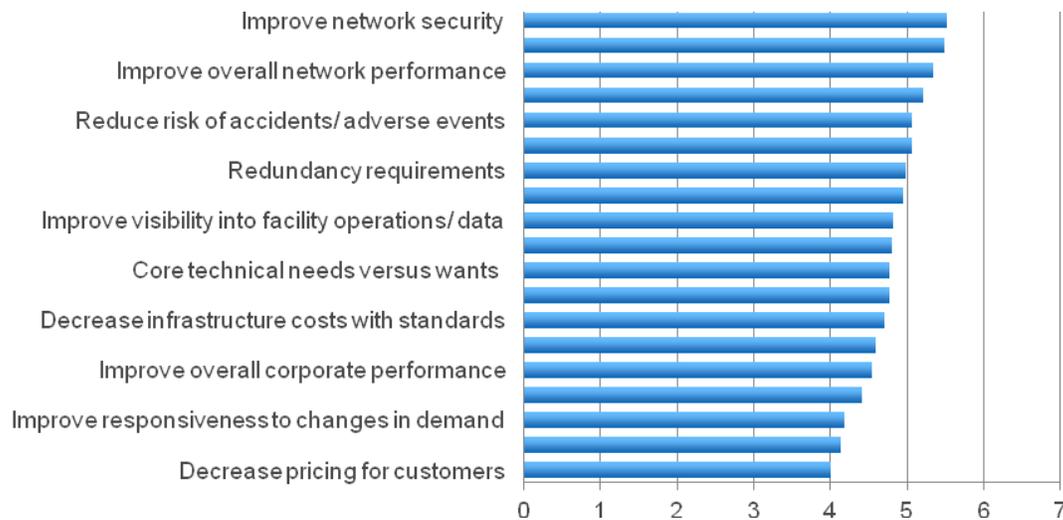
Decision makers were not telling us that they lacked information. They were telling us that they – and their partners – lacked access to critical information.

They were also telling us that they had finite budgets that were under increasing scrutiny. Large scale projects – including and especially tear-downs and '*pallet or forklift*' upgrades – were not likely to be funded. Projects that created new data streams were suspect as well. For sure, smaller budget, shorter schedule projects were more attractive.

These conditions largely persist today. So, in this environment, decision makers turn to network switching solutions as the response to their requirements. But what *specifically* are they trying to achieve with these investments?

## Primary Drivers for Investment in Network Switching for Industrial & Transportation Infrastructure Facilities

(Average Importance Rating. Most Important = 7)



Decision makers are trying to address a number of goals with their network switch solution investments, but the following appear paramount:

1. Improving overall network performance KPI.
2. Particular emphasis on network security and reliability.
3. Reducing complexity and cost of maintaining higher performing network environments.

Interwoven with these top rated network performance goals was an overall operational efficiency goal. This is not surprising. Rare is the approved investment that does not enable cost reductions, quality enhancements or productivity metrics.

But what might be telling of the mindset of decision makers is the fifth highest rated investment driver: reducing risk of accidents and adverse events. This can be interpreted to mean work safety, equipment safety, or digital/cyber/network security.

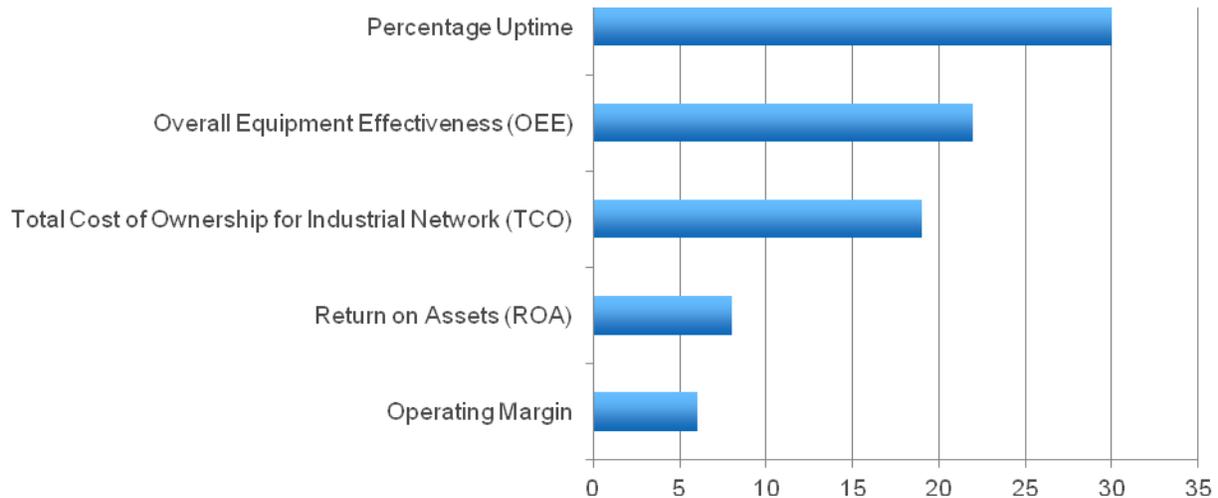
The primary themes driving investment in network switch solutions in industrial, transportation and other infrastructure environments revolve around a larger concept of secure networks. We can use other terms, and should, for the market does, including: reliable, resilient, and available.

Secure networks keep employees, partners, customers, equipment, companies, and ecosystems, safe.

And you can be sure that network switch solution decision makers and their teams are measuring the effectiveness of their investments.

## Key Metrics for Measuring Network Switching Solution Impact for Industrial & Transportation Infrastructure Facilities

(Percent of Survey Respondents Citing, N>100)



This list of metrics is powerful for two key reasons:

1. It accurately reveals the priorities of the people on the teams making the decisions. Remember, those teams are made up of Information Technology (IT), Operations (Ops) and Finance executives. Within that context, it is no surprise that we see overall equipment effectiveness (an ops metric) or ROA (a finance metric).
2. In a sign of an ever more sophisticated market, the metrics are dominated by network performance (percentage uptime) but also include traditionally harder to quantify TCO.

Success in these markets requires solutions to support layers of goals including technical, operational and financial. That support will likely go far beyond the performance specifications of the qualified equipment.

### The Path to Returns: What Applications Are Being Deployed?

For solution deployers and technology providers, the intersection between investment in network switch solutions and realizing these metrics is in applications. A number of factors shape deployers application targeting and sequencing, including:

1. Application maturity – How stable is the application and what is the risk of changing its deployment, access or management status?
2. Application complexity – How challenging will integration be and at what financial cost? Operational risk?
3. Application ROI potential – What impacts on key performance indicators (KPI) will a change to that application represent?

VDC Research believes that decision makers remain conservative with their network switching solution application rollouts and that this position is evidenced in the data below.

### Current Installation Status of Primary Applications Deployed On/Enabled by Network Switch Solutions for Industrial & Transportation Infrastructure Facilities (Percent of Survey Respondents Citing, N>100)

	Installed	Upgrading	Evaluating	Not Applicable
Data/ DAQ	62%	7%	12%	19%
Process Control	49%	10%	17%	24%
HMI	51%	9%	14%	26%
VoIP	32%	3%	23%	42%
Video	35%	5%	23%	37%
Logic Control	38%	10%	20%	32%
Motion Control	15%	5%	18%	62%

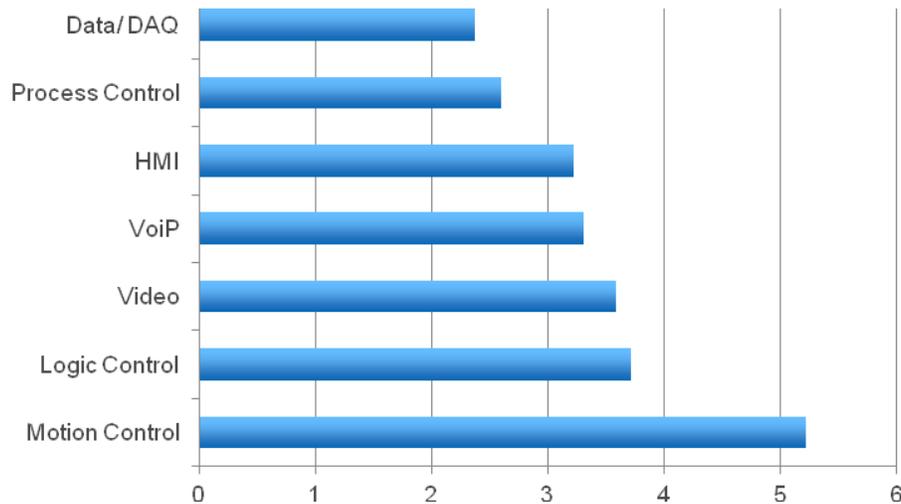
Supervisory monitoring and control layers, or low-latency/data rate applications appear to be the vanguard of network switch solution investment target. This would make sense, for upon brief consideration, they are likely to offer the most attractive positions with respect to the three core questions above.

On the other end of the spectrum is the most complex, mission critical, and high risk application cluster: motion control (including multi-axis). It is joined by VoIP which continues to carry the perception that it is materially unreliable in harsh environments. The facts would bear out that the former is being explored more often than most perceive, and suppliers of the latter have some market re-education to support.

Regardless, it is the comfort level of the deployers with their analyses that drives application deployment sequencing.

## Sequence of Applications Deployed on/ Enabled By Network Switching Solutions for Industrial & Transportation Infrastructure Facilities

(Average Position of Rollout, 1=First)



Of course, careful consideration of this issue would lead the reader to the point that the availability of technical solutions and market-expert support would be key inputs to customer comfort.

Looking at this chart, they are going to need network switch solution providers with:

1. Clear leadership in supervisory monitoring and control platforms.
2. Significant expertise and experience in real-time control environments.

And, perhaps, in some cases, capabilities in multimedia environments which is an interesting point. First, let's take HMI and VoIP out. Then let's consider the applications that are remaining.

Now looking at the chart above, it is a fairly straight forward progression of applications, from higher level and less-mission critical (relatively) with Data acquisition/ DAQ and process control typically among the first solutions to be '*connected*'. Then HMI and logic control are fairly closely paired at approximately 3.2 and 3.7 respectively. Finally, motion control with all of its real and perceived limitations to ROI through a network. That all reads fairly straight forward based on our experience with these systems. As real-time requirements go up, market perception of the requirements to achieve ROI with these applications goes up.

But what about presence of VoIP and video in this list? Well, there are a number of factors to explain that:

1. The mix of respondents to this survey include(d) operations, finance and IT professionals. And these professionals, especially, IT and finance, are bringing their experiences with enterprise networks into the evaluation of requirements and opportunities in industrial, transportation and other infrastructure facilities automation environments.
2. As they, and some of their enterprise IT vendors, look to accelerate the merger of enterprise and automation networks, preferences and practices from one, bleed into the other. VoIP and video are two such examples.
3. In some leading industrial, transportation and other infrastructure operations, VoIP and Video offer promising ROI.
  - a. With VoIP, process control and factory automation managers are finding a productivity and cost management tool that is allowing their teams to have real-time wireless voice throughout facilities without having to burn cellular plan minutes, or expose potentially sensitive information to the larger wireless public networks.
  - b. With Video, the same managers are exploring another quality control and assurance tool for a number of applications.

To be sure, VoIP and Video are not core applications, yet, but, neither are they fringe.

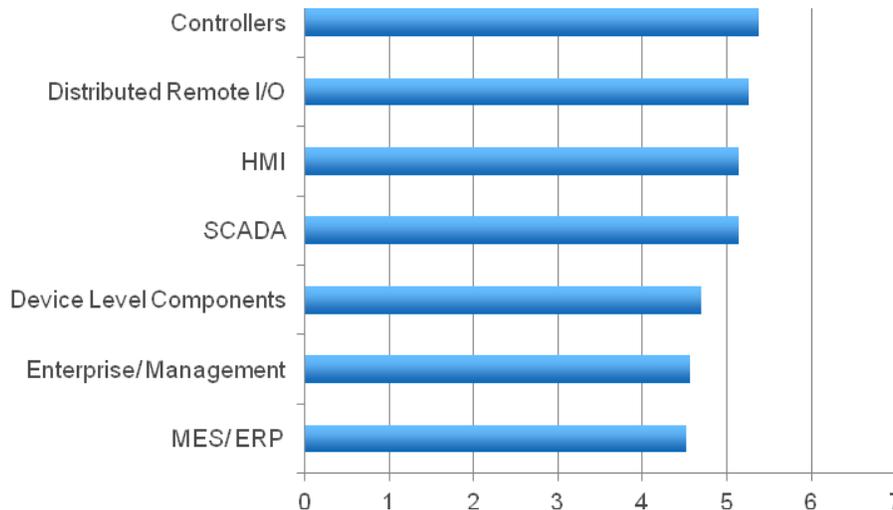
These needs are further evidenced and detailed in how deployers define the scope and priorities of their network switch solution projects.

### Where Are Network Switch Solutions Being Deployed and How?

Network switch solution deployment in industrial, transportation and other infrastructure environments is clearly centered on building connections with supervisory monitoring and control platforms.

### Importance of Connecting Various Nodes to Network Switching Solutions for Industrial & Transportation Infrastructure Facilities

*(Average Importance Rating. Most Important = 7)*

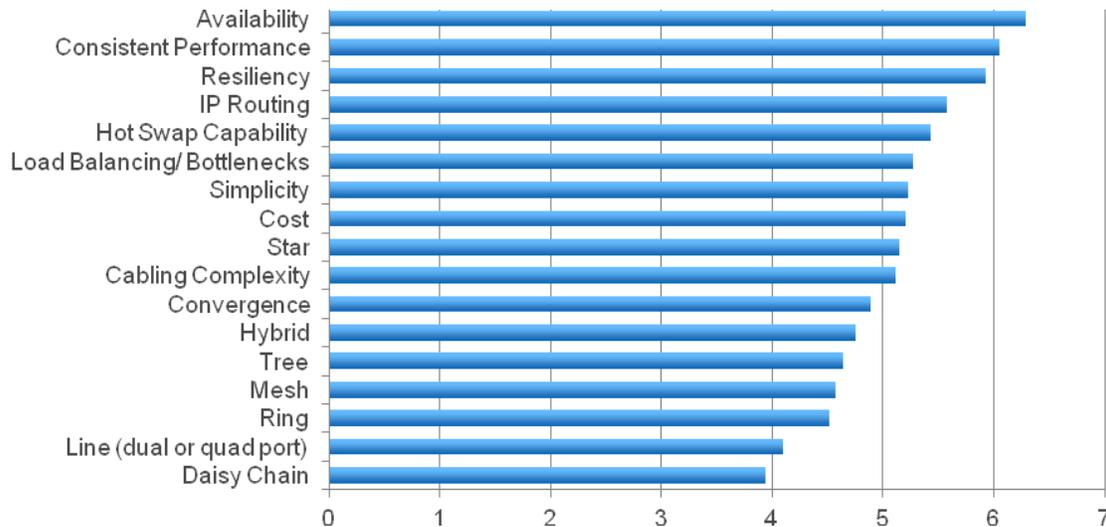


However, as the application mapping above stated, these charts reveal, connections are progressing through multiple additional layers of the OSI 7-layer model. Controllers – typically process or sequential logic – RDIO, and SCADA solutions evidence this. Moreover, the high rating of priority places on network switch solution providers illuminates the requirement for solution providers to be expert in real time systems.

This expertise requirement influences network design criteria for these connections.

## Importance of Various Network Design Criteria When Specifying Network Switching Solutions for Industrial & Transportation Infrastructure Facilities

(Average Importance Rating. Most Important = 7)



The highly fragmented protocol and heavily customized environments that dominates industrial, transportation and infrastructure automation environments drives make attaining high levels of availability consistent performance and resilience paramount network design criteria.

In other words: A core requirement of the network switch solution and solution provider is to account for, forgive and remediate the myriad installed bases of connections that they need to support.

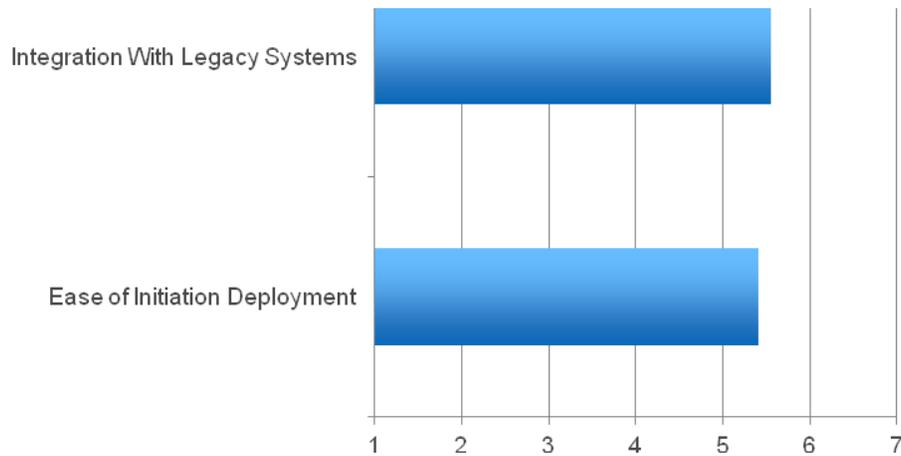
But it is important also to elevate and the approximately equal importance placed on some often at-odds requirements, including in the chart above:

1. Load balancing/ bottleneck mitigation and simplicity
2. Hot swap capabilities and cost

And the *'apparent'* contradictions in requirements do not end there.

## Importance of Critical Integration Requirements for Network Switching Solutions for Industrial & Transportation Infrastructure Facilities

(Average Importance Rating. Most Important = 7)



It used to be that deployers were faced with a choice: quick and easy implementation, or an installation that leveraged the installed base. As the chart above implies, deployers place the same level of importance to both integration requirements.

For suppliers of network switch solutions, meeting these 'dual-mode' challenges (where the choices of the past decade become the parallel requirements of the current market) begins, but does not end with, their approach to architecting their switches. The most successful suppliers also offer world-class training and implementation support directly, or through partners.

In other words, the most successful network switch solution providers to industrial, transportation and infrastructure automation markets will be providing whole product solutions, not just boxes.

## What Are Deployers Looking For In Their Network Switches?

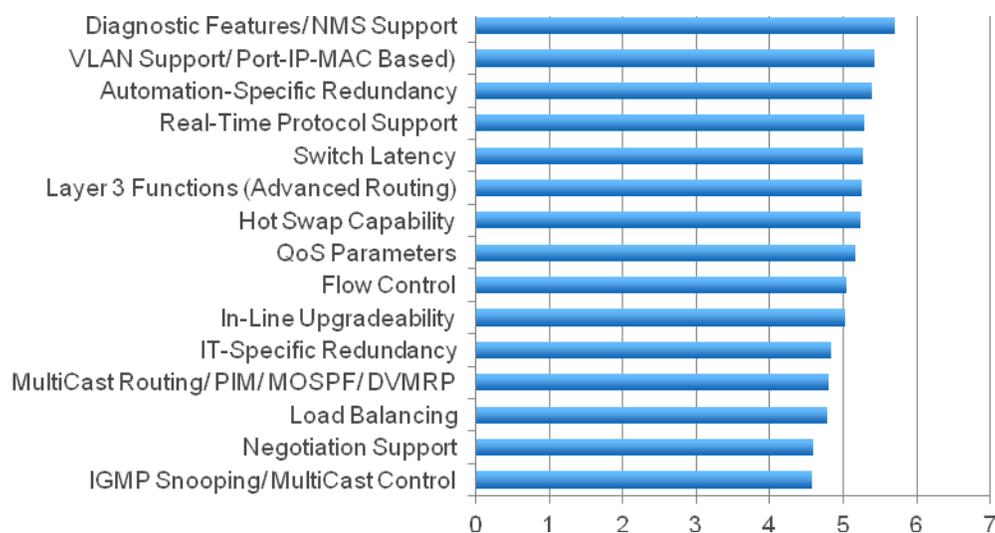
As we might expect, there are a few fundamental requirements cited consistently, and myriad combinations of ‘second order’ features, functions, specifications and performance capabilities. This topic is addressed in three parts. Each part has its own chart.

First, they are looking for Network Management Solutions (NMS) capabilities in real-time environments

Remember, demand for network switch solutions in industrial, transportation and infrastructure environments is driven at the highest levels by the need for a broad range of users to be identified, authenticated and provisioned so that they can gain access to sensitive, real-time information ... in real time. These solutions are largely about bridging disparate, legacy, and in some cases proprietary protocol real-time environments with more homogenous, standards-based enterprise data, voice and media intranets and extranets.

### Importance of Various Technical Capabilities & Features Sets for Network Switching Solutions for Industrial & Transportation Infrastructure Facilities

(Average Importance Rating. Most Important = 7)



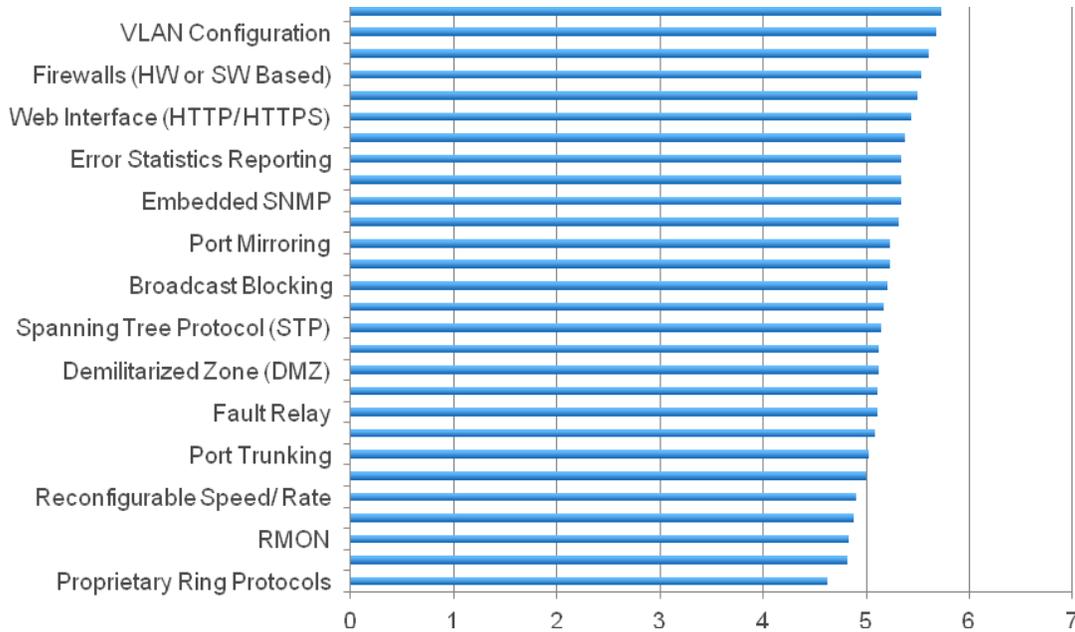
But the core requirements are largely rooted in real time environment experience and capabilities:

1. Automation specific redundancy
2. Real-time protocol support
3. Switch latency

These keys will become more critical going forward, as deployers start rolling out applications that are deeper in the OSI stack, closer to real time, connected to individual sense, control and actuate devices.

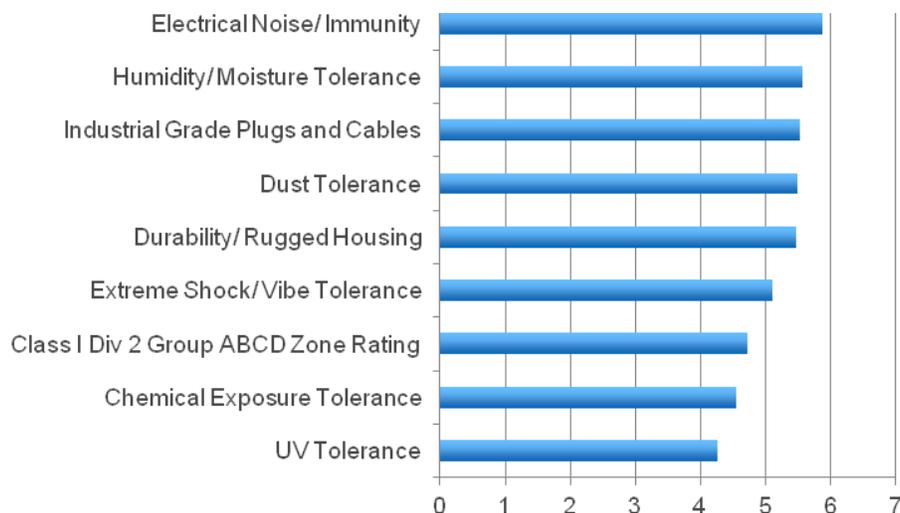
Second, within the larger context of NMS capabilities, security and flexibility dominate. That makes sense, as these core elements of a resilient deployment.

### Importance of Various Network Switch Management Functions in Network Switching Solutions for Industrial & Transportation Infrastructure Facilities (Average Importance Rating. Most Important = 7)



The third domain of network switch solution requirements that survey respondents shared with us was related to the physical configuration of the devices. Specifically, the requirements they experienced or perceive in upgrading commercial grade (CG) switch solution in order for them to operate in industrial, transportation and infrastructure control environments.

### Importance of Various Features When Adapting Commercial Grade (CG) Network Switching Solutions for Industrial & Transportation Infrastructure Facilities (Average Importance Rating. Most Important = 7)



Discussion of commercial switch hardening is an important topic, for it helps to frame a few important trends in technology investing in industrial and infrastructure markets. It also helps to highlight some potential challenges for deployers. The truth is commercial grade switches can be less expensive to purchase. They might deliver a number of required features in facilities with consistently controlled environments.

However, they could also prove more expensive, perhaps much more expensive, than industrial grade switches after the customized hardening is completed. Or after the custom protocol translations and integrations are complete. Or when they are deployed in applications that have less consistent control of environmental factors.

Commercial grade switches offer one key benefit that is often challenging for buyers to resist: Lower cost of acquisition. However, in many instances, their associated Total Cost of Ownership – starting with their customization costs and continuing through their ongoing maintenance and upkeep – can erase early ‘gains’ in lower initial transfer pricing.

### **Lest We Forget, the Commercial Requirements and Barriers Form a Powerful Context**

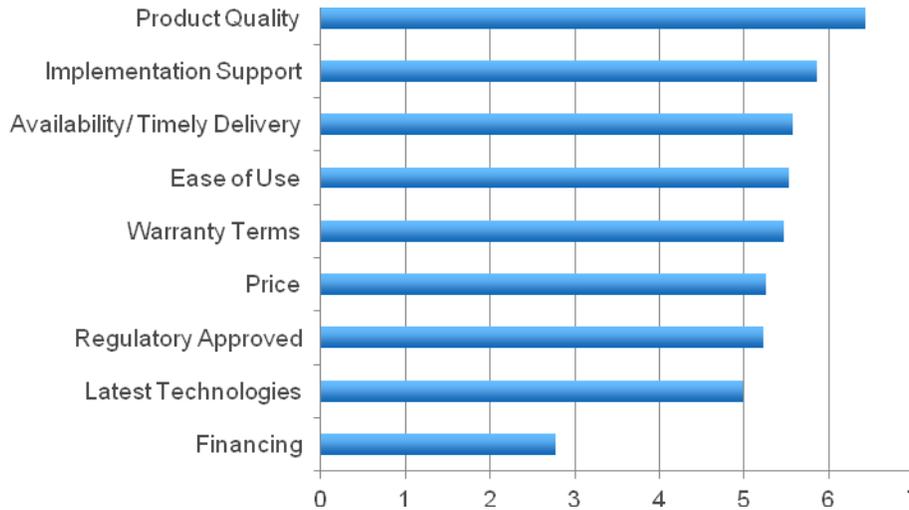
Throughout this white paper, we have shared evidence of the complex technical requirements of the industrial, transportation and infrastructure markets for network switch solutions. And much of that evidence highlighted or reinforced the decline of mutual exclusivity in traditional network design, implementation and technical feature trade-offs.

This final topic is no different on a number of levels. First, the most compelling technical offering must still meet a number of critical commercial requirements. Second, those commercial requirements and barriers present conflicts to be resolved among themselves, too.

Decision makers know what is at stake with their implementations. Their options are more expansive today than at any other time in recent history in these markets. They are aware of this, and they are putting creative pressure on suppliers to reduce the number and scope of their trade-offs – technical and commercial.

## Importance of Various Commercial Factors in Selecting Network Switching Solutions for Industrial & Transportation Infrastructure Facilities

(Average Importance Rating. Most Important = 7)



The very definition of leadership in these markets begins with product quality. This applies to deployers, network switch solution providers, and their integration and service partners. Quality is so far ahead of the other commercial factors, it might as well be considered a precompetitive factor. This means it is table stakes, entrance fee to the game, no guarantee of sustainable differentiation even at the highest levels of reported quality.

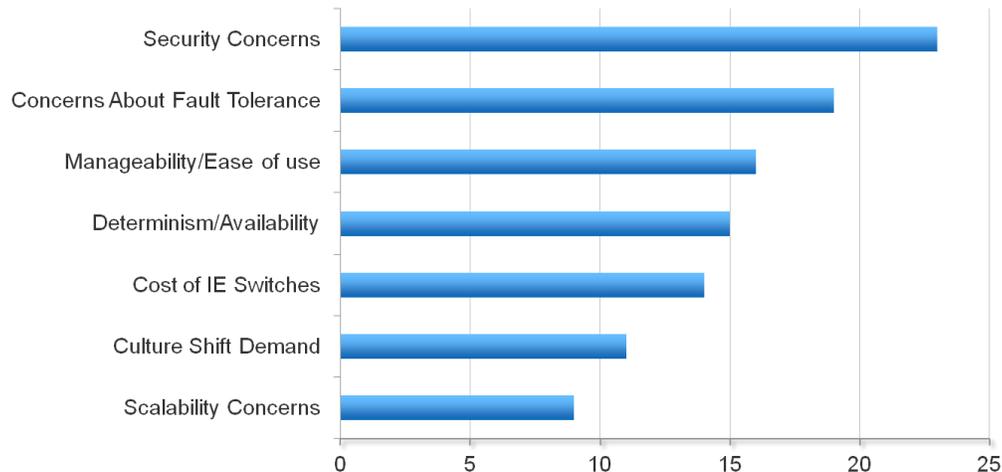
Where differentiators are established, and brands defined, might be a number of criteria that broadly make up implementation support.

That darling of the recession – financing – is a non-starter. As quickly as it emerged and rose to the top of commercial selection criteria toward the end of last decade, it is just as quickly faded. Back to core value propositions beginning with product quality and extending into key elements of customer service and support.

But a supplier could still do all that and deployers still have reservations. What are their most powerful barriers to deploying network switch solutions in industrial, transportation and other infrastructure markets?

## Primary Barriers to Deployment of Network Switching Solutions for Industrial & Transportation Infrastructure Facilities

(Average Importance Rating. Most Important = 7)



And so our view of the current market opportunity, and this white paper, come full circle. Back to:

1. Security – including the attributes associated with a secure network: reliability, resilience, availability
2. Performance – in real-time, mission critical, line of business installation applications
3. Complexity and related to cost to maintain required levels of performance in industrial, transportation and infrastructure operating environments

These markets are looking for comprehensive and superior network management, network performance and measurable operating results.

### Where Can The Market Go for Those Results?

There are myriad approaches to next generation network design, development and deployment in industrial and infrastructure markets. However, there is one company, and particularly, one product line, that we think offer a strong option, and an excellent reference point, for state of the art approaches to delivering the kind of measurable operating results that are in such high demand.

That reference company is [Siemens](#) and the example solution is the [X-500](#) model in its Scalance X series.

During the past 5 years, VDC Research has been conducting a number of new and innovative surveys of automation investment decisions. This work has framed these investment decisions in an number of emerging technical, commercial and financial contexts.

Two of the most important and most powerful have been:

1. The need for operations to identify, define and prosecute the appropriate integration of real-time environments with upstream and downstream partners and customers
2. The opportunity to pursue cloud-based development and deployment approaches.

The X-500 development began with the definition of a number of core value propositions reflecting these core strategic issues for managers in industrial and infrastructure operations. X-500 core value propositions are focused specifically on:

- Improving network reliability through a number of features and capabilities
- Supporting network and operational flexibility and agility
- Elevating ease of maintenance for operations under significant performance pressure
- Providing real-time data analysis to support rapid, accurate decision making requirements
- Decreasing TCO throughout the deployment lifecycle of the X-500

And Siemens, the company behind the Scalance X line and the X-500 is one of the most consistent innovators in the integration of real-time and enterprise network environments. The company consistently invests in and delivers, unique combination of deep domain experience in real-time control, and enterprise and operations management, including its global leadership in PLM.

The importance of these combined capabilities is that they map perfectly with the primary approaches industrial, transportation and infrastructure operations are taking to achieving the next level of performance in their enterprise operations, network management and control environments.



#### ABOUT VDC

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