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WHITE PAPER

IT INFRASTRUCTURE EQUIPMENT STANDARDS

Examining the benefits and detriments of adhering to global equipment standards

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Executive Summary

The demands on modern IT organizations are growing. Initiatives to “go digital” and to create or leverage cloud technologies abound. There is an increasing pressure to be a service provider to internal clients, making it easier for employees and customers to consume a wider range of IT tools on demand and under budget. This burgeoning IT-as-a-Service modality is driving requirements to lower costs, increase agility, enhance the user experience, and reduce risk.

This paper examines a common foundational approach to meeting these growing demands: global infrastructure equipment standards. Deliberately and thoughtfully creating, implementing, and revising such standards over time is one of the best ways to set your IT organization up for immediate and ongoing success.

This is not done without risk, however, and this paper describes both the potential benefits and the possible pitfalls of applying standards to your IT infrastructure. It is intended to provide a thorough basis for IT leadership at any company to evaluate the concept and decide on a best course of action.

Introduction

This paper examines the benefits and detriments of global IT infrastructure equipment standards. This begs the question: what does that even mean?

Taking it one word at a time, we should first point out that global is meant in relation to your enterprise, not necessarily the world. In order for standards to have the highest impact, they must be given the widest reach. Universal, all-inclusive, and comprehensive are synonyms in this case. In some organizations, global may also mean world-wide, but you do not need to be leading a multi-national corporation for global standards to be a potential benefit to you.

IT is also meant in the broadest terms: information technology. To narrow the scope of this paper we also include the term "infrastructure." This is simply to say that we are not talking about end-user devices but rather the core structures that service multiple users. While it is very likely that equipment standards can benefit many areas of your business, this paper is focused on IT infrastructure. This includes switches and routers, servers and storage arrays, cables and PDUs, etc.

Computer scientists and software developers are fond of the saying "garbage in, garbage out." Like anything else, standards are only as good as the process used to develop them. This paper makes one major assumption: that the standards in question were developed deliberately and mindfully, taking into consideration all stakeholder input, all organizational requirements and constraints, and were then tested both technically and procedurally. Standards development is crucial, but outside the scope of this document. Specific standards themselves are also outside our current scope; this paper does not advocate for or against any particular standard, instead it evaluates the use of standards in general.

To better understand what is meant by a global IT infrastructure standard it is helpful to consider the alternatives. A few potential alternatives are listed here:

No standards: When there are no pre-determined IT infrastructure standards at all. Every add, move, or change within the infrastructure requires architectural decisions – "how" must be decided at every step.

Departmental or group standards: When small functional groups decide on standards for themselves without broad consensus or buy in. Many duplicative evaluations and decisions are made and interoperability is not guaranteed.

Business unit or regional standards: When larger functional groups decide on standards for their specific domain with consensus and buy in limited to that domain. Duplicative work and interoperability issues are limited to the defining lines, encouraging fragmentation along those lines.

Global standards: When standards are built and tested considering the entire organization and all stakeholders. The enterprise operates as a single entity from an IT infrastructure perspective.

The following sections will provide a thorough examination of the benefits and potential drawbacks of these global standards, ending with a brief conclusion based on the information uncovered.

Benefits of Global Equipment Standards

Creating infrastructure standards provides the ability to create consistency, predictability, efficiency, and performance reliability that spans both geography and organizational units. The sections below dive into the various ways this can benefit your organization.

Reduce Cost

Cheaper is not always better, especially when it comes to the infrastructure upon which your organization relies. Lowering cost responsibly, however, is a goal of virtually every enterprise in existence. The following sections describe how global equipment standards can be leveraged in the never-ending pursuit of financial efficiency.

CAPEX

Capital expenditures are most often curtailed by employing one of two strategies: buying less or buying for less. Global equipment standards have the potential to provide opportunities for both.

> "The obvious upside is better negotiation leverage through higher volume, which should translate to CAPEX savings."
>
> (Network Architect at a Global Telecommunications Provider)

One natural result of standardizing on a set of pre-approved devices is that more of those devices are purchased. This typically puts the buyer in a stronger negotiating position, which often leads to a lower per-unit cost. In addition to simple price reduction, the increased level of spending and/or commitment frequently leads to additional concessions from the manufacturer. These concessions may include things such as additional training, reduced-cost or enhanced support, custom solutions or features, and other uncommon benefits. The size of each purchase and the overall commitment will determine the amplitude and frequency of these offers, but it never hurts to ask.

Perhaps a less obvious but perhaps even more common effect of implementing infrastructure equipment standards is the ability to buy less. When each functional role is filled by one or two standard devices, fewer spare devices are needed overall. Common sparing leverages economies of scale to be much more efficient than the 1:1 or 2:1 redundancy required when no equipment standards are present.

OPEX

Operational expenditures are often centered around staffing costs and those can often be boiled down to the time required to complete necessary tasks. The more time things take, the more staff is required, which leads to higher spending.

Global equipment standards can help eliminate these rising costs primarily through operational simplicity. Just as simplifying operations reduces risk, it also reduces time. Faster installs and faster troubleshooting, as covered above, force multiply here by requiring less staff to operate a similarly sized, but non-standard IT infrastructure.

> "It's better for upper corporate to negotiate bulk deals—note that I did not say 'one vendor'—and offer standard solutions to each national BU, so that the engineering does not need to be repeated 100 times. Simple economies of scale."
>
> (Director of Network Operations at a massive online Publisher)

A standard set of equipment also reduces the amount of training needed. This allows new staff to get up to speed faster and for veterans to become experts more readily as well. In addition to less overall training, you may need less staff, as support can be provided from anywhere to anywhere under the assurance that the operational environment is the same everywhere.

Furthermore, due to these economies of scale in staffing, headcount does not need to track infrastructure growth linearly – resulting in greater and greater efficiency as the organization grows.

Increase Velocity

It is no longer sufficient for IT infrastructure to simply not break. In today's fast-paced and ever-accelerating business world, technology must not only meet current needs, it must also facilitate growth and agility across the entire organization. This section describes two key ways that global equipment standards facilitate this needed velocity

Expansion

It has been said that "if you're not growing, you're dying" and that certainly seems to apply to many—if not most—21st century enterprises. Growing businesses are almost constantly adding new headcount, new floors, new branch offices, new retail locations, new points of presence or collocation facilities, new racks or pods within those facilities, etc. In fact, the speed at which these new locations can be created is often a limiting factor in how fast the

organization itself can grow. Fortunately, global equipment standards facilitate faster turn up.

As we saw above, infrastructure standards make new location implementation a practicable and repeatable process that is less prone to error. This template-based simplicity facilitates much greater expansion velocity than the alternative, every-site-is-unique, approach.

Expanding existing sites is faster and easier, too. Adding standard equipment to grow capacity is quick and painless because there are no big-picture decisions to be made and little testing needed, as it was all done ahead of time.

Innovation
In addition to physical expansion and added headcount, another important growth vector is innovation: the development of new products and services, new processes and tools, etc. Global equipment standards facilitate innovation velocity in at least two ways. First, by providing a universal platform to innovate upon and, second, by freeing up time for technical talent to think big picture.

Having a common platform with uniform features, capabilities, and interfaces allows innovators to focus on developing the new, rather than mitigating the old. Likewise, the operational simplicity of a standardized architecture provides employees with more time to think about innovation, instead of managing unnecessary complexity.

Enhance User Experience

When scaling a business into multiple locations, it is generally understood that aesthetics and processes should be replicated to represent the brand. This same concept of standardization applies to technology as well.

Technology plays a key role in the consistency of a brand across locations. Whether the users are employees, partners, or customers, global equipment standards ensure that their experience is the same at any location. The ability to leverage the same features and tools, in the same ways—regardless of physical or logical location—provides brand fluidity, reduces the need to contact technical support, and generally enhances the user's experience.

Reduce Risk

Reducing risk should be one of the primary focuses of any IT infrastructure design. There are several ways that properly applied global equipment standards can help you reduce risk.

Design Rigor
Before a global equipment standard is applied, the standard must be designed. This fundamental step is an opportunity to reduce risk, if seized.

By definition, a global equipment standard is created and agreed upon once. This provides the opportunity to apply much more rigor to the design process than when making ad hoc decisions on the fly in a case-by-case or location-by-location approach.

> "Rather than standardizing on a vendor, I support standardized deployments. Deployment X gets bill of materials Y. A significant assumption supporting this model includes well-known variables that distinguish one deployment type from another, defined by centralized technology research, acquisitions, and engineering teams."
>
> (Principal Networking Systems Engineer at a major University)

Developing a standard ahead of time allows all relevant stakeholders to have a say. It allows all variables to be considered. This is an opportunity to gather requirements and constraints, to evaluate multiple manufacturers and equipment models against the agreed-upon architecture, and to thoroughly test them for the desired functionality and interoperability.

The result of a rigorous design process is an equipment standard that is known to meet the needs of the entire organization. This eliminates the risks inherent in introducing unknown or untested equipment.

Interoperability
In particular, a global equipment standard greatly minimizes, or even eliminates, the risk of interoperability challenges by testing for them long before deployment.

One of the greatest risks when turning up new or expanding existing infrastructure is that the devices selected do not work together as expected. While most interoperability challenges can be overcome, the solution is almost never ideal. In some cases, workarounds or "hacks" are put in place, creating non-standard configurations that deviate from industry best practices and lead to troubleshooting challenges down the road. In other cases, the desired functionality is simply not possible, leading to

a “least common denominator” solution which lowers the functionality of the entire infrastructure to accommodate specific devices. In extreme cases, the install or upgrade may have to be abandoned altogether. In all cases, extra (unbudgeted) time is required at the time of turn up to work through these unexpected issues, which could have been avoided by pre-testing a standard set of equipment.

This is particularly problematic for end-to-end features like IPv6, QoS, traffic security analysis, and application quality monitoring, which all require cross-location interoperability. Even if everything within one location, site, or pod works great, there can still be interoperability issues on a broader scale. What’s worse is that these cross-location issues can be even harder to identify and resolve.

Vendor Responsibility

Another common challenge facing organizations without global equipment standards is vendor finger-pointing. It is unfortunately—if understandably—common for vendors to blame each other when interoperability issues are found.

Global equipment standards mitigate this risk in two ways. First, when standardizing on a single device for a specific role, all of the devices are from the same vendor, leaving no one to point their finger at. Second, in cases where the standard specifies a multi-vendor solution, all relevant interoperability is rigorously tested in the design phase where all parties have time to resolve the issues or find alternate solutions.

In both cases, when it comes time to deploy or expand an infrastructure according to a global equipment standard, all involved vendors have agreed ahead of time to support the chosen architecture and take full responsibility for their equipment’s functionality.

Operational Simplicity

One of the biggest risks to an organization’s IT infrastructure is human error. A global equipment standard mitigates this risk by providing consistency and predictability.

The best global equipment standards provide a detailed template for new installations. They list what equipment needs to be installed where, as well as how to install it, often down to the length and color coding of cables. This makes implementation a practicable and repeatable process, far less prone to error than “winging it” every time with a different and unpredictable set of devices.

This advantage holds throughout the operation and troubleshooting of a standardized infrastructure. Standard equipment allows for common and repeatable upgrade and maintenance processes. It allows for consistent reporting from and interaction with devices, regardless of location. This consistency raises visibility and lowers the risk of configuration errors.

What’s more, standardized infrastructure streamlines communication and shortens time to repair. When all parties are aware of the applicable standards, confusion and misinterpretation is drastically reduced. Likewise, when troubleshooting a known environment, no time is wasted trying to understand how it should work, as that is already known. The result is that problems are identified, communicated, and resolved much more efficiently.

Finally, the simplicity of an architecture built on a standard set of equipment allows support staff to gain a deeper understanding of fewer devices. This leads to a faster time to mastery of equipment and processes and an overall more competent staff.

From an operational cost perspective, a smaller, standardized set of equipment can be deployed and managed by a smaller staff of engineers.

Security

IT security is a broad topic encompassing a litany of individual risks with varying relevance to each organization. While addressing each of these individual risks is beyond the scope of this document, there is a clear security advantage gained through global equipment standards: the uniform and universal application of security policy across an organization.

> “You’ll need to know upfront in as much ex-cruciating detail as you can exactly what you intend to do at each level of the operation and stipulate that each component -- even those from different vendors running different operat-ing systems -- be capable not just of functional equivalence but semantic equivalence.”
>
> (Anonymous Security Professional)

Standard equipment can and should be selected based in large part on its security capabilities. Doing so ensures a consistent set of security features, which allows a common security posture across all locations, sites, pods, etc. When this is not the case, organizations must either reduce their overall security policy to one that can be met by the least capable devices or accept that some parts of the infrastructure are less secure than others. Neither of these options are likely to be acceptable in today’s increasingly hostile security environment.

Enable Automation

As we move forward into the 21st century, it has become clear that the road to greater infrastructure efficiency lies in greater levels of automation.

> "System automation and life cycle management is exponentially easier when you have uniform environments."
>
> (Systems Engineer at a Major Cloud Provider)

Standardization is the bedrock of automation. The more variables found in an infrastructure, the more complex the system that automates it must be. Complexity leads to mistakes and inefficiency. Just as standardized naming conventions and configuration variables are prerequisites to automation, so too are common hardware and software platforms.

Potential Drawbacks of Global Equipment Standards

Nothing in modern enterprise is so simplistic as to be one-dimensional. Everything has caveats, drawbacks, and potential pitfalls. Of course, this includes infrastructure standards. In response to this reality, the below sections take a look at the "dark side" of global equipment standards to ensure informed and rational decisions.

Lack of Vendor Leverage

The dark side of buying power when standardizing on a single manufacturer to partner with is the risk of "vendor lock in." Leverage is required to negotiate well, and should never be given up lightly. Fortunately, there are methods for maintaining autonomy, even when deploying global equipment standards:

- Avoid proprietary protocols and solutions. An open, standards-based architecture provides the flexibility to swap one vendor for another with much less disruption.
- Don't use a single manufacturer for everything. There are many ways to implement a standardized multi-vendor architecture; maintaining buying relationships with more than one manufacturer maintains leverage on all of them.
- Build relationships with trusted partners. Do business with companies committed to your long-term success.

Lack of Innovation

Another pitfall to be avoided is the stifling of innovation as a result of an overly strict and unresponsive standard. A standard should never be forever, and should always be open to change as new products and technologies are introduced and as new requirements are uncovered. An interval should be selected to examine and evaluate the equipment standards.

Lack of Flexibility

The above drawbacks can almost all be summarized as a lack of flexibility. This is not the goal of a successful infrastructure equipment standard. Quite the opposite, a solid standard should be crafted to provide the needed flexibility, while also being able to economize scale and other benefits.

While the vast complexities of multinational corporations are beyond the scope of this document, what is absolutely certain is that these considerations must be accounted for. A rigorous design process and commitment to constant improvement are required to avoid the many potential drawbacks of any standardized architecture.

Bug Vulnerability

One of the largest potential risks inherent with global equipment standards is that any software bug or security vulnerability that could affect one location, could affect all locations.

This is a serious issue, and must be treated as such. However, when compared to a non-standard environment there may actually be advantages to consciously accepting this risk. While it is true that deploying standard equipment globally provides a single attack surface globally, it is also far more likely that the rigor of a global standardization process has carefully evaluated the security risks of each device than an ad-hoc, as-needed process can. Additionally, as discussed above, equipment standards typically lead to tighter relationships with manufacturers, making it more likely that an organization will be alerted and provided with bug fixes early.

It should also be noted here that a global equipment standard does not necessarily mean a single vendor, a single device, or a single software load. For example: The global standard may specify that all BGP speaking routers are deployed in pairs, with one from vendor X and one from vendor Y. Alternatively, the standard may require that firewalls from vendor A and vendor B are deployed round-robin to every other location. The same can be done with software or any other devices.

The best security posture is a comprehensive defense-in-depth strategy, employing multiple interoperating layers of security. The best protection against bugs is thorough testing ahead of time coupled with continuous attentive awareness. Both of these strategies can often best be implemented through rigorous and inclusive standardized architecture development and maintenance.

Regional Differences

There are various regional factors both inside and outside of any organization that can affect the feasibility of a global equipment standard. The following sections reflect on two of the most frequently encountered.

Government Regulation

Regulatory issues must be considered in every aspect of business and, unfortunately, infrastructure standards are no different.

Import and export restrictions, tariffs, bribes, required backdoors, and other special legal requirements can all pose risks when creating a truly global standard.

In some situations, these challenges may even make setting a single standard untenable. In the vast majority, however,

they simply require flexibility or specific use cases to be included in the successful standard. Design rigor is, once again, your ally.

Vendor Support Infrastructure
Just as governments vary from location to location, each IT manufacturer's support model can be drastically different depending on your geography.

Here again, this is absolutely something that needs to be considered, but shouldn't necessarily preclude a global equipment standard. If the chosen vendor does not provide support in a given area, there are typically several potential solutions:

- Choose another vendor. Not always ideal, but usually an option.
- Settle on two (or more) vendors. They can be geographically bound, or simply provided as options on a case-by-case basis. While this may reduce some of the benefits of a single standard, and is typically harder to execute, it is far better than no standard at all.
- Negotiate support with the vendor. If you are making large enough purchases and will have a large enough presence in the area, it may be worthwhile for the vendor to provide support.
- Seek alternate support. Direct support from the vendor is often the default model, but rarely the only option. Find a local partner to provide support, or staff up your own local support team complete with a stock of spare parts.

Organizational Politics

Almost as inescapable as external regulation is internal politics. No one likes being told what to do, and equipment standards are no different. The design process needs to be inclusive, both to accurately reflect the needs of the enterprise and to facilitate buy in. In extreme cases, some level of organizational change may be required, as was the case with Cisco[1]:

> There were also some other political or business drivers for more local IT. Local design teams didn't want to give up their political autonomy. This issue was removed by Cisco IT management turning local design and support teams into global teams, reporting to other leaders in other location.

While organizational politics and employee emotions constitute valid inputs to the design process, they should never stand in the way of business.

Shadow IT
Another aspect of culture and politics failing within an organization is what has been referred to as "shadow IT." This is the phenomenon of individual employees or whole teams of employees using their own technology tools instead of those provided by the organization. This is almost always a sign that the provided IT infrastructure is inadequate or does not meet their needs or expectations in some way and is a risk in almost any environment – including one with global infrastructure standards.

The best way to prevent and/or remedy shadow IT is an attentive and responsive IT service organization.

[1] http://blogs.cisco.com/ciscoit/b-boit-03252015-why-it-standardization

Conclusion

Global IT infrastructure equipment standards provide the potential for many benefits. What's more, these benefits contribute precisely to meeting the most pressing demands on every IT organization: reducing cost, increasing velocity (agility), enhancing the user experience, reducing risk, and more and more, enabling automation. Additionally, after evaluating the potential drawbacks that come with creating and adhering to such standards, it is clear that none are insurmountable. The challenges are real but manageable.

> "Repeatable patterns of deployment are a great economic and organizational simplification."
>
> (Network Engineer at a major Content Delivery Network)

In the vast majority of cases, a properly crafted and applied global standard is one of the best tools IT executives can use to set their organization up for success. As the old adage goes: "measure three times, cut once."