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INTENT-BASED DATA CENTERS

Are the Next Evolutionary Step for Enterprises

WHITE PAPER

Prepared by
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ABOUT THE AUTHOR

Zeus Kerravala is the founder and principal analyst with ZK Research. Kerravala provides tactical advice and strategic guidance to help his clients in both the current business climate and the long term. He delivers research and insight to the following constituents: end-user IT and network managers; vendors of IT hardware, software and services; and members of the financial community looking to invest in the companies that he covers.

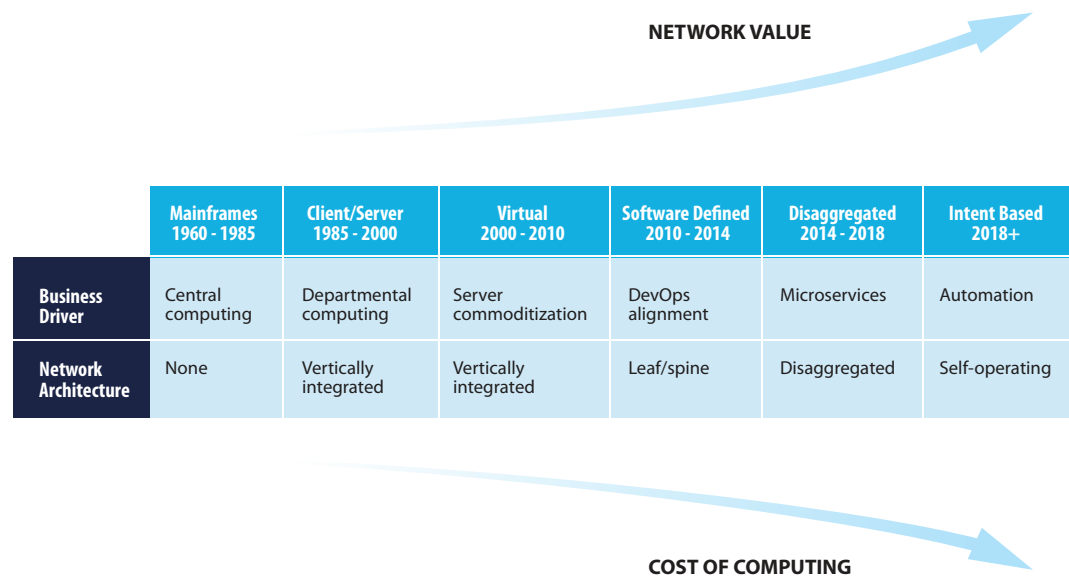## INTRODUCTION: DATA CENTER EVOLUTION IS A CONSTANT

The enterprise data center has undergone several major shifts since the introduction of computing as a business resource. Data centers have evolved from mainframes to client/server to virtual servers, and then to being "software defined," and finally to their current state of disaggregation. Today, we sit on the precipice of the next major data center transition—the evolution to an intent-based data center (IBDC) (Exhibit 1). Each transition saw the cost of computing decrease and the importance of the network increase, and each enabled organizations to boost the efficiency of their data center operations and improve asset utilization—ultimately leading to a better experience for users.

The transition to an intent-based data center will be the most significant technology transformation since the birth of the internet, as the vision is to deliver autonomous operations across all IT infrastructure.

Digital transformation is driving business strategy. Companies that are successful in making the shift will see an increase in revenue and lower operational costs, and they will be more profitable. Consequently, 89% of businesses now have digital initiatives underway, according to the ZK Research 2018 IT Priorities Study.

Success in the digital era is based on adapting to market shifts faster than the competition, which puts a premium on business agility. However, businesses can only be as agile as their infrastructure enables them to be. Legacy operational models are manually intensive and far too slow to keep up with the speed of digital transformation. This problem has been exacerbated as the data center has evolved and grown more complex. Multi-cloud, hybrid clouds, virtualization, containers

Exhibit 1: The Changing Data Center

NETWORK VALUE

	Mainframes 1960 - 1985	Client/Server 1985 - 2000	Virtual 2000 - 2010	Software Defined 2010 - 2014	Disaggregated 2014 - 2018	Intent Based 2018+
Business Driver	Central computing	Departmental computing	Server commoditization	DevOps alignment	Microservices	Automation
Network Architecture	None	Vertically integrated	Vertically integrated	Leaf/spine	Disaggregated	Self-operating

COST OF COMPUTING

ZK Research, 2018

and other trends enable businesses to do so much more with their infrastructure than ever before, but that capability has come at a price—increased complexity.

According to ZK Research, businesses are now dedicating 82% of their IT budgets solely to keeping the lights on, leaving very little budget for innovation. It's unlikely IT budgets will see a surge in growth. Therefore, if businesses want to shift more resources to innovation, they must find a way to lower the cost of running the environment.

The automation capabilities delivered by an intent-based data center can radically change the operational model and enable businesses to slash the costs of running the data center and focus more on innovation. If businesses are to flourish in the digital era, evolving to an intent-based data center must be one of their top priorities.

SECTION II: INTRODUCING INTENT-BASED DATA CENTERS

The intent-based data center is the next evolutionary step in data centers, and it will bring unprecedented levels of automation and intelligence. Intent-based systems will simplify operations, improve agility and increase security by using declarative statements to mandate intent for deployment, operations, moves, adds, changes, policy enforcement, problem resolution and troubleshooting.

By using declarative statements, intent-based systems enable IT professionals and line-of-business owners to determine the desired outcomes of the infrastructure and then automate the configuration of the network. Business outcomes can be used to determine policies in a declarative model and then be automatically implemented and enforced. It's important to understand that intent-based systems operate on a closed-loop model (Exhibit 2) in which policies are constantly being checked. If a change is made that violates the policies, the configuration is automatically updated.

For example, if a policy is created to keep all development servers in their own virtual segment, and then a server moves, the virtual segment will be reconfigured to extend to the new location of

Exhibit 2: Intent-Based Systems Operate in a Closed-Loop Model
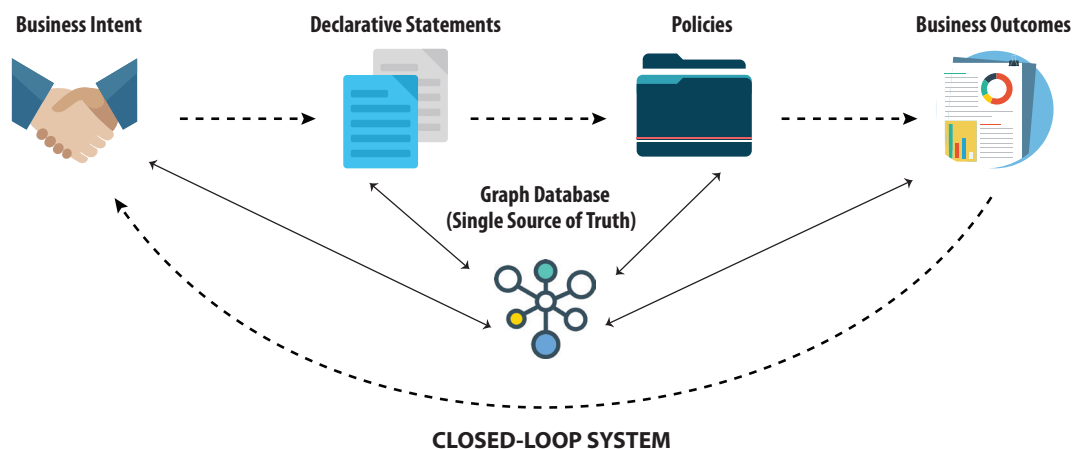
ZK Research, 2018

Intent-based systems eliminate all of the manual configurations that are in use today.

the server. If, for some reason, the segment can't be extended to that point, the server will not be able to communicate with the other development servers, as this would violate the policy. This is all done automatically with no intervention from IT.

The vision of intent-based systems has existed for more than a decade, but it was not feasible to implement—particularly in the network, where the systems were built to be vertically integrated. Recently, advancements in software-defined networking (SDN), orchestration platforms, open application programming interfaces (APIs) and open network software have made intent-based systems a reality. And although adoption is currently light, ZK Research believes that the technology will be mainstream within five years. Therefore, companies that do not shift to this model will not be able to compete with those that have done so.

Intent-based systems eliminate all of the manual configurations that are in use today. More importantly, they understand the rules to ensure mistakes are not made. A good analogy is the difference between automation in a car and autonomous vehicles. Many vehicles today are equipped with automation features such as parallel park assist, which enables the car to park itself. However, the driver still needs to determine where to park and understand the rules in place. If the driver chooses to park on the street but violates a rule because street cleaning is underway, the car would be towed. Juxtapose this with an autonomous vehicle, where the driver would issue the declarative statement "Drive me home." In this case, the intent-based system would drive the person home, but it knows all of the policies associated with parking. Therefore, it would still use parallel park assist to automate the task of parking, but it would park in a spot that does not violate the rules.

Most systems are at level 0 intent-based networking, which is basic automation, or, at best, level 1, which is a single source of truth. Level 2 intent-based networking, which incorporates real-time change validation, is necessary for seamless operation on an intent-based data center. Ultimately, any solution must be designed to easily move to level 4 intent-based networking, which is full self-operation.

Legacy operational methods are very slow, as they are manual in nature. The ZK Research 2018 Network Purchase Intention Study found that the average time to implement a change across the network is four months—far too slow for digital businesses. With intent-based systems, the engineer states the desired outcome, and the intelligence in the system determines how that should be achieved. Also, intent-based systems enable a lower level engineer or even a line-of-business owner to define outcomes by specifying intent without requiring the use of a senior engineer. High-level engineers can be costly and should be used to drive innovation. With legacy operations, many spend more than half of their time working on day-to-day issues. Intent-based data centers change that paradigm.

The following are the key attributes of an intent-based data center:

Closed-loop system: Automatically regulates itself to reach a desired state without requiring human intervention

IT and business leaders should make an intent-based data center a top priority.

Single source of truth: Stores and correlates all attributes of the system in a single database, including configuration, IP address management and cable management

Translation: The ability to translate technical commands into actions

Real-time change validation: Confirms that policies are verified before they are executed and that the original intent is monitored and enforced on a continuous basis

Automation: Automates configuration updates and policy validation

Understanding of state: Constant knowledge and validation of the data center

Self-documenting: Continuously monitors, tracks and logs security, compliance and regulatory intent
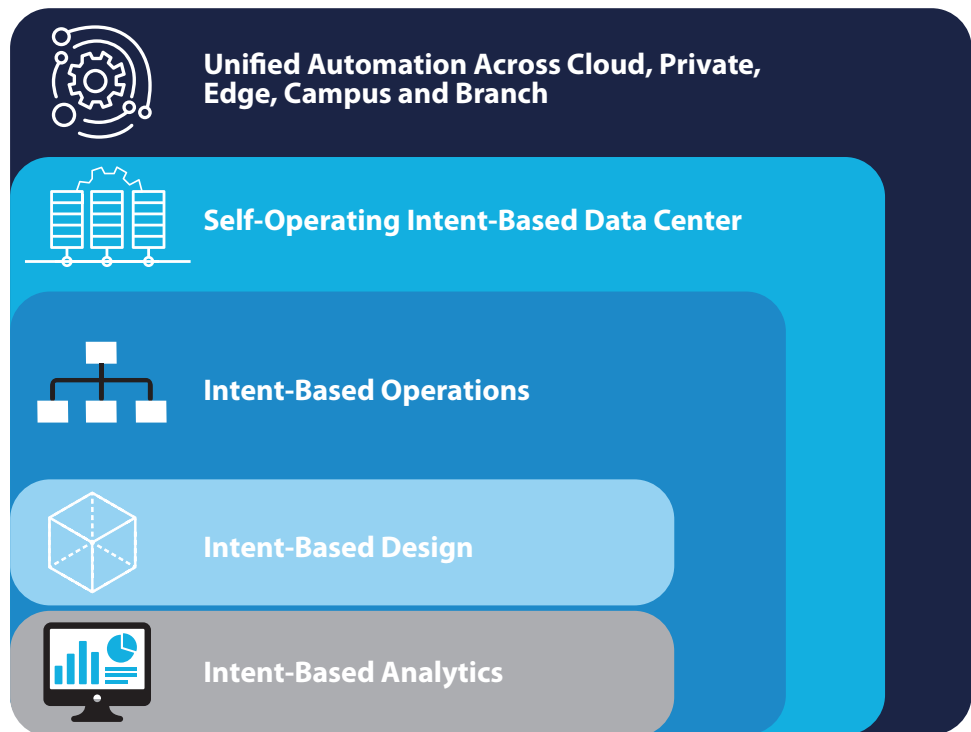
The data center is undergoing a massive shift. Legacy, monolithic platforms have given way to an agile, web-centric architecture based on modernized infrastructure. The modernized data center has come at a cost—increased complexity. Consequently, IT professionals are being crushed under the weight of manual processes. An intent-based data center delivers the necessary automation capabilities to enable IT to focus more on innovation rather than the mundane tasks required to maintain the status quo.

SECTION III: THE FIVE USE CASES OF AN INTENT-BASED DATA CENTER

IT and business leaders should make an intent-based data center a top priority. ZK Research recommends thinking of intent-based technology as something that can be applied to use cases in the life cycle of running a data center.

Exhibit 3 presents the different use cases in which intent can be applied in the data center. It's important to note that each use case—design, analytics, operations, self-operating and unified automation—may be implemented independently but also can be combined with the others to enable a broader use case.

For example, a business might be in the process of redesigning the data center so that it would start with intent-based design and then later expand to operations. Alternatively, an organization might have just deployed a data center and want to implement self-operating tools including intent-based network operations, analytics and design. Intent-based principles can be applied anywhere as a starting point and then expanded to every other use case.

Exhibit 3: Use Cases for an Intent-Based Data Center

Unified Automation Across Cloud, Private, Edge, Campus and Branch

Self-Operating Intent-Based Data Center

Intent-Based Operations

Intent-Based Design

Intent-Based Analytics

Apstra and ZK Research, 2018

The five use cases are discussed below:

Use Case 1—Intent-based design: This use case involves specifying the intent of the architecture or blueprint using logical constructs that can then be applied to the underlying network hardware. The design aspect is the foundation for an intent-based data center.

Use Case 2—Intent-based analytics: There's an axiom in networking that states, "You can't manage or secure what you can't see." This means that network professionals need to have an end-to-end view of network activity. Visibility requires more than just data—it requires analytics to interpret the data. Data is collected from pre-packaged or custom probes. Intent-based analytics implements telemetry across the data center and can operate in read-only mode, so it can create no harm. Advanced analytics uses sophisticated telemetry for ongoing or proactive monitoring through the use of advanced probes.

Use Case 3—Intent-based network operations: This phase incorporates complete automation of the data center including a single source of truth for all operations, configurations and data stores. This includes abstracting profiles, templates and configurations across every network device in the data center. Other operations include implementing policy enforcement;

managing moves, adds and changes; and maintaining constant operation of the data center. Intent-based network operations also incorporate intent-based analytics.

Use Case 4—Self-operating intent-based data center: This phase introduces total autonomous operations with the option for changes or updates to be validated by people. At this phase, the scope of the intent-based system expands from being switches only and includes security devices, routers, application delivery controllers, servers, storage, workloads, applications and Internet of Things (IoT) endpoints.

Use Case 5—Unified multi-cloud intent-based automation, policy and operations: This final use case is where the intent-based data center expands beyond borders and becomes independent of the physical location of enterprise applications and infrastructure. The intended policies, security and configurations extend across hybrid environments operating in both public and private clouds. This is critical, as ZK Research forecasts that hybrid environments will be preferred into the foreseeable future (Exhibit 4). With an intent-based data center, IT will have the ability to design, build, configure, deploy, manage, maintain and proactively monitor all of these locations and services as a single system.

Exhibit 4: Public and Private Clouds Will Both See Aggressive Growth Through 2021
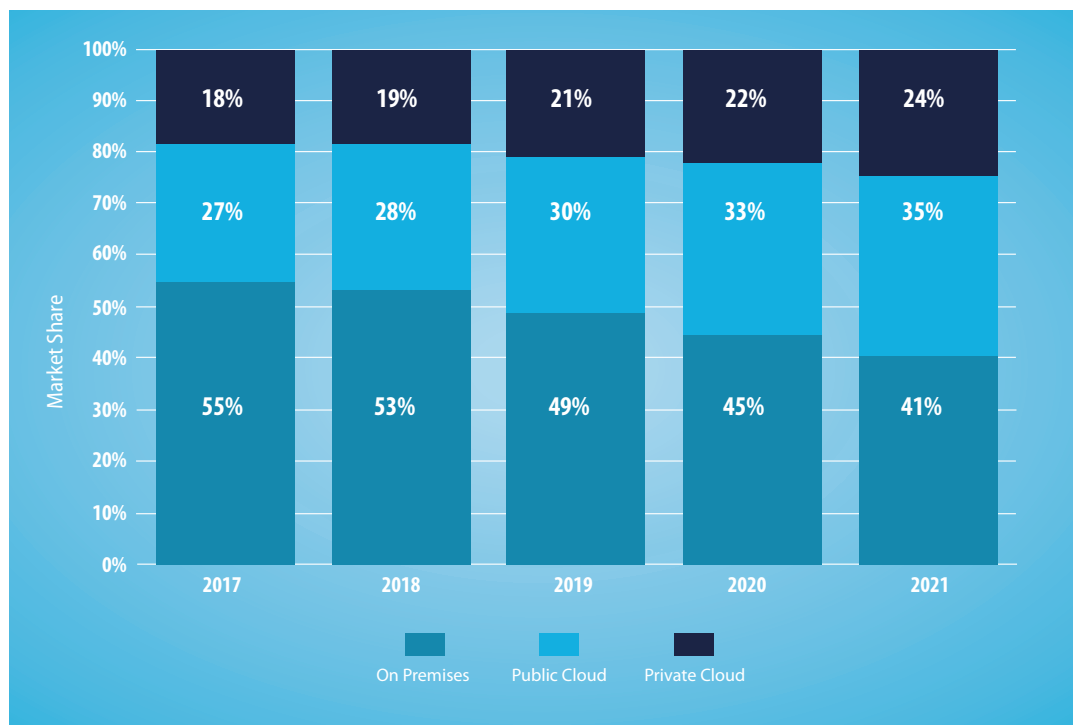
ZK Research, 2018

SECTION IV: UNDERSTANDING APSTRA'S INTENT-BASED DATA CENTER SOLUTION

Apstra displays the end-to-end network through a single, graphical dashboard that is highly intuitive.

Silicon Valley–based Apstra is a startup that was founded specifically to deliver intent-based networking to data centers. Unlike traditional vendors, Apstra has no legacy business to protect, so it has put all of its research and development efforts into helping its customers get to Use Case 5 quickly but without risk. Apstra's intent-based networking technology enables the integration, configuration, monitoring and troubleshooting of thousands of disparate elements into a single agile system capable of being managed by declarative intent.

The solution includes intent-based analytics, which leverages big data to monitor the entire network or networks across one or more data centers. This includes pervasive and real-time telemetry problems, which can see even the smallest changes in the system—which are then quickly communicated back to the operations team to confirm recommended actions.

Apstra's solution is unique in the following ways:

A distributed system architecture enables engineers to view, operate, manage and troubleshoot the end-to-end data center in real time from a single source of truth. The architecture scales to include every network node and maintains continuous, real-time integration to quickly enact changes specified through the intent of IT. The solution also detects and mitigates anomalies across the data center or data centers.

A vendor-agnostic overlay enables Apstra to work with any existing network vendor. By using an overlay model, the people, processes and tools can be decoupled from the network, eliminating many complexities. Apstra displays the end-to-end network through a single, graphical dashboard that is highly intuitive. This view can be used to implement modifications declared by IT through intent and also consolidates health status and configuration. Apstra can abstract the hundreds of combinations of hardware, software and operating systems from the different network vendors including open source. Customers that choose Apstra can take advantage of best-of-breed technology without the concern of vendor lock-in.

Apstra's intent–based data center solution enables IT operations to move at the speed of DevOps and provides "one throat to choke" across all of these vendor, software and hardware options; it is choice without the associated risk. In today's digital world, business transformation is driving the need for change, and line-of-business managers will move to the cloud if IT can't operate fast enough. Apstra meets all of these new demands and puts IT in a position to be "superheroes," as they are able to design, build, deploy and maintain an intent-based data center that dramatically increases application reliability and performance, simplifies deployments and operations, and reduces both capex and opex costs.

Also, customers that use Apstra can run network operations at the same scale and with the same operational efficiency as the cloud providers but without the risk of custom scripting and development. This speed is critical in competing in a digital world where market transitions come quickly. Exhibit 5 presents data that ZK Research has aggregated from Apstra's customer base, highlighting many of the qualitative and quantitative benefits of the solution.

SECTION V: CONCLUSIONS AND RECOMMENDATIONS

Digital transformation is disrupting all industries at lightning speed. As evidence of this, 55% of the Fortune 2000 companies that existed in the Year 2000 are now gone. There has never been more pressure for businesses to move with speed and agility. Companies that can achieve this will thrive, while those that cannot do so will struggle to survive and possibly vanish. Digital trends mandate that companies transform or die.

Because of this, business leaders have turned to the IT department to drive innovation. However, for IT to lead a company through the digital journey, its underlying infrastructure must be modified, particularly in the data center, where the majority of the business's data and applications are housed. As the infrastructure has become increasingly disaggregated, the network has begun to play a more important role because it's the resource that connects the disparate components to one another—but this, in turn, mandates network change.

Initially, software-defined networks were viewed as a panacea that would lead networking into the digital age, but most SDN solutions are locked into a specific vendor. This makes them difficult to scale, particularly in multi-cloud environments. The intent-based network shifts the value to the management plane and enables the transition to an intent-based data center. With an intent-based data center, customers can focus on intent and outcomes instead of the operational tasks associated with the changes.

The intent-based data center is the single biggest transition in the history of compute and will bring fully autonomous operations that enable businesses to move at digital speeds. The evolution

Exhibit 5: Apstra's Intent-Based Data Center Delivers Qualitative and Quantitative Benefits

Business Benefits of Apstra's Intent-Based Data Center					
Increases network agility by **up to 90%**	**Decreases** application outages by **up to 80%**	**Simplifies** deployments and operations	**Reduces** opex and capex by **up to 90%**	**Improves** security and finds compliance gaps	**Obviates** the need for custom scripting and coding

ZK Research, 2018

to an intent-based data center must be a strategic priority for every business and IT leader. To help with this shift, ZK Research makes the following recommendations:

Embrace automation at the C-level. The concept of automation is one that many engineers fear, as it threatens to take their jobs. The fact is that automation should be viewed as the engineer's best friend because it removes the burden of having to execute repetitive and mundane tasks. CIOs must buy into automation and make it a top-down initiative to ensure it permeates all points in the data center.

Plot a journey to an intent-based data center. IT professionals should educate themselves on the five use cases of an intent-based data center and implement the one that provides the most immediate value. Companies that are going through the process of implementing a private cloud should focus more on analytics and design, while businesses that are struggling to evolve because of a lack of resources dedicated to innovation should consider starting with automating day-to-day tasks. From there, IT can plan out a course to use intent-based technology more broadly, eventually leading to a fully autonomous data center.

Be willing to use alternate vendors. When looking at technology, it's easy to make a decision based on market share or incumbency. However, when markets are in transition, the traditional vendors often are the slowest to adapt. Choose a vendor that can deliver an agnostic solution that is built from the ground up to meet the demands of an intent-based data center. ZK Research believes Apstra is such a vendor and should be included on any business's short list.

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