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Cloud providers' DIY data center network automation: key motivations, challenges and true costs of in-house-built automation

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Executive summary

Data center network automation is a strategic imperative for every digital organization. This is driven by the need to run business-critical applications in a more reliable and efficient manner and to accelerate digital transformation activities. However, progress in automating data center networks has been limited to-date. The use of a fragmented set of in-house-built tools and solutions is prevalent, and this current DIY-based approach to automation is not delivering the desired results.
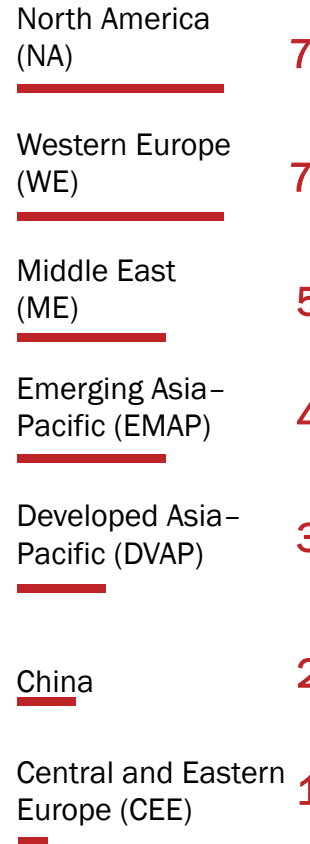
Juniper Networks partnered with Analysys Mason to gain a deeper understanding of DIY data center network automation activities within communications service providers (CSPs), enterprises and cloud providers. We identified the key motivations and challenges of the DIY approach, examined overall data center automation strategies and benchmarked the level of automation across key operational processes. This report focuses on the results from the cloud provider segment.[1] These players are typically small-to-medium-sized and regionally focused; we exclude major public cloud providers such as AWS, Google, IBM, Microsoft and Oracle.

This report showcases the key findings from an online survey of 29 cloud providers and complementary deep-dive interviews with senior decision makers and data center network operations staff.

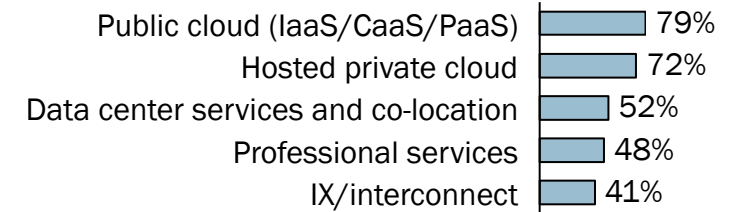[1] Please see the further reading section for the links to the other segment reports.

Geography

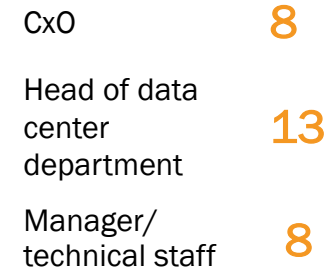|	
North America (NA)	7
Western Europe (WE)	7
Middle East (ME)	5
Emerging Asia–Pacific (EMAP)	4
Developed Asia–Pacific (DVAP)	3
China	2
Central and Eastern Europe (CEE)	1

Total: 29 cloud providers

Cloud provider profile

Public cloud (IaaS/CaaS/PaaS)	79%
Hosted private cloud	72%
Data center services and co-location	52%
Professional services	48%
IX/interconnect	41%

79% have less than USD1 billion in annual revenue

Respondent profile

CxO	8
Head of data center department	13
Manager/ technical staff	8

Data center footprint

100+	5
50–100	9
25–49	13
10–24	2
5–9	
1–4	
0	
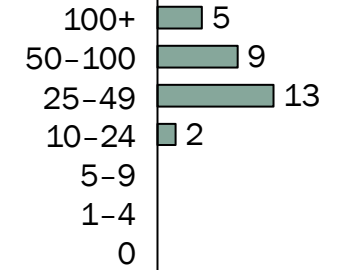
Deep-dive interviews

- Director of Network and Cloud, NA, 1–4 DCs
- Cloud Sales Lead, WE, 100+ DCs
- Network/IT Consultant, NA, 10-24 DCs

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Key findings

Overall data center automation trends

- The level of data center automation among cloud providers (44%) is higher than that for CSPs and enterprises, but it still lags behind that for the major cloud players (AWS, Azure and GCP).

- Most cloud providers are motivated by the need to keep pace with the major cloud providers' agility and customer experience.

- Cloud providers struggle the most with Day 1 operations, and multi-vendor support/integration is their main automation pain point.

- The most automated cloud providers perform Day 0, 1 and 2+ operations much more quickly than their less automated peers, but they have not significantly reduced their headcounts to realize opex benefits.

In-house/DIY data center automation

- 82% of cloud providers' Day 0, 1 and 2 data center operations rely on DIY automation tools; this is the highest of all segments.

- In-house software development is ingrained in cloud providers' organizational culture, and they typically take a DIY approach when building tailored services for their customers and achieving a technological edge against the competition.

- Cloud providers need large development teams to manage the lifecycles of their DIY automations. As a result, resource and skill availability is their main challenge with DIY automation.

- No single cloud provider is fully satisfied with their DIY solutions; those that suffer the most from a lack of resource availability are inclined to replace them with vendor solutions.

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Overall data center automation trends

The state of in-house data center automation

Recommendations

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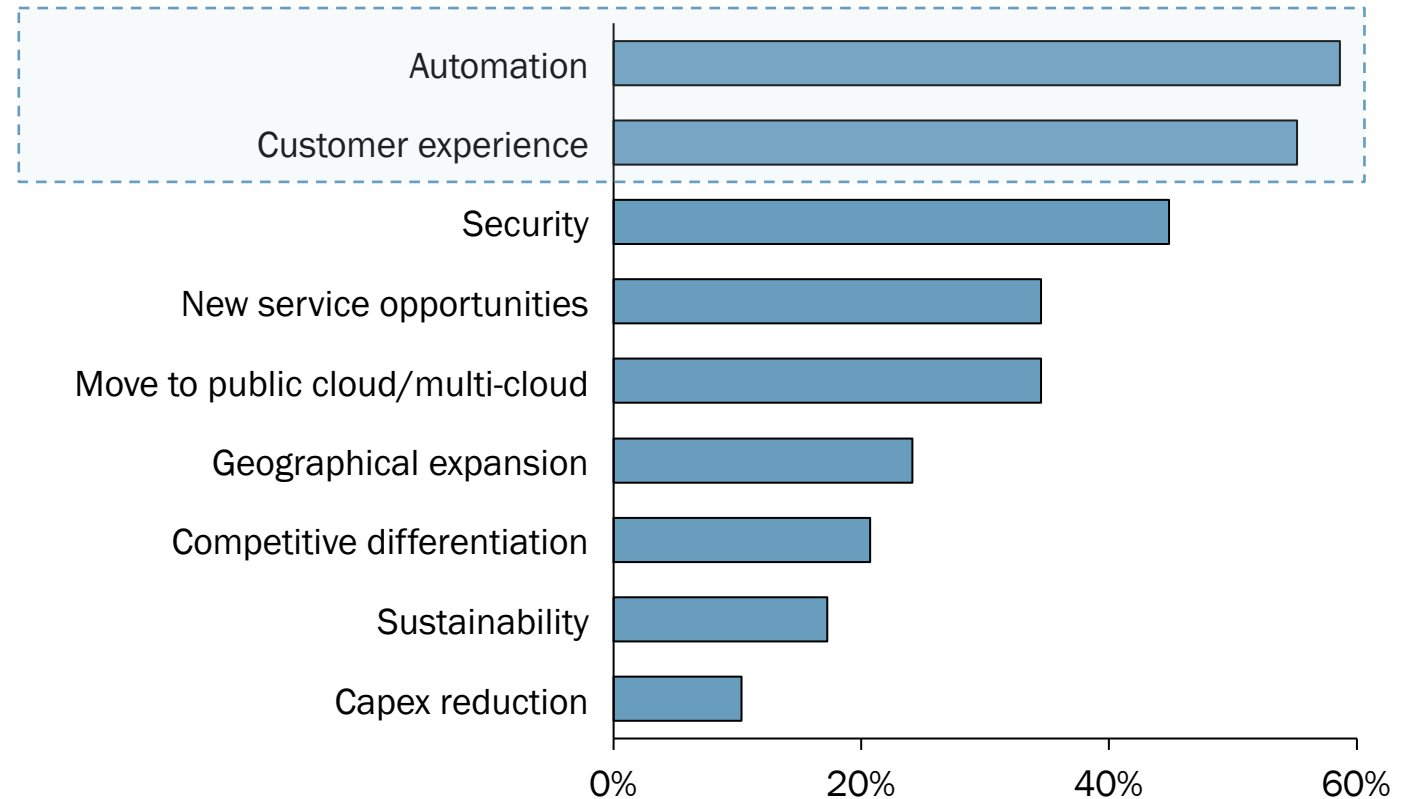# Cloud providers want to use automation to address customers' demands

- The cloud provider market is made up of many niche players that need increased levels of automation to keep pace with the service agility, programmability and on-demand customer experience that the major public cloud providers can offer.

- Larger players' (USD1 billion or more in annual revenue) data center and automation agendas are driven by strategic drivers such as new service opportunities.

- Smaller players typically do not have strong commercial ambitions, but they want to protect their market shares by using automation to provide a similar customer experience to that of the major players.

> " The pandemic extended the lifespan of small cloud providers by a few years. If they don't switch very quickly to automation and SDN they will not survive in this highly competitive market.
>
> *Network/IT consultant, cloud provider from North America*

Question: What are the **top business drivers** for your data center strategy?

Automation	
Customer experience	
Security	
New service opportunities	
Move to public cloud/multi-cloud	
Geographical expansion	
Competitive differentiation	
Sustainability	
Capex reduction	

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70% of cloud providers struggle with data center design
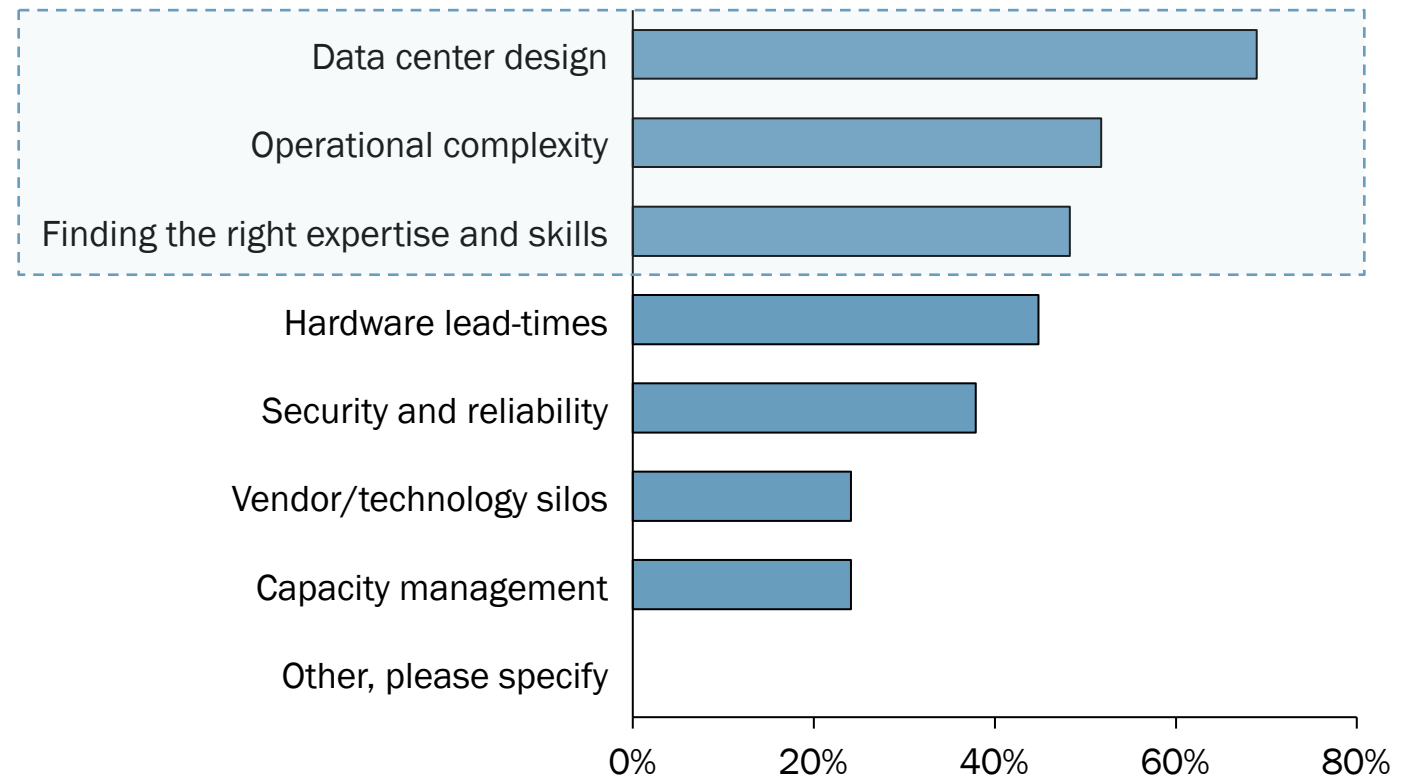
Cloud providers with 50 or more data centers

- These providers overwhelmingly chose data center design as their top operational challenge.
- Balancing cost, performance and energy efficiency to meet current and future requirements is challenging.

Cloud providers with fewer than 50 data centers

- These providers struggle with operational complexity, security and data center design. They lack resources and standards across data centers.

Cloud providers of all sizes find obtaining the right expertise and skills a challenge. This is a limiting step to automation.

Question: What are your top data center **operational challenges?**

Bar chart categories (top to bottom):
- Data center design
- Operational complexity
- Finding the right expertise and skills
- Hardware lead-times
- Security and reliability
- Vendor/technology silos
- Capacity management
- Other, please specify

X-axis: 0% 20% 40% 60% 80%

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Cloud providers are less than 50% automated on average

- Cloud providers reported the highest level of data center network automation among all the segments we surveyed.

- Cloud providers have made the most progress in automating Day 2 (50%) and Day 1 (47%) operations, but their limited automation of Day 0 operations (35%) brings down the overall level.

- 38% of cloud providers stated that Day 0 operations are their top automation priority.

- 50% of the eight most automated cloud providers are from North America and are mainly driven by new service opportunities.

- 60% of the five least automated cloud providers are from Southeast Asia and suffer from a lack of expertise.

Question: What **level of automation** have you reached in the following data center network operational areas today?

16%

Average level of automation across Day 0/1/2 for the **five least automated cloud providers**

69%

Average level of automation across Day 0/1/2 for the **eight most automated cloud providers**

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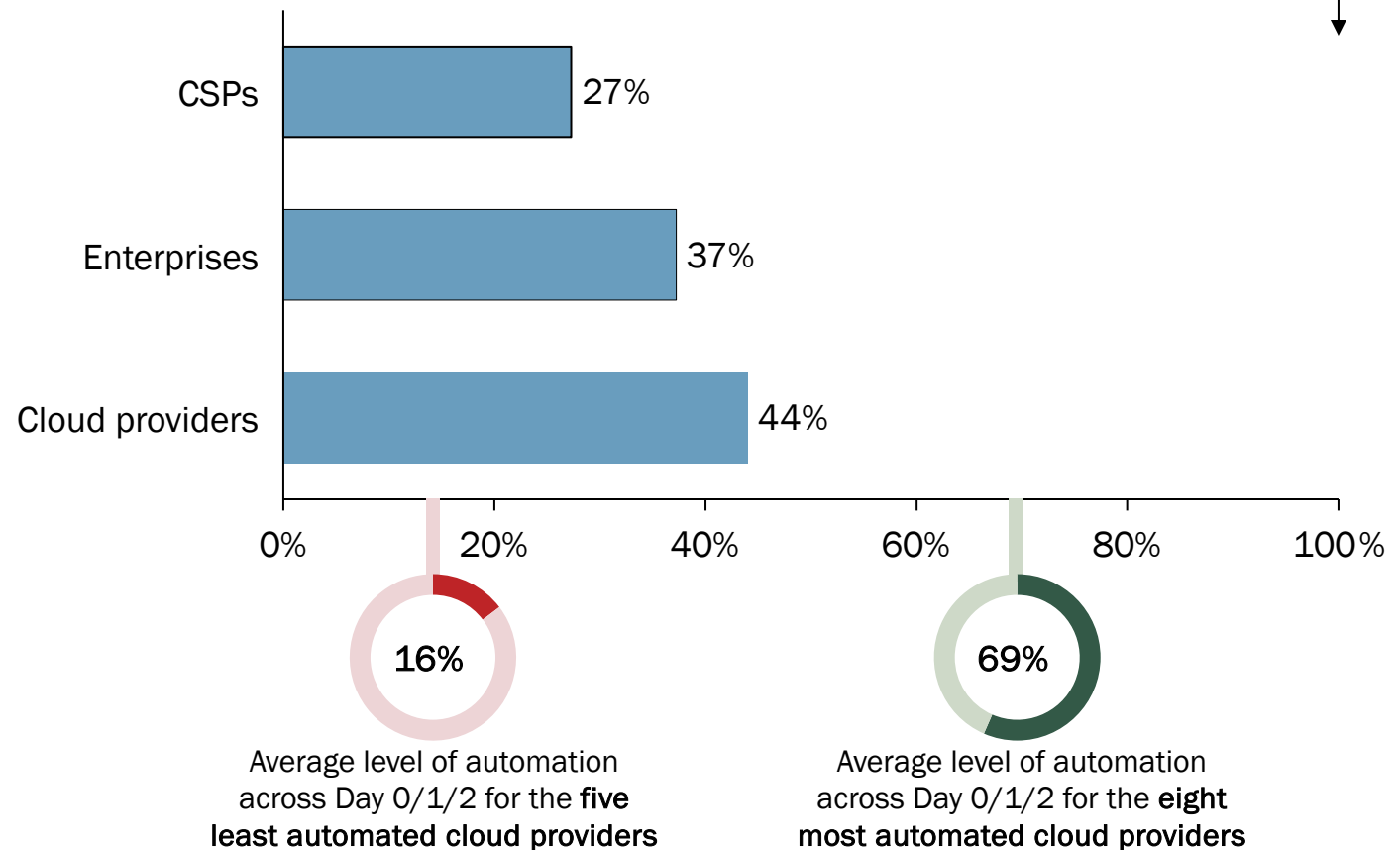
Lack of multi-vendor support/integration is by far the biggest data center network automation pain point

- Cloud providers are increasingly adopting data center network equipment from multiple vendors to reduce vendor lock-in.
- Co-location providers struggle with multi-vendor environments because they need to manage a heterogenous set of customer-specific vendor environments.
- Co-location providers are among the least automated cloud providers.
- A lack of multi-vendor support is affecting automation progress and is a major contributing factor to costly/time-consuming automation and operational complexity challenges. It is the biggest pain point across Day 0, 1 and 2+ operational processes.
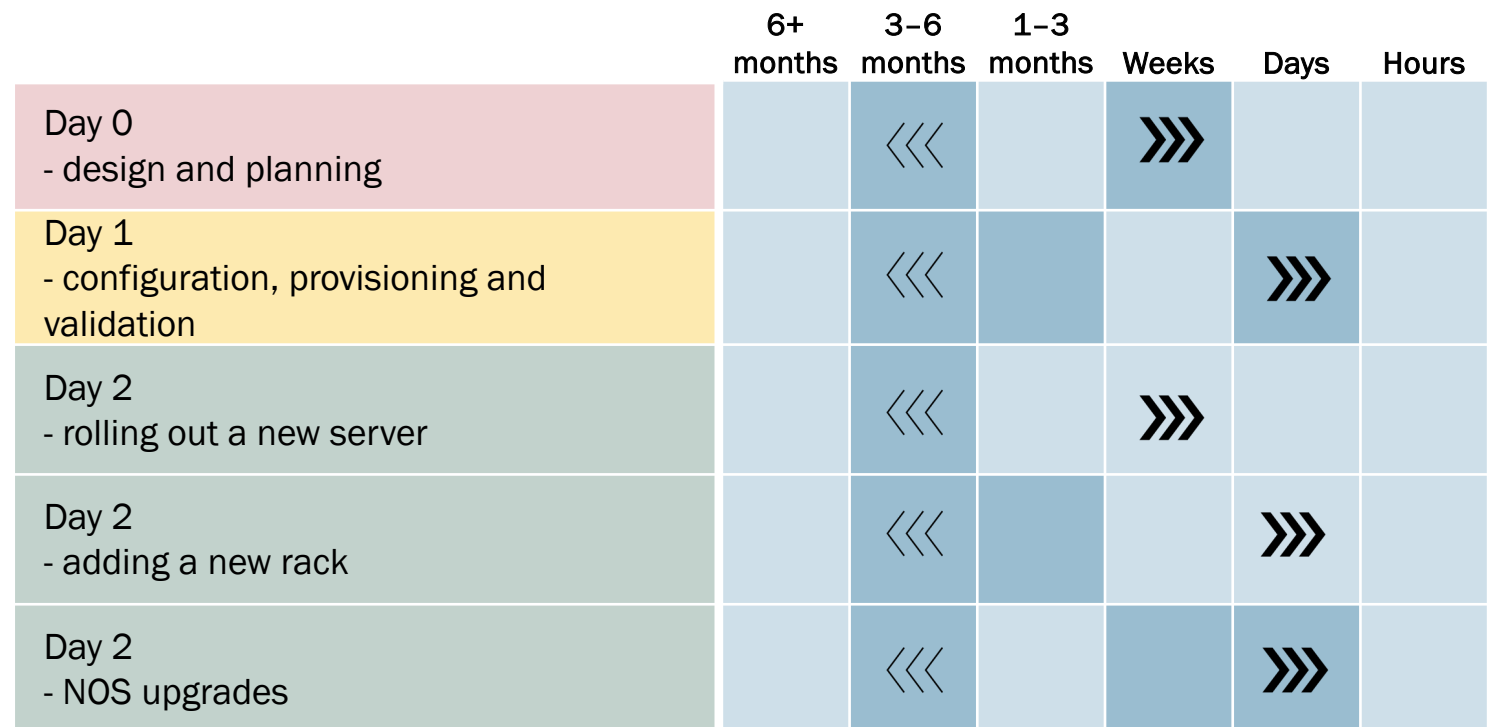
Question: What are the top data center network automation **pain points** in the following operational area?

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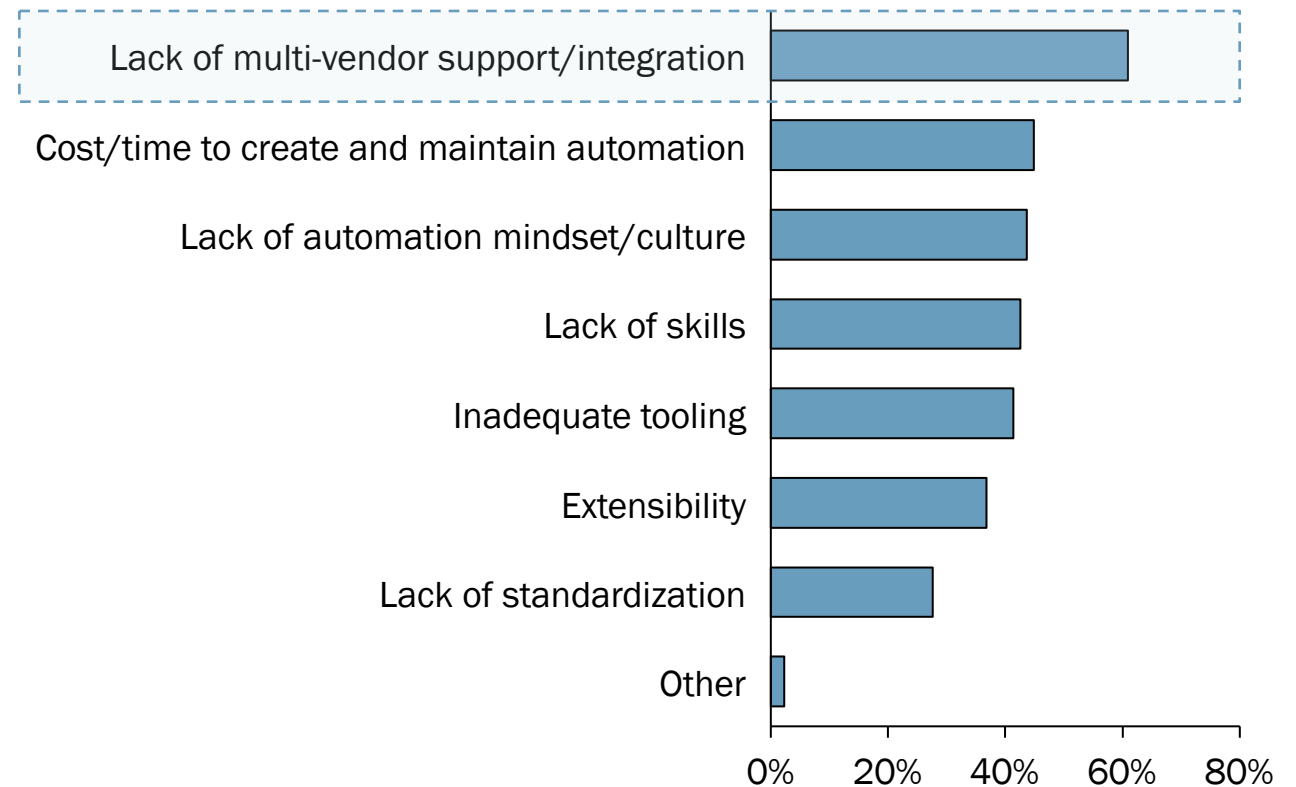
The most automated cloud providers take just days and weeks to carry out key operational processes

- The most automated cloud providers are saving months of work and effort across key Day 0, 1 and 2 data center network operations compared to their least automated counterparts.

- However, the most automated cloud providers still have the potential to improve.

- The time taken to add a new virtual network and the mean time to repair are both of the order of hours for the most automated communication service providers, but of the order of days and weeks, respectively, for cloud providers.

Question: On average, **how long does it take to perform** the following data center network operational processes?

	6+ months	3–6 months	1–3 months	Weeks	Days	Hours
Day 0 - design and planning		⟨⟨⟨		⟩⟩⟩		
Day 1 - configuration, provisioning and validation		⟨⟨⟨			⟩⟩⟩	
Day 2 - rolling out a new server		⟨⟨⟨		⟩⟩⟩		
Day 2 - adding a new rack		⟨⟨⟨			⟩⟩⟩	
Day 2 - NOS upgrades		⟨⟨⟨			⟩⟩⟩	

⟨⟨⟨ Five least automated cloud providers

⟩⟩⟩ Eight most automated cloud providers

Percentage of respondents
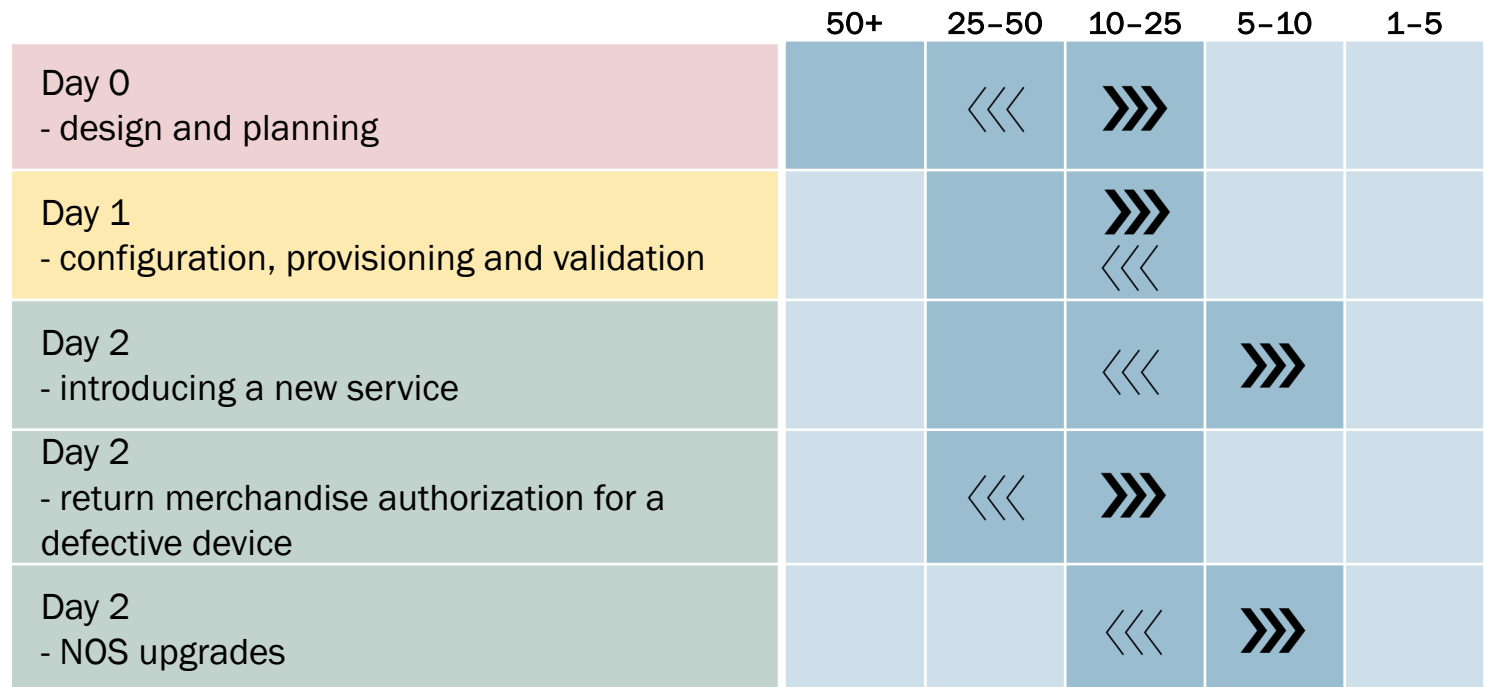
<20%   20–40%   >40%

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Cloud providers are more focused on the operational efficiency benefits of automation than on cutting costs

- The most automated cloud providers deploy only slightly fewer staff on average than their less automated peers for most Day 0, 1 and 2+ processes.

- Reducing the number of FTE hours for key operational processes can lead to significant opex savings, but the most automated respondents are not prioritizing this yet, or have yet to achieve this.

- Cloud providers need large teams to develop and maintain their DIY data center automations and they may not have achieved 'true' automation yet; manual inputs/adjustments are still heavily required.

> " The cloud market is consolidating. We acquired small, cloud-native companies and SI/consulting teams and we are also investing in training new graduates to plug the automation skill gaps in our data centers.
>
> *Cloud Sales Lead, cloud provider from Western Europe*

Question: On average, **how many FTEs** are involved in performing the following data center network operational processes? Per data center

	50+	25–50	10–25	5–10	1–5
Day 0 - design and planning		⟨⟨⟨	⟩⟩⟩		
Day 1 - configuration, provisioning and validation			⟩⟩⟩ ⟨⟨⟨		
Day 2 - introducing a new service			⟨⟨⟨	⟩⟩⟩	
Day 2 - return merchandise authorization for a defective device		⟨⟨⟨	⟩⟩⟩		
Day 2 - NOS upgrades			⟨⟨⟨	⟩⟩⟩	

⟨⟨⟨ Five least automated cloud providers

⟩⟩⟩ Eight most automated cloud providers

Percentage of respondents

<20%   20–40%   >40%

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Overall data center automation trends

The state of in-house data center automation

Recommendations

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82% of cloud providers' data center network operations rely on in-house/DIY automation tools

- Cloud providers rely heavily on a wide range of DIY automation tools and solutions and use these across Days 0, 1 and 2+ operations.

- Cloud providers' third-party vendor share of solutions is lower than that for communications service providers and enterprises.

- A significant use of shell scripts and CLI commands indicates widespread imperative, static and error-prone automation. This may be a contributing factor to the high number of FTEs required in the most automated cloud providers.
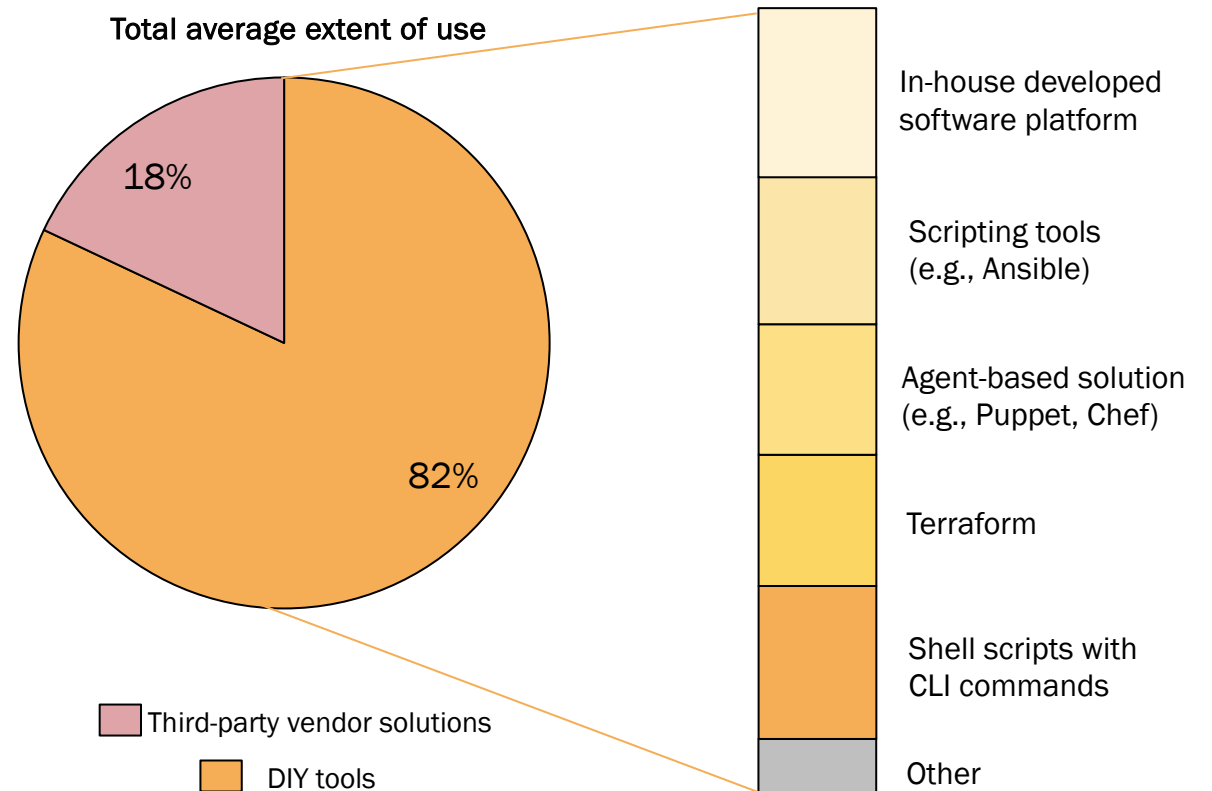
> "
> The different units within our business started with different sets of tools, for example Ansible in networks, and Puppet and Chef within server/storage. But they are increasingly sharing the tools and knowledge between them.
>
> *Director of Network and Cloud, cloud provider from North America*

Total average extent of use

- 18% Third-party vendor solutions
- 82% DIY tools

In-house developed software platform

Scripting tools (e.g., Ansible)

Agent-based solution (e.g., Puppet, Chef)

Terraform

Shell scripts with CLI commands

Other

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Cloud providers believe that DIY tools will help them to achieve differentiation
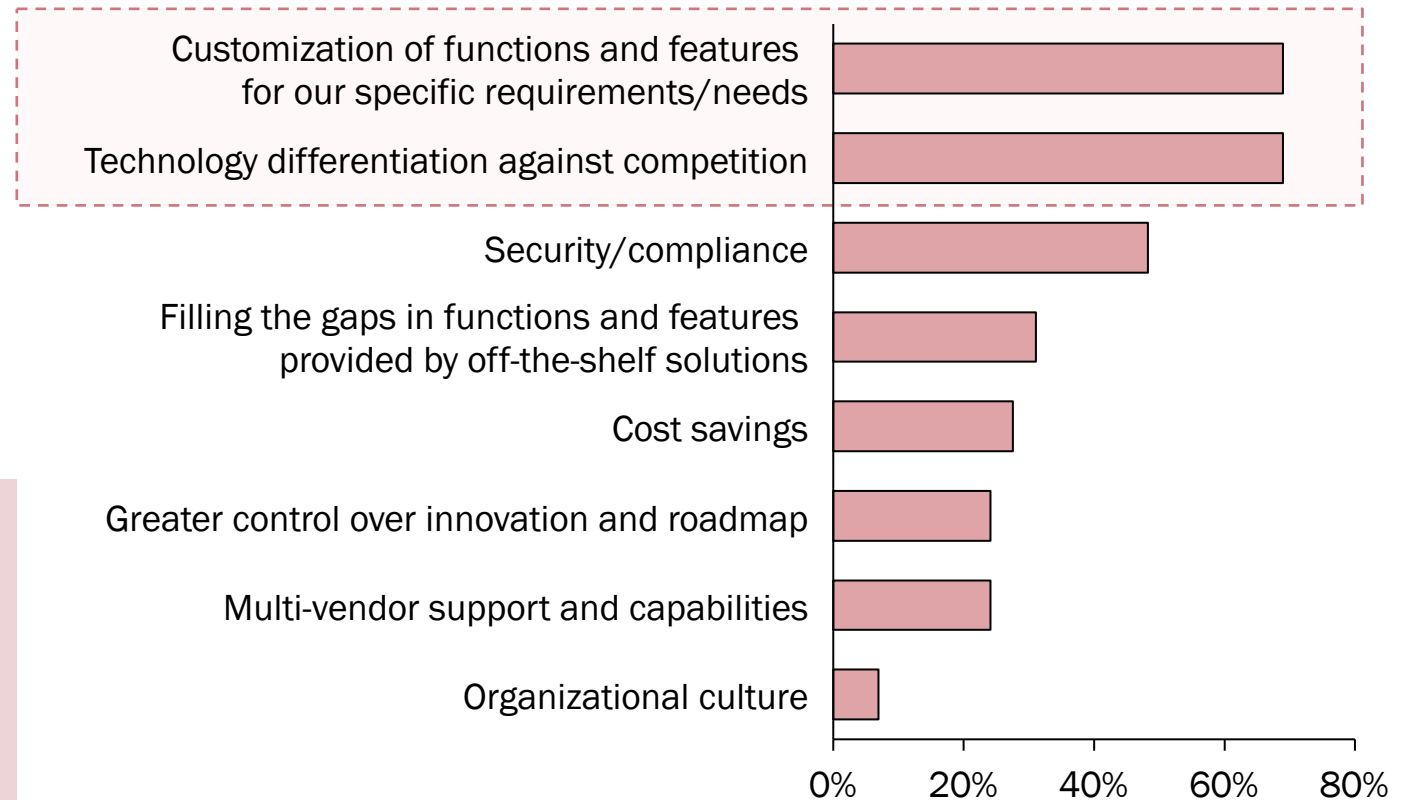
- Cloud providers' data center organizational structures are typically fragmented, with many specialized units/silos.

- DIY software development is deeply ingrained in cloud providers' culture, and helps them to build specific, customized automation for different silos.

- Cloud providers generally believe that third-party vendors' automation solutions will not help them to address their unique needs and stand out from the competition.

> " Cloud providers use huge teams for testing and developing tools to determine what is right for them. This allows them to experiment and identify ways of differentiating themselves. However, it is just too difficult and expensive for smaller companies.
>
> *Cloud Sales Lead, cloud provider from North America*

Question: What are your top 3 motivations for developing data center automation software internally?

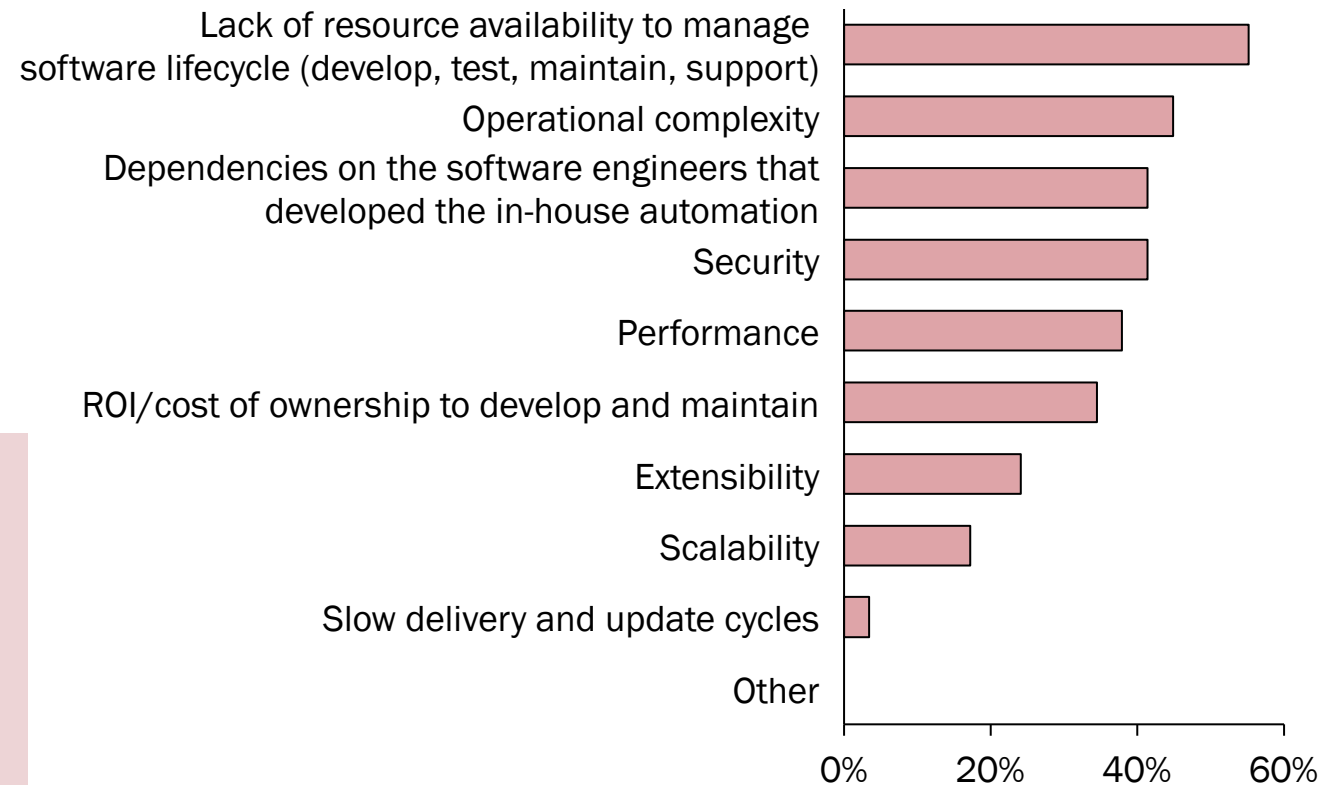| Category	Value
Customization of functions and features for our specific requirements/needs	~68%
Technology differentiation against competition	~68%
Security/compliance	~48%
Filling the gaps in functions and features provided by off-the-shelf solutions	~31%
Cost savings	~28%
Greater control over innovation and roadmap	~24%
Multi-vendor support and capabilities	~24%
Organizational culture	~6%

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DIY data center automation is putting a strain on internal resources and there is not enough staff to deal with complexities

- Many skilled resources are required for DIY automation across the software lifecycle.

- Most cloud providers struggle to deploy staff efficiently, even though they have large dedicated DevOps teams and a large common developer pool (50+).

- A small set of key staff are integral to the lifecycle of DIY automation and the dependency on these individuals is a major concern for 45% of respondents.

- Operational complexity stemming from fragmented multi-vendor environments and the wide range of DIY tools is a challenge for in-house automation activities.

> " Cloud providers remain organizationally siloed, with specific teams developing DIY tools for network, storage, security and so on. Cloud providers want a flatter and leaner organization with automation and SDN, but are struggling to find the right people with end-to-end skills, and are therefore unable to merge teams yet.
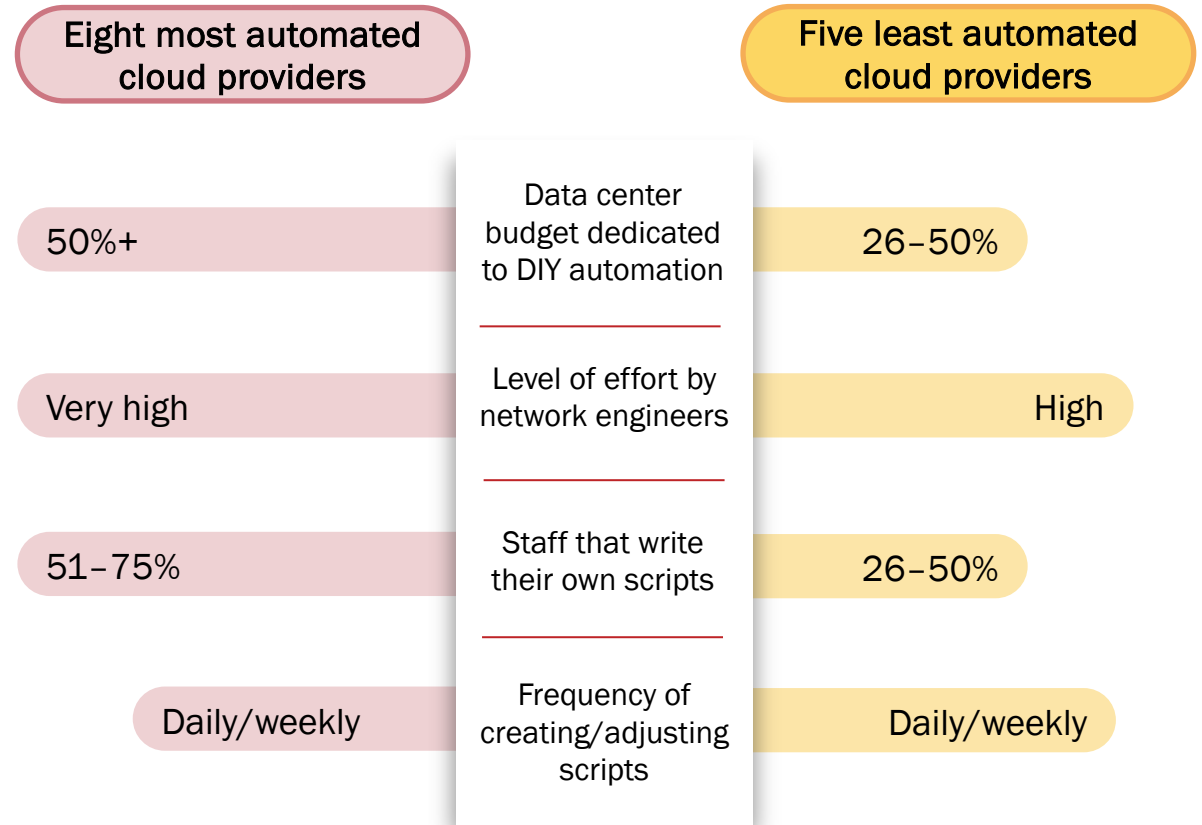>
> *Cloud Sales Lead, cloud provider from North America*

Question: What are the top 3 **challenges** you have with your **in-house developed data center network automation?**

Bar chart showing challenges with in-house developed data center network automation:
- Lack of resource availability to manage software lifecycle (develop, test, maintain, support): ~55%
- Operational complexity: ~45%
- Dependencies on the software engineers that developed the in-house automation: ~42%
- Security: ~42%
- Performance: ~38%
- ROI/cost of ownership to develop and maintain: ~35%
- Extensibility: ~24%
- Scalability: ~17%
- Slow delivery and update cycles: ~3%
- Other: 0%

(x-axis: 0%, 20%, 40%, 60%)

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# Cloud providers incur major opex from resource-intensive DIY automation development

- Cloud providers generally have a formal team that is dedicated to the development and maintenance of DIY automation.

- Seven of the eight most automated cloud providers have a dedicated team (three of which are formed of more than 20 people).

- This contributes to a high DIY automation budget (More than 50% of the entire data center budget).

- All of the least automated cloud providers also do ad-hoc automation development using a pool of common resources in the organization.

- In addition, up to 75% of network engineers write/adjust scripts on a daily/weekly basis across all cloud providers.

- Automation is still too dependent on staff, so the opex benefits of automation are difficult to realize.

Eight most automated cloud providers		Five least automated cloud providers
50%+	Data center budget dedicated to DIY automation	26–50%
Very high	Level of effort by network engineers	High
51–75%	Staff that write their own scripts	26–50%
Daily/weekly	Frequency of creating/adjusting scripts	Daily/weekly

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All cloud providers would revise their approaches to DIY data center automation if they could

- No cloud provider is fully satisfied with DIY automation, but most would rather refine their DIY tools and processes than replace them with third-party vendor solutions.

- The most automated cloud providers still want to continue with an in-house development approach and are open to getting support from external partners (for example, via outsourcing).

- 60% of the least automated cloud providers would opt for a third-party vendor solution; this includes those that suffer the most from a lack of automation culture and skills.

- The larger cloud providers are gradually changing their attitudes towards third-party vendor solutions. The providers that resell vendors' IT tools are also adopting vendor solutions for their internal data center operations.

Question: In retrospect, if you were to make a change to your in-house tooling, what would that be?

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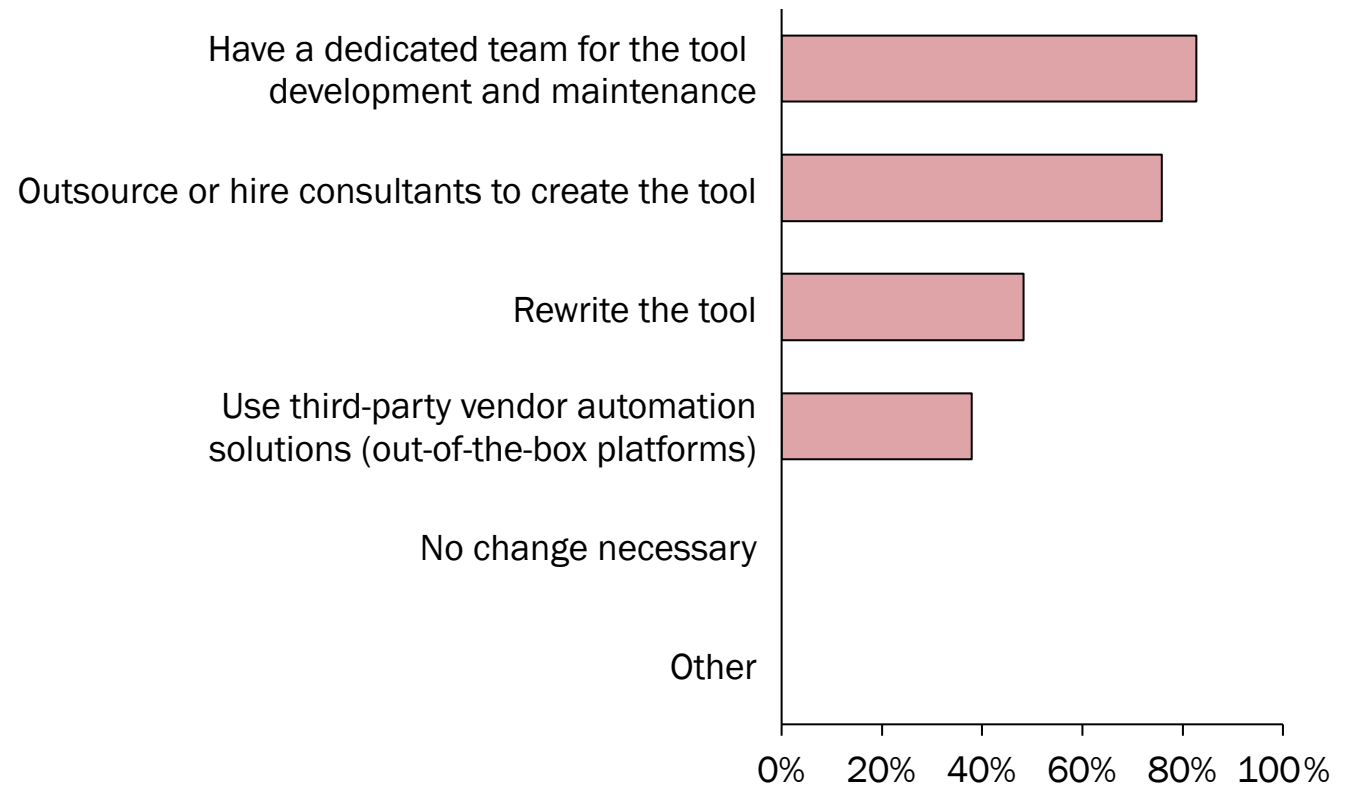
Overall data center automation trends

The state of in-house DC automation

Recommendations

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Recommendations
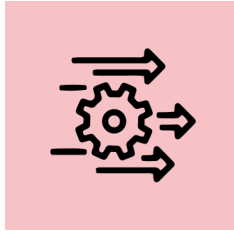
Cloud providers must increase their level of data center network automation to keep pace, or at least narrow the gap, with the major public cloud providers

Some cloud providers are lagging behind the major cloud players such as AWS, Google and Microsoft in terms of data center network automation, and others are finding it difficult to keep pace with them. This could pose a major risk to their competitiveness and longevity if they cannot match the level of agility, programmability and customer experience that these major cloud providers can offer.
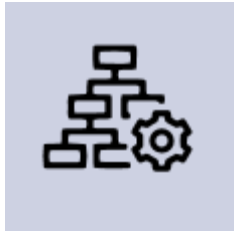
Cloud providers should assess and revise their DIY data center network automation strategies.

Cloud providers' DIY efforts are resource-intensive. These players are struggling to achieve scalable, cost-effective automation. They should identify and map out their DIY activities and processes to see which give them a technical edge and which can use third-party, out-of-the-box solutions so that they can redeploy skilled individuals in areas where they can create real competitive differentiation.

Cloud providers should adopt the right vendor solutions to increase their level of data center automation.

The top data center network automation challenge for cloud providers is a lack of multi-vendor support, leading to operational complexity. Cloud providers should therefore adopt multi-vendor, intent-based platforms to enable repeatable and reliable automation, as well as platforms with developer-friendly SDKs and APIs for seamless integrations with existing DIY tools and workflows. This will help cloud providers to reduce staff costs and integration efforts and maximize ROI.

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Further reading
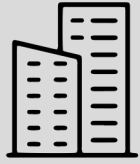
Enterprise survey

Level of data center automation among enterprises is low (37% on average). DIY tools account for a huge proportion of enterprises' data center network automation solutions, primarily due to customization requirements and a desire to save costs.

The full perspective can be found here:

Communications service provider (CSP) survey

CSPs have lower levels of data center network automation than enterprises and cloud providers. They struggle with operational complexity stemming from vendor/technology silos and fragmented automation solutions, and try to use DIY tools to stich these solutions together.

The full perspective can be found here:

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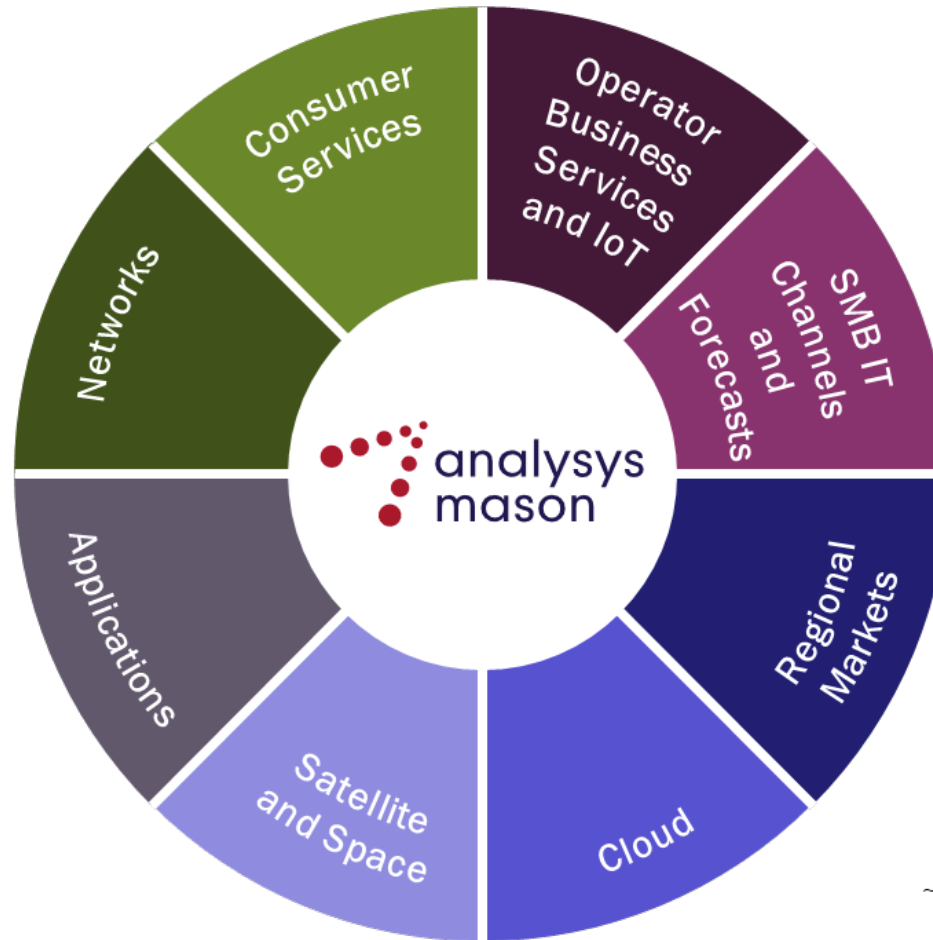
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Regulation and policy

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Transformation

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Change and programme management
Sustainability

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