



Best Practices for Developing and Growing a Cloud-Enabled Workforce

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Executive Overview

The aim of this guide is to provide a practical reference to assist enterprise Information Technology (IT) managers and business decision makers on best practices for developing and growing a “cloud-enabled” next generation IT workforce. The need for businesses to transform their development and operational capabilities for increased agility and efficiency is approaching an all-time high, which in turn drives increased demand for cloud-knowledgeable solution IT architects, operations staff and DevSecOps teams to apply cloud services and related technologies to these challenges. This guide outlines:

- the business reasons to develop and grow a “cloud-enabled” IT workforce to accelerate cloud adoption, agility and transformation;
- a strategic framework to ensure that an enterprise can attract, develop and retain talent using innovative learning experiences and career certification paths that recognizes and rewards employees who are proactive in growing their skills;
- specific best practices and employee development activities in various cloud computing domains that can be employed to ensure that your organization maintains its competitive edge and fosters a partnership between employers and employees.

The Case for a Skilled Cloud-Enabled Workforce

Cloud computing and related technologies like blockchain, data science and artificial intelligence is transforming the nature of IT resulting in skill shortages in some domain areas and staffing surpluses in other traditional IT domains. As businesses consolidate data centers and relocate or virtualize workloads on-premises or via external cloud service providers, the needs for certain data center positions (e.g., facility monitoring/management, server setup and configuration, etc.) sharply diminish. A new set of domain skills around process automation, architecture, resource optimization and cost management are required to drive cloud-based initiatives. A solid understanding of infrastructure, middleware, and application concepts in the context of the enterprise business model is critical.

A recent survey by CEB [1], depicted in Figure 1 below, highlights how some of these expected shifts in IT infrastructure staffing will impact future skills needs with dramatic increases in Security and Cloud Hosting domain skills and corresponding decreases expected in traditional Hosting and Storage skills.

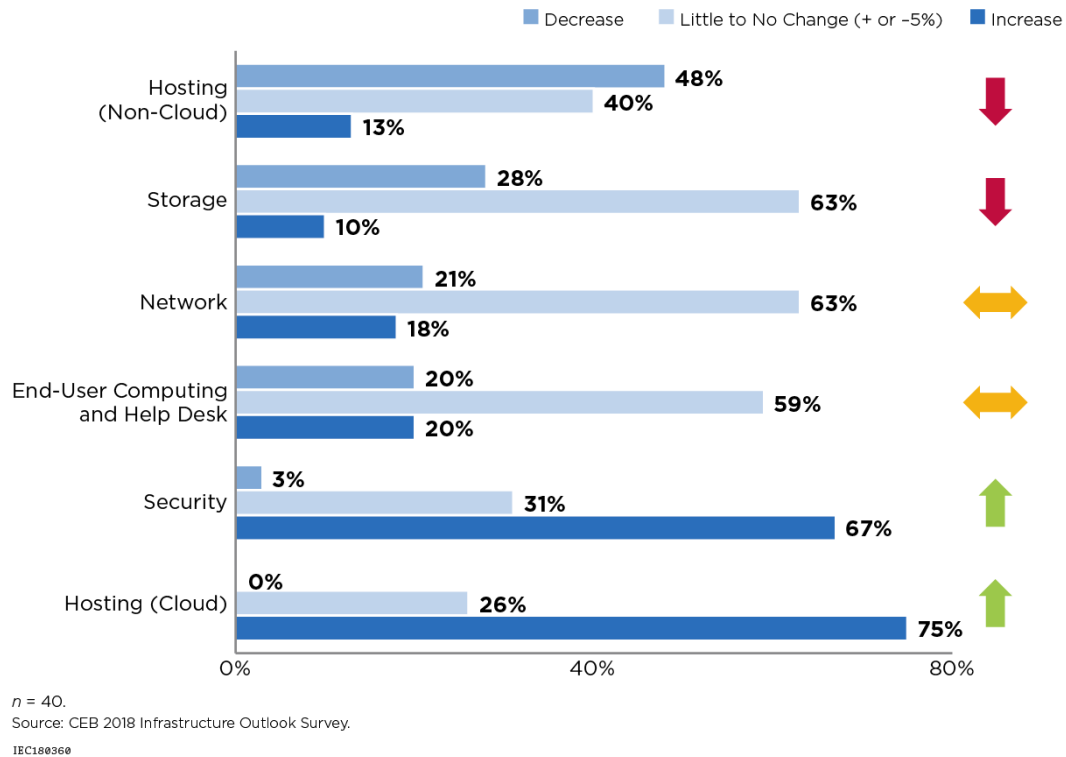


Figure 1: Infrastructure Head Count Changes [1]

A 2016 Cloud Foundry and ClearPath Strategies Global Perceptions study [2] of 845 IT professionals reaffirmed the trend as depicted in Figure 2 that many companies favor investing in new skills development for their existing IT staff to address these shortages over hiring or outsourcing for these skills.

To meet our company's developer skills need, we are putting more emphasis on:

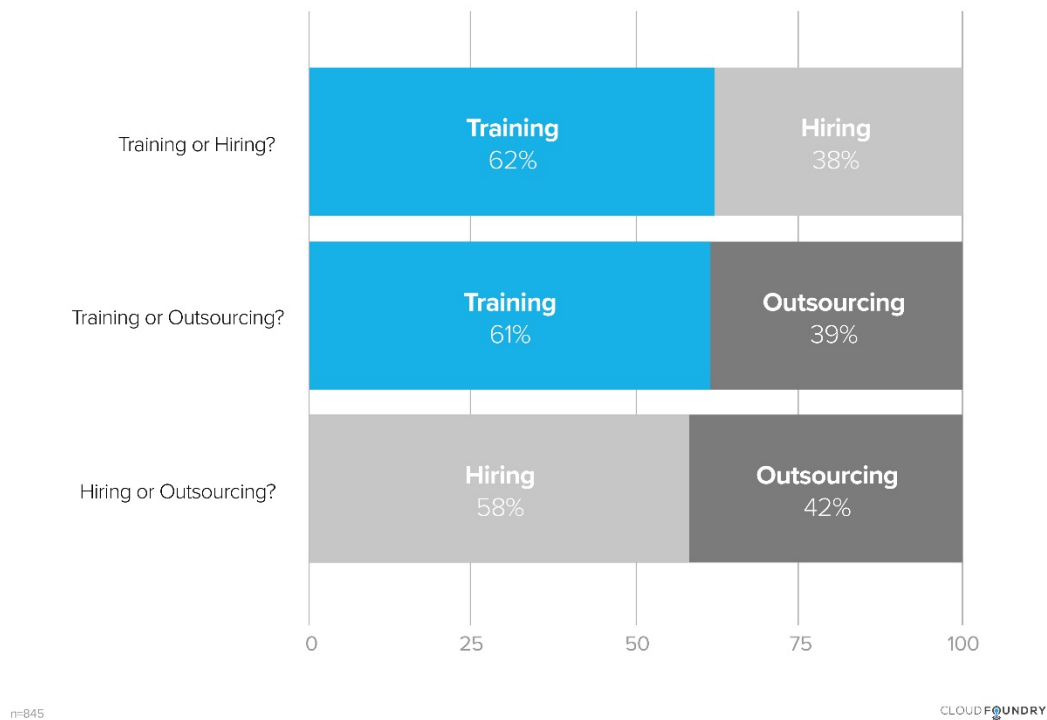


Figure 2: Cloud Developer Skill Acquisition Focus [2]

Another forecast recently predicted by the Gartner Group [3] is that “by 2021 40% of IT staff will be “versatilists” holding multiple roles, most of which will be business- rather than technology-related.” The implications are that those best equipped to thrive in this new era of IT will be those who have a complete understanding of the business value of the technology they are deploying.

To understand the need for a skilled cloud-enabled workforce, we must understand the benefits of cloud computing. These benefits were outlined in the CSCC white paper, *Practical Guide to Cloud Computing v3.0* [4] as:

1. Achieving economies of scale
2. Reduce CapEx by moving to OpEx
3. Improve access
4. Implement agile development at low cost
5. Leverage global workforce
6. Gain access to advanced capabilities

We must also understand that not all these benefits may apply to every organization. Every organization is different, and a justification must be built by understanding the goals of the organization together with the benefits of cloud computing. This can be used to build both an organizational business case as well as a financial business case for transformation of the workforce. When considering these points, consider also that some of these benefits may be the sole purpose of leveraging a cloud solution. The reasons driving these benefits may be technical, business-driven, solving a problem, cost savings, financial, organizational, staffing-related or culture-related.

To achieve these benefits, we must also have a fundamental understanding of just what cloud computing is. The definition of cloud is often context dependent and often referred to as using someone else's computer, outsourcing, or even virtualization. The generic definition of cloud computing contains the following six characteristics as defined by NIST Special Publication 800-145 [5]:

1. Broad network access
2. Measured service
3. Multi-tenancy
4. On-demand self-service
5. Rapid elasticity and scalability
6. Resource pooling

Once the desired benefits and key characteristics are defined for cloud computing, an organization can then develop a case for ramping up the skills of their cloud-enabled workforce. A correlation between characteristics and benefits needs to be identified. As stated above, the reasons driving these benefits can cover a wide spectrum. Cloud computing can clearly change the way organizations, both IT and line of business, do their jobs. Roles change. Control changes. Different governance may be needed, and financial models may need to be changed as well.

A Strategic Framework for Meeting Today's and Tomorrow's Skill Needs

A strategy for ongoing cloud skills training ideally aligns with the organization's cloud transformation plans or an existing cloud strategy. The perception that this is a bit of a 'chicken and egg' issue is common; how can we come up with a transformation plan or strategy if too few people have the skills or understanding?

The adoption of cloud services may be part of a transformation agenda that begins at the top of the organization or it might originate within a Line of Business (LoB), individual department, or a team. When adoption occurs organically, the IT and Procurement teams traditionally responsible for oversight of technology use and purchase are often outside the loop. This can lead to strife, a negative effect on projects, or slow down the possibility of a larger transformation initiative.

Several of the CSCC's practical guides to cloud computing include guidance on whom to include in planning and decision making, processes that are most likely to change, and "gotcha" categories that require the most attention. These guides can serve as key references of the aspects of cloud computing that have a matching skill base or requirement that should be looked at. The information in these guides can help your organization focus attention on areas where it is most important to enlist support. The

papers *Practical Guide to Cloud Computing, v3.0* [4] and *Migrating Applications to Public Cloud Services: Roadmap for Success, v2.0* [6] itemize business and technical personnel, processes and metrics to support identifying new roles and skills needed to sustain a cloud-enabled organization. A list of these whitepapers and links for download can be found in the Resources Appendix at the end of this document.

Step 1: Understand the existing culture

“Culture eats strategy for breakfast...” is a famous quote believed to be originated by Peter Drucker. If an organization wants to adopt cloud computing as a strategy, it is paramount to view it under the fabric of its current culture. Hence the first step would be to understand high level current cultural capabilities in relation to cloud transformation. Understanding the existing culture, which may reflect generational differences, is also key to understanding how to attract and retain new employees. Processes like DevSecOps and Agile development are behaviors, more than they are technologies. Identifying people who are interested in new approaches and eager to learn from colleagues coming in with new skills can help to overcome resistance to change. An organization that makes the effort to understand key areas of its culture and ask the following questions will be much more able to focus on what is needed to develop their cloud enabled workforce, not only from a skills perspective but from a cultural perspective as well.

- Ease of changing IT processes
 - How was the last significant IT process change handled, and what were the reactions from across the organization?
 - Does the organization carry a lot of legacy barriers like procedures, standards and manual processes?
- Ease of changing the financial model
 - How easy or challenging has it been in the past to change a financial model in the organization?
 - Ease of changing or adopting new technology
 - When did the organization adopt new technology, and how did the company adapt to it?
- Ease of changing organizational structure
 - How easy is it to change organizational structure, and adopt the processes and people around it?
- Maturity of automation
 - Do the employees of the organization see automation as an area of improvement, or is the culture lethargic and more comfortable with traditional methods? Were previous automations transformational in nature, or implemented in bits and pieces?
- Maturity on IT security aspects
 - How much importance does the leadership of an organization give to security as a whole?
 - What level of awareness of security best practices exist at the various levels in the organization?
- Maturity and cloud understanding at the leadership level

- Is the leadership style inspirational or prescriptive?
- What level of empowerment does the organization encourage at all levels to experiment with emerging technology?
- What level of empowerment is delegated at all levels of the organization to make it more “responsive” to change?
- Does the leadership understand the full implications of cloud transformation?
- Is the leadership able to ‘connect’ while communicating at the various levels?

Step 2: Understand the skills and processes that are needed

The acceleration that cloud services bring to projects means that the danger of being in a reactive position to skills training is greater than ever. In more traditional project planning, it was sometimes possible to build in time for a developer or admin to learn new skills. Now, organizations are better off if they can attain a proactive approach to identifying necessary skills and encouraging exploration by their technical teams. Some organizations may have Enterprise Architecture groups that scout out new technologies and programming techniques. In other organizations, developers at the Line of Business level might be the most engaged. Companies with ties to academic research or have intern or co-op programs may also have a window on what is up and coming.

Additionally, there are also non-IT skills that may be required. For example, acquisitions, contract management, business process change, accounting, and other domain knowledge will be needed for operations in the cloud and monitoring for improvement. A good example of this is in the accounting and finance area with the financial transition from a Capital Expenditure environment (CapEx) to an Operational Expenditure (OpEx) environment.

Breaking the legacy barriers and mentality

Large organizations will, by nature, have lot of processes (IT and non-IT) carried forward from previous generations of leadership. Usually it is noticed that some of these processes tend to be carried out ‘because it was done previously’, while not looking at the relevance of the same in the current context. While new processes are easy to define, it becomes a challenge to implement due to a mindset barrier. Secondly, some organizations tend to use previously defined IT standards and templates to adapt to the new model, which may not necessarily work well in a cloud adoption model.

The organization should:

- encourage employees to regularly challenge the status quo,
- lean towards empowerment at all levels to freely speak about challenges with the existing processes; the best of ideas can come from employees at the lowest levels,
- be open to changing standards so that it is not a barrier to adopting the cloud and a force fit to pre-defined standards,
- be tolerant of failure when piloting or prototyping new technology or process transformations.

Automation in the blood

One of the key success factors for a cloud transformation is minimizing hands touching IT systems for routine procedures. Ruthless automation is primal, especially for the cloud provider. This is a mandatory requirement to run a cost-efficient, high quality, reliable and secure operation. The cost of operations in a cloud model should be lower by an order of magnitude compared to the traditional model to get economies of scale. To achieve this, a culture of 'hands free' operations should be inculcated amongst the employees.

To encourage automation, the organization should have a specific and defined strategy for these operational changes. This includes amongst others:

- Arriving at a baseline for the time taken to deliver services
- Identifying areas of automation based on business strategies and target market
- Collation of existing automation opportunities
- A framework for automation initiatives
- Executive sponsorship to free up resources so that they can engage in automation initiatives

A cloud enabled workforce that understands the importance of automation and supports it is an important factor in transformation.

DevSecOps

Adopting a DevSecOps methodology is a key paradigm shift for a cloud-enabled workforce to understand. DevSecOps combines development (Dev), security (Sec) and operations (Ops) domains though strong automation, monitoring, testing, and release of new capabilities through all facets of IT service delivery. This contrasts with the waterfall development method and benefits include increased deployment frequency, faster time to market, and dynamic capabilities to align with the speed of changing business.

The DevSecOps methodology requires new roles and new capabilities. While the type of services being delivered may change, the difference is the way in which they are delivered. IT waterfall processes are disrupted for a delivery process that now includes continuous integration, continuous testing, packaging management, advanced release automation, and different monitoring. Adopting a DevSecOps methodology may have a secondary impact on the traditional organizational model. Previously siloed application development, infrastructure and security personnel are now encouraged to function as a seamless team.

Secure operations as a culture

While cloud makes perfect sense for an organization from a commercial perspective, a single major security incident on cloud can be catastrophic to the brand of the organization.

Spread the message that 'security is not just the security team's job'. It must be practiced at all levels. Security is everyone's business, from the physical security of access to floor space, to application and data security. Any cloud implementation should revolve around security requirements, and therefore a

workforce skilled in security concepts is one of the most critical factors in a successful cloud-enabled workforce.

IT Frameworks

One of the considerations and requirements for a cloud environment is to understand the new frameworks the IT development staff and admin staff will be working in. While most developers are familiar with traditional languages such as Java and Python, they are not necessarily familiar with designing cloud-enabled applications. Whether you are migrating existing applications or writing new ones, there is a difference between changing or writing an application to be hosted on the cloud vs. changing or writing an application to be cloud-enabled. This is what we call Cloud Engineering; the architecture, development and delivery of apps and services that are designed to run and leverage cloud services, not just hosted on the cloud.

This requires a variety of skill areas:

- Understanding basic frameworks, such as Docker containers and Kubernetes,
- Understanding Open Source cloud tools and services, such as Cloud Foundry,
- Understanding DevSecOps tooling,
- Architectural experience for modeling such applications and making decisions, such as IaaS vs. PaaS vs. SaaS,
- Being able to do problem determination and problem source identification when issues arise.

In addition, required IT skills differ based on roles. Cloud adopters that are leveraging IaaS and other virtualization services need infrastructure skills specific to a cloud environment in order to build it and run it.

From a development perspective, the traditional legacy support structure, such as ticketing systems, may no longer be available, and developers will frequently find themselves on their own. There may be support venues from an infrastructure point of view, but that will not be helpful when dealing with an application problem. Development teams must be prepared to monitor and support their applications in a run-time environment so a strong consideration when architecting an application to run on the cloud is if there are skills and tools available to provide lifecycle support.

Whenever your organization is a cloud provider (private cloud), or consuming public cloud services, there is a need to guide which workload is appropriate for which cloud model. But beyond this, you need to control the cloud usage to ensure a cost-effective way of running your apps. This “brokerage layer” introduces new roles that do not exist in traditional IT. A shortage of skills in this area is evident today and finding the right person(s) to address this shortfall is key for success. This typically requires a broad knowledge of public and private cloud pricing models.

IT Governance

IT Governance is the cornerstone of a successful IT organization. IT Governance includes the control over and publication of IT processes, standards, and guidelines. It extends to the checking and verification that IT infrastructure and IT applications adhere to those processes, standards and guidelines. This also

includes enforcement and the ability to deal with non-compliance. This is especially important when dealing with government bodies or other organizations with strict controls. Therefore, when considering a cloud-enabled workforce, a critical skillset needed is a familiarity with the concepts and execution of IT Governance from a cloud perspective.

Step 3: Understand the existing skill and process gaps

Once it is understood what skills are needed to cloud-enable an organization's workforce, the next step is to examine the skills that the organization has on-hand and where gaps exist.

One approach is to do an assessment of each employee's current skillset:

- Can their existing skills be leveraged?
- Is there an opportunity or desire for retraining?

This requires a substantial amount of research if there is no skills repository or tool that the organization uses to maintain this type of information. There will be some manual effort involved in gathering this information and then comparing it to the list of skills that are needed.

Once this is done, the data gathered can be reviewed with a conclusion:

- What skills are entirely missing?
- What skills exist, but are insufficient for the expected demand?

A part of this skills picture includes process and process management skills. The organization is facing a new world and perspective when it comes to being a cloud consumer and dealing with its IT portfolio being hosted by someone else. There will undoubtedly be gaps between existing organizational processes and the best practices and processes that need to be considered in the new cloud consumer environment. Therefore, some research needs to be done with respect to these procedural requirements and best practices. An appropriate skill gap analysis needs to be done with respect to the unique skills needed to address these procedures and best practices. Expect this to be manual as well:

- What are the best practices needed for IT management?
- What are the procedures and processes that are needed to adopt these best practices? Do these exist already or do they need to be developed and put in place? Who will lead that effort?
- Does the existing skillset exist within the organization?

Everything from development processes, project management, IT management, and communications must be considered. Someone needs to take on the role of developing these processes, and later, be responsible for governance.

Step 4: Understand what is needed to remediate and close gaps

Once a complete examination of the skills and process gap is done, a plan can be devised to remediate the gaps. Some aspects of the plan become self-evident based on the data. For example:

- List of personnel that can be more effectively utilized by providing additional training
- List of skills that need to be hired
- Reorganization possibilities

Once the need is understood, an IT skills and transformation plan can be developed and enacted.

Disruptions created by Site Reliability Engineering (SRE) & DevSecOps philosophy

An important prerequisite to transforming an IT organization into a DevSecOps culture is getting people to adopt the new environment and roles. Traditionally, IT roles fall into the categories of development, security, operations, or testing (including change management). DevSecOps disrupts these roles, but the technical skills used in the previous roles translate. A good example may be that a developer has the technical skills to set up a DevSecOps tool chain, and a tester or developer has the skillset to create build tests as part of the DevSecOps build and deploy stages.

Site Reliability Engineering (SRE) is a concept that was created at Google [7]. The main principle of this approach is to let software engineers be part of production systems maintenance unlike the traditional approach of having a separate ‘system admin’ or ‘Operations team’. As part of SRE philosophy, management enables software engineers to spend a certain amount of their time performing operations work in addition to development-related activities. By doing so, the expectation is that the developer who is coding the software understands maintenance issues and develops automation for maintaining the system.

An IT skills plan

An IT skills plan needs to be developed to remediate skills gaps. This plan can take a formal approach with a standard project management methodology or tools, or it can be more ad-hoc, such as establishing an education repository, website, or other reference materials that are readily available. The plan can be formalized with classroom training or less formal with on-demand online content such as YouTube™ videos or customized presentations and recordings.

The important thing to remember about enabling self-study and other classroom training is management and organizational support. Time for self-study, supporting sandboxes, attendance at local meetups and lunch-and-learns are all methods for technical staff to gain new skills. There must be visible and tangible support from line managers up to department heads for this to work. This is an important point – when technical staff take time for education, it can affect productivity. The organizational management team must understand this and support this effort and create a balanced approach to including education as an important part of the organization’s culture.

Step 5: Develop and execute plan for remediation

When CompTIA conducted a 2017 survey into the IT skills gap, participants identified five top strategies for remediation [8]:

1. Better ways to provide on-the-job experience, such as internships
2. Better ways to provide intense job training, such as apprenticeships
3. Early student exposure to careers in IT
4. Certifications and credentials to validate skills and knowledge
5. Better assessments and methods for evaluating the skills of job candidates

These strategies are supported by the Harvard Business Review (HBR) report on the “middle-skills” gap back in 2012 [9] in which they identified three attributes of successful programs:

6. Multiple employers in the region or industry sector cooperate with one another and with educational institutions to design and fund initiatives and to train and hire graduates
7. Classroom education is integrated with opportunities to apply new concepts and skills in actual or simulated work settings—an approach proven to be the way adults learn best
8. Training focuses on offering workers career pathways, not just skills for the initial job

The HBR report shows that successful businesses partnered with external organizations (universities, community colleges, high school STEM programs and so on) to develop and sustain programs to remediate the existing workforce and assure a stream of qualified people in the future. These partnerships typically took the form of:

- apprenticeships, internships and co-op opportunities
- sector-based, regional collaboratives
- on-line education programs

Successful execution of a remediation plan will likely include parallel paths including:

1. Quickly training or hiring resources to meet an immediate project need
2. Putting together a sustainable plan to ensure staff maintain/upgrade skills on an ongoing basis
3. Assuring a stream of available new hires with up-to-date technical skills

If the immediate need is meeting a project deadline, the organization will be moving much faster than items 2 and 3 may allow. Treat the solution for item 1 as a pilot that can inform choices the organization makes for its larger initiatives.

Step 6: Prepare to embrace change

Oscar Wilde famously wrote, “Nothing succeeds like success” and it is certainly true that a high profile, successful project that includes a training component is a good advertisement. What is more important than a single, big win is a consistent, intentional program to communicate, celebrate and sustain the habits of ongoing skills training that is embraced by staff and ‘owned’ at every level. This program should include:

- Consistent learning metrics
- Regular survey of learners

- Ongoing review of up and coming technologies
- Align new skill adoption to business success
- Regular communications to participants in programs and to the organization at large
- Consistent ways of recognizing and rewarding learning
- Recruitment of long time employees into skill upgrade programs
- Set expectations during new employee on-boarding

Assuring inclusion of existing employees early on and recognizing their participation in a program is one way to help remove roadblocks to adoption created by a legacy mentality. The leadership of a skills program should also be sufficiently broad such that it demonstrates the value of the program across the organization. Executive sponsorship from Lines of Business, Human Resources and across work group or IT domains is essential. If your enterprise architecture group is active in identification of new technologies, they need to participate in the program.

Best Practices for Cloud Skills Training, Employee Development and Career Growth

Now that cloud computing has become a mainstream initiative within most enterprises and large organizations, it's an excellent opportunity to recognize the wealth of existing formal and informal training materials, knowledge sharing tools, and certification programs that can be leveraged for your workforce. The best part is that it doesn't have to be an expensive and time-consuming process to incrementally build up a training or knowledge-sharing program that can meet your organization's needs. This section lays out a series of steps and various options that leverage the past successes of other enterprises and allows you to choose those best suited to your specific needs.

Recognize the transformative impact and embrace change

Within a relatively short period of time, cloud computing has blossomed from an interesting experiment in resource pooling, on-demand access and measured service consumption to a mainstream element in computing service delivery for many enterprises. The impact extends beyond the underlying IT technology itself to the way new applications are developed and deployed and how organizations budget for IT spending. Major elements of IT have suddenly become commodity services that can be rapidly provisioned and released as the business needs change. While some members of the IT department may become initially threatened by the prospect of being "outsourced," a healthier way to think about this transformation is that the value proposition of the IT team has shifted up the service delivery stack. A new set of "full-stack" IT skills as depicted in Figure 3 will be required to help guide an organization to become smart consumers of this new service-based environment as traditional IT usage models change to make cloud computing a viable business proposition.

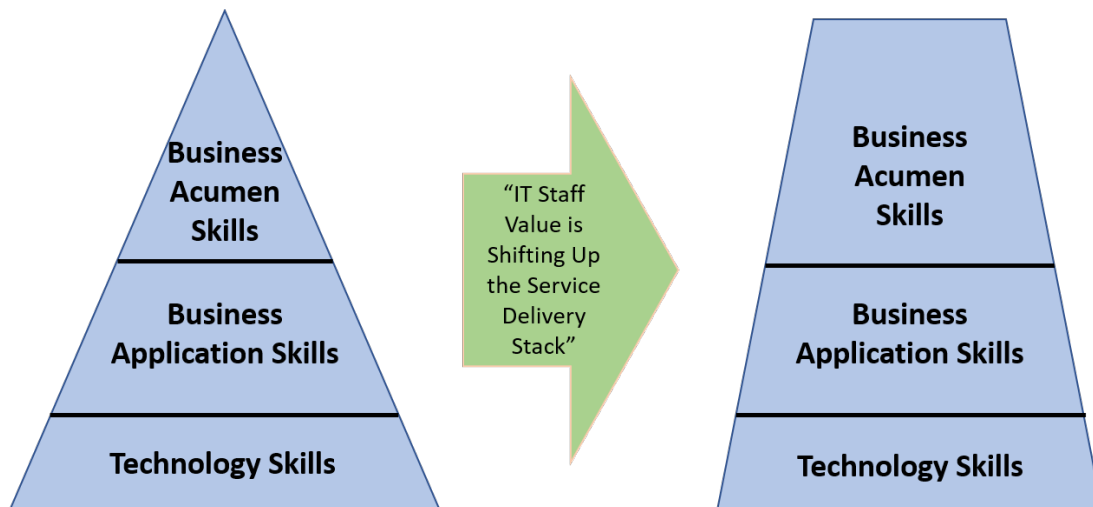


Figure 3: Shifting the Value of IT to Meet Changing Business Demands

While the service delivery and operations model and skillset may have shifted, it takes considerable new skills to assemble these cloud service elements into cost-effective and fault-tolerant building blocks for enterprise IT. Many seasoned IT professionals have experienced several paradigm shifts during their IT careers and this particular shift can bring new learning and growth opportunities once they embrace the prospect of change and its challenges. **As with any technology that is new and evolving, cloud skills are not a “once and done” activity but a continual knowledge and professional growth opportunity that can keep your IT workforce engaged and excited.**

Share ownership for rolling out new learning and development programs

When creating an enterprise cloud education and training program, it's best to rely on your intended audience to help you craft a blueprint for the new program. This can be accomplished in several ways. Some organizations hold short “think time” events and gather several key junior and senior members of the IT staff together with other stakeholders from the education/training department, for example, to map out various avenues for curriculum development. This may lead to informal on-the-job training, lunch-and-learn sessions, after hours education, or formal vendor-led training. It can also be accomplished by enlisting the support of a small team of company stakeholders with the challenge of coming back with creative ideas for a new pipeline training program that is briefed to management for approval and funding.

Start out by clarifying your goals and skills development objectives and identify the best options to achieve those goals. Understanding budgetary and schedule constraints, specific cloud skills to be acquired, and numbers of staff members requiring training in various disciplines are essential core elements of any program. Encouraging creative thinking and maximizing team involvement will pay dividends to engaging your workforce towards a win-win outcome.

Think of your cloud training and knowledge-sharing program as a multi-phased journey rather than a sprint and structure your planned offerings to align with the phases of your cloud deployment. Undoubtedly, there will be many details to iron out and bumps in the road along the journey, and these

will form the basis for lessons learned and mid-course adjustments. Your cloud development and deployment team will form the basis of your future subject-matter experts and likely assist in the critical on-the-job training of your other IT staff members. Let them do the critical learning first before pressing them to pay it forward with training courses they may be ill prepared to conduct.

Leverage the wide range of knowledge sharing tools already in existence

Unless your target cloud service deployment is extremely unique to your organization, there is little need to completely “re-invent the wheel” when it comes to leveraging existing cloud knowledge resources. Have the team that is establishing your training or knowledge-sharing programs survey existing resources to see what content they can apply to your program and establish customizations that may be specific to your defined operational processes and procedures to augment existing “out of the box” training or learning modules. Most of the foundational and intermediate-level cloud training materials and cloud service provider or online courseware will apply to the majority of the cloud deployments. Advanced cloud administrator training and organization-unique processes, workflows, and procedures may need to be developed and delivered by in-house resources on a topic-by-topic basis. Specific resources to survey for existing content should include:

- Cloud service provider virtual or instructor-led training
- Third party training resources such as business partners or training consultants affiliated with your cloud server provider or platform provider
- Massive Open Online Courses (MOOCs) that offer free or low-cost cloud-specific training
- Cloud Certification Provider Education aligned to your service or platform of choice
- Online virtual seminars and YouTube™ instructional videos on specific cloud technology or product topics
- Your existing skilled workforce that is configuring your cloud service catalogs, establishing service deployment templates and defining your organization-specific processes and procedures

Another useful approach to augment “out of the box” training and knowledge-sharing for maximum impact is to consider pairing experienced and less experienced staff members together in informal or formal mentoring relationships during critical phases of the cloud deployment program. Having that additional working relationship during periods of significant workplace change can strengthen the team and provide valuable just-in-time knowledge reinforcement that is context-based to your environment.

Recognize the accomplishments of those who take control of their career development

Having an excellent training and learning/development program established to grow and inspire an organization’s transformation to the cloud certainly provides a solid foundation for organizational success. However, it takes the initiative and perseverance of IT staff to yield the dividends of this acquired knowledge. While many people in IT careers are drawn to this field by the prospect of the continual learning and growth opportunities that new technology brings, some will view the transition to cloud technology as a direct threat to their livelihoods. This becomes an opportunity to reward those who take control of their career development by active participation in the cloud training and development programs with recognition of their accomplishments. Formal recognition may take a variety of forms depending on an organization’s existing employee recognition and communications

channels. Additionally, there's an opportunity to identify emerging cloud talent with roles that allow them to apply this newly acquired skill with stretch assignments in future phases of the cloud deployment team and to assist in cloud mentoring, knowledge transfer sessions, and new cloud service deployments. Where possible, integrate these learning and knowledge-sharing objectives into the performance objectives of your key staff so success can be measured and recognized.

Survey of Available Cloud Training and Certification Programs

The following table contains a list of some of the available cloud training providers and certification programs in various cloud computing services, platforms or technologies. It is not intended to be a complete and exhaustive list, but to introduce the reader to the breadth of options, programs and career growth paths in cloud technologies that may be pursued. The applicability of a given program, service offering, or certification path will vary based on the technology, platforms or services targeted by an organization.

Table 1: Survey of Cloud Training and Certification Offerings

Offering	Program Type	Website URL
A Cloud Guru	Training and Certification Prep	https://acloud.guru/
AWS Training and Certification	Training and Certification Prep	https://aws.amazon.com/training/
Azure Training and Certification	Training and Certification Prep	https://www.microsoft.com/en-us/learning/azure-training-certification.aspx
Cisco CCNA Cloud Training	Training and Certification Prep	https://www.cisco.com/c/en/us/training-events/training-certifications/certifications/associate/ccna-cloud.html
Cloud Academy	Training and Certification Prep	https://cloudacademy.com/product/courses/

Offering	Program Type	Website URL
Cloud Credential Council	Training and Certification Portal	https://www.cloudcredential.org/
Cloud Institute	Certification Exams	http://cloud-institute.org/
Cloud Security Alliance	Training and Certification Prep	https://cloudsecurityalliance.org/
CompTIA Cloud Essentials	Certification Exam	https://certification.comptia.org/certifications/cloud-essentials
(ISC) ² Cloud Security Training and Certification	Training and Certification Program	https://www.isc2.org/Certifications/CCSP
OpenStack Training Marketplace	OpenStack Training Provider Portal	https://www.openstack.org/marketplace/training/
Oracle Cloud Training and Certification	Training and Certification	http://education.oracle.com/pls/web_prod-plq-dad/ou_product_category.getPillarPage?p_pillar_id=502 http://education.oracle.com/pls/web_prod-plq-dad/ou_product_category.getPillarPage?p_pillar_id=502&p_mode=Certification
SANS Cloud Security Training	Cloud Security Training	https://www.sans.org/course/cloud-security-fundamentals

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Summary of Keys to Success

Make learning a part of every job and project and ensure that it is part of the yearly objective of each staff member. Make mentoring within teams and sharing skills a yearly goal and requirement for advancement. Paired programming can be adapted for a “learn one, do one, teach one” training program. Leverage a variety of proven techniques (e.g., agile development practices, targeted online skills training, apprenticeships, lunch-and-learns, and mentoring) to include training more efficiently in day-to-day activities. Reward those who embrace and drive the change with recognition.

Keep track of where you are and where you want to be. To be successful, your program needs to be able to adapt to the ever-changing cloud technical and business landscape. Align your training program to your cloud adoption transformation, so a twice per year assessment of current skills and gaps prevents surprises and gives a longer runway for attainment of new business needs.

Don’t re-invent the wheel. Leverage existing training capabilities and involve a range of IT staff members to build your specific education roadmap. Build an education program reflective of the mix of your new hires and skills growth for existing IT staff.

References

- [1] CEB: *Building an Adaptive Infrastructure Workforce*. CEB Infrastructure Leadership Council, March 2018. CEB is now Gartner.
<https://www.cebglobal.com/member/infrastructure/research/digital-white-paper/18/building-an-adaptive-infrastructure-workforce.html>
- [2] Cloud Foundry: *Identifying the Developer Gap*. Cloud Foundry Global Perceptions Study, November 2, 2016.
https://www.cloudfoundry.org/wp-content/uploads/2016/11/CFF_DeveloperGap_2016Report_Lo_res.pdf
- [3] Gartner: *Top Strategic Predictions for 2018 and Beyond*. October 3, 2017.
<https://www.gartner.com/smarterwithgartner/gartner-top-strategic-predictions-for-2018-and-beyond/>
- [4] Cloud Standards Customer Council: *Practical Guide to Cloud Computing*, v3.0. December, 2017.
<http://www.cloud-council.org/deliverables/practical-guide-to-cloud-computing.htm>
- [5] NIST: NIST Special Publication 800-145, *The NIST Definition of Cloud Computing*. September 2011.
<https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf>
- [6] Cloud Standards Customer Council: *Migrating Applications to Public Cloud Services: Roadmap for Success* v2.0. February 2018.
<http://www.cloud-council.org/deliverables/migrating-applications-to-public-cloud-services-roadmap-for-success.htm>
- [7] Beyer, Betsy et al.: *Site Reliability Engineering: How Google Runs Production Systems*. O'Reilly, March 2016. <https://landing.google.com/sre/book.html>
- [8] CompTIA: *2017 Skills Gap Survey*. May 2017.
<https://www.comptia.org/about-us/newsroom/press-releases/2017/06/26/organizations-struggle-to-close-widening-skills-gaps-comptia-survey-reveals>
- [9] Harvard Business Review: *Who Can Fix The Middle Skills Gap?* December 2012.
<https://hbr.org/2012/12/who-can-fix-the-middle-skills-gap>