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DIHUB DACUM Process

Cloud job and skills at glance

Algebra University College

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DIGITAL INNOVATION HUB FOR CLOUD BASED SERVICES

Content

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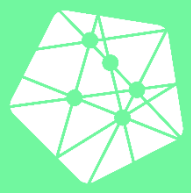
DIHUB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1. DIHUB Digital Innovation Hub for Cloud-Based Services

A DACUM (Developing A Curriculum) provides the foundation for the development of education, training and other performance improvement interventions by using information gathered from relevant stakeholders within a desired job description and/or occupation during a analysis process. The DACUM yields a Job/Duty/Task Chart that lays out Areas of Responsibility (Duties) and tasks that performers in the target position accomplish on a regular basis. The analysis chart also provides additional information about traits, characteristics, attitudes, essential tools/equipment, and trends and/or issues that impact how performers do their work.

DACUM is a widely used, effective, international method of job analysis. The Experimental Projects Branch, Canada, Department of Manpower and Immigration, and the General Learning Corporation of New York designed the process in the 1960's. Since then acceptance of the process continues to grow. Business and industry, the military, secondary and post-secondary schools, and government agencies employ the DACUM Competency Analysis Process at local, national, and international levels.

The DACUM philosophy states that high-performers are the best source for information concerning their roles or positions.

DACUM is a quick yet highly valid job analysis technique. The DACUM process is used to determine the competencies that should be addressed in a training curriculum for a specific occupation. DACUMs are used to develop job profiles for all types of occupations, including top-level managers and specialized jobs. This cost-effective and efficient technique has been validated through research and compares very positively with other job analysis methods. DACUM is based on three premises: (1) expert workers can better describe their job than anyone else, (2) any job can be effectively described in terms of the competencies or tasks that successful workers in that occupation perform, and (3) the specific knowledge, skills, attitudes and tools required by workers in order to correctly perform their tasks can also be described.

The result of the first part of the DACUM process is a chart or profile that shows the duties and tasks performed in the occupation. The profile also lists necessary worker traits and attitudes, general skills and knowledge, and the tools and equipment the worker uses. Once a DACUM profile is developed and reproduced on paper, it should be validated by having other expert workers and supervisors review it for completeness and accuracy. The validation process can include a variety of criteria, but some of the most useful are criticality of the task, frequency that the task is performed. and need for training this task. The specific tasks that should be included in a training curriculum are one of the outcomes of the validation. The next step after validation is task analysis. Through task analysis, ideally conducted jointly by expert workers and curriculum developers, each task is further analysed and broken down into sequential operational steps. These steps describe exactly how to accomplish the task and should include the specific knowledge, skills, tools, and equipment needed to perform the task. The completed task analyses become the foundation or outline for developing the training curriculum.

Considering cloud technologies to be horizontal and not easy to be separated from other related digital ecosystem components, goral of this document is to provide relevant, resourceful yet well-structured and easy to use starting point aligned with DIHUB position of first-stop-shop for all practitioners in cloud technologies together with relevant policy and industry representatives.

For the need of this document, the DIHUB DACUM process will be focused on mapping all aspects of cloud and will be guided in seven stages:

Stage #1: Description of key facts of cloud technologies
Stage #2: Identification of experts in cloud technologies, organization of interviews to chart the need-structure
Stage #3: Based on the interview results, identification of specific jobs on the labor market that are pertinent for various aspects of cloud technologies with aim to cover all aspects of cloud ecosystem
Stage #4: Description of jobs identified under Stage #3 in the matrix "tasks/skills" including relevance score for most important skills
Stage #5: Description of jobs identified under Stage #3 in the matrix "groups of skills" + establishing ESCO connections
Stage #6: Defining micro-credentials learning programs (curricula) for life-long learning and certification programs

Stage #7: Devising sets of recommendation on integrating the learning programs defined in Stage #6 in the EQF5 and EQF6 study programs

2. Cloud technologies: Key facts and business overview[1]

Cloud technologies are accelerating the pace of digitally empowered change and facilitating entirely new ways of doing business. In order to build competitive advantage, a company cannot start with technology – it must start with learning about cloud technologies. Successful **cloud strategy has to address business imperatives** and opportunities that are specific to industry, business model, and human capital requirements. It is about mapping a organizational and technological path of continuous transformation making it integral part of the company culture – using it to set the stage for the company that it is intend to become.

Organisations that **move quickly have an opportunity to rethink** how technology is enabling virtual work, workforce, and workplace and to use infrastructure as a competitive differentiator.

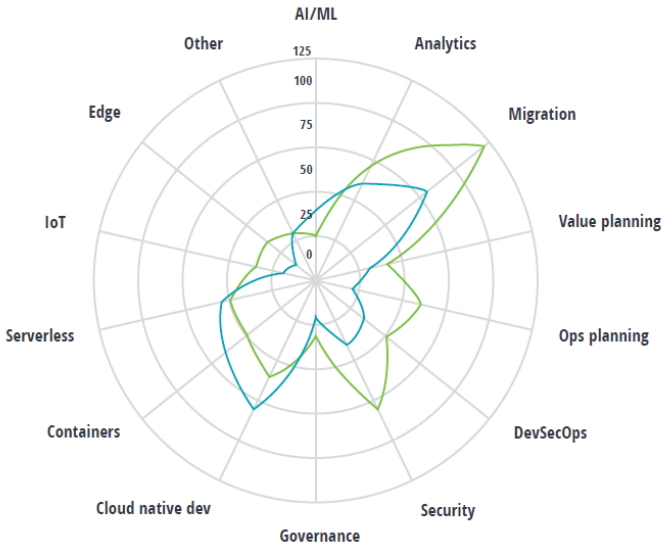

Figure 1 Importance related to cloud technologies, key shift points; survey

Legend:
blue line (Pre-pandemic cloud market before 2020)
green line (PostPandemic cloud market 2021-)

Source:
The future of cloud-enabled work infrastructure, Deloitte Insights (perspective based on several sources, including analyst input, clients, and thought leadership trends, among others)

Growth in cloud computing has been a megatrend over the last decade, with the market experiencing triple-digit annual growth. Even though growth among the largest hyperscale public cloud providers had declined to "only" 31% annually by the end of 2019, and this rate had been projected to (slowly) decline further in 2020 and 2021 as the industry-matures, growth in cloud continued to outpace that in many other sectors. It would have not been surprising to see cloud spending go down a few points in 2020, given the spending reduction in multiple areas driven by the COVID-19 pandemic and the associated global recession. Instead, the cloud market has been remarkably resilient. As shown on Figure above, by some metrics, growth was more or less flat in 2020; by some other ways of measuring growth, it increased faster than in 2019, even in the face of the steepest economic contraction in modern history. The likely reason: COVID-19, lockdowns, and work from anywhere (WFA) have increased demand, and it is predicted that revenue growth will remain at or above 2019 levels (that is, greater than 30%) for 2021 through 2025 as companies move to cloud to save money, become more agile, and drive innovation.

Of course, cloud is not the only solution available to play. When viewed at the total company level, very few systems will be only on-premise, only public cloud, or only private cloud. Most deployments will likely use a combination of a public cloud and a private environment that remain distinct entities but are bound together, an approach known as hybrid cloud. Hybrid cloud can take many forms, such as a combination of private with public cloud or public cloud with on-premise resources, but all offer the benefits of multiple deployment models.

[1] Inspired by/based on the following literature: *"Unlocking value: Four lessons in cloud sourcing and consumption", McKinsey, November 2020 by Abhi Bhatnagar, Will Forrest, Naufal Khan, and Abdallah Salami; "Debunking seven common myths about cloud", October 2020 by Mark Gu, James Isenberg, Leandro Santos, and Isabelle Tamburro; "The future of cloud-enabled work infrastructure", Deloitte Insights; "Technology, Media and Telecommunications Predictions 2021", Deloitte Insights; "Cloud strategy and readiness", Deloitte.*

2.1. Cloud adoption

Cloud adoption is no longer a question of "if" but of "how fast" and "to what extent." Between 2015 and 2020, the revenue of the big-three public cloud providers (AWS, Microsoft Azure, and Google Cloud Platform) has **quintupled**, and they have **more than tripled their capital-expenditures investment** to meet increasing demand. And enterprises are ever more open to cloud platforms: **more than 90% of enterprises reported using cloud technology in some way**[2]. These trends reflect a world where enterprises increasingly "consume" infrastructure rather than own it. The benefits of this model are plentiful. Cloud adopters are attracted by the promise of flexible infrastructure capacity, rapid capacity deployment, and faster time to market for digital products. The COVID-19 crisis has accentuated the need for speed and agility, making these benefits even more important. From an infrastructure economics perspective, perhaps the **most attractive innovation of cloud is the ability to tailor the consumption of infrastructure to the needs of the organization**. This promises greater economic flexibility by transforming underutilized capital expenditures into optimally allocated operations expenditures. While this concept is attractive in theory, **many enterprises are facing challenges in capturing the value** in reality. Enterprises estimate that around 30% of their cloud spend is wasted. Furthermore, around 80% of enterprises consider managing cloud spend a challenge. Thus, even though more than 70% of enterprises cite optimizing cloud spend as a major goal, realizing value remains elusive[3].

A **major driver of value capture** is transforming the approach to sourcing and consuming cloud. Enterprises that approach this task with a traditional sourcing and infrastructure consumption mindset are likely to be surprised by the bill. The flexibility to consume cloud as needed and cost effectively places responsibility on enterprises to maintain a real-time view of their needs and continuously make deliberate decisions on how best to adjust consumption.

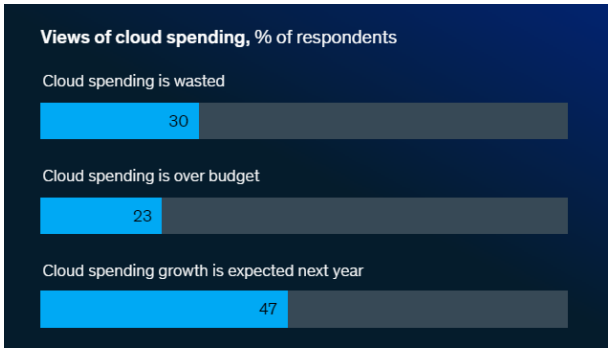

Figure 2 Views of cloud spending[4]

Over the years, enterprises developed a robust model for sourcing IT infrastructure assets. It is episodic in nature based on asset refresh cycles and follows a structured sequence: requirements to request for proposal (RFP) to negotiations to award. Success in this model requires solid negotiation and contracting skills and the ability to engage the business at the right touchpoints in the process. The RFP juncture came to constitute the major point at which value was captured. Once the contract was signed, the organizational focus normally shifted to other areas until the next negotiation cycle. Cloud economics mandates a fundamentally different approach. While cloud service provider (CSP) selection and negotiation are critical components of the cloud journey - determining, for example, the price of services and discount levels - many of the decisions impacting value capture come afterwards. The **very flexibility that cloud provides** means that enterprises must continuously make dynamic consumption decisions about which services and specifications are needed when and for how long.

Many organizations have moved beyond the initial challenge of selecting multiple cloud providers, determining what data to store in public or private cloud services, and managing interoperability across their multiple cloud infrastructures. The next frontier in managing cloud complexity will likely be about building on that foundation by configuring tools, software, and technology to deliver a full-stack, multicloud solution - whether that includes identity and access management, network monitoring, metadata management, or artificial intelligence for IT

[2] *2020 Flexera state of the cloud report, Flexera, April 2020, https://www.flexera.com/about-us/press-center/flexera-releases-2020-state-of-the-cloud-report*
[3] *ibid*
[4] *ibid*

operations (AIOps) to manage workforce systems and platforms used to perform work. Multicloud solutions should consider orchestration across these tools and technologies to manage data, resources, and workflows and help ensure the most efficient flow of data across the full solution architecture including storage, databases, platforms, and even security. Only then can the multicloud infrastructure efficiently and securely support business applications to drive value on an application-by-application basis.

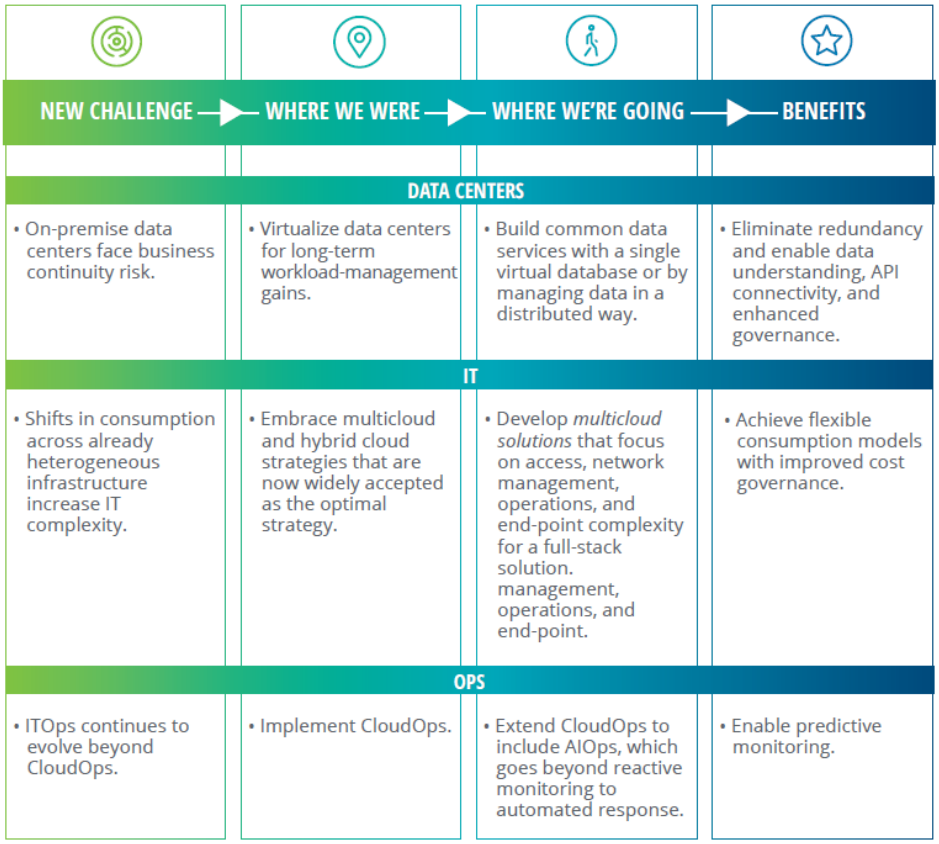

Figure 3 Cloud challenges and benefits

Each of these decisions **can have significant cost implications** if not deliberately managed. The need to continuously manage cloud consumption is accentuated by the rapidly evolving vendor marketplace and its continuous introduction of new offerings, features, pricing mechanisms, and regions.

With server and storage assets essentially being commodities, enterprises purchasing traditional infrastructure optimized around two variables: **price and quantity**. The latter is less flexible, as it is mandated by the number of assets that need to be refreshed and by fluctuations in peak and average demand. This has encouraged enterprises to focus on supply-side solutions, such as consolidating volume, standardizing SKUs[5] (Stock Keeping Units), and structuring favourable contract terms. In a cloud world, enterprises have to solve for more numerous, interconnected, and demand-focused variables. Take compute as an example: Which instance types, of the dozens offered, deliver the right balance between performance and cost? Should the enterprise preselect instance types to be used by teams or leave the decision to the teams based on the use case? Which instance regions should be selected? For example, does the cost benefit ratio justify provisioning instances closer to the customer in order to minimize latency? How long is the capacity needed, and if the duration is predictable, should the organization purchase reserved capacity rather than on-demand, since reserved instances can be up to 60 percent cheaper? And finally, how should the enterprise dynamically adjust these choices as it rolls out new products and features or expands into new markets and geographies? Given these variables, **a deep understanding of an enterprise's demand is critical** across the cloud journey. During the CSP selection and negotiation phases, enterprises equipped with a proper understanding of the level and variability of their future demand will be able to better negotiate discounts and make calculated decisions on

[5] *SKU stands for "stock keeping unit", a number (usually eight alphanumeric digits) that retailers assign to products to keep track of stock internally, once it arrives from a warehouse or distributor*

spend commitments, if any. Following that, on a continuous basis, enterprises that capture value are ones that take a “consumption approach” to cloud, continuously matching their demand to the best fitting cloud services and pricing arrangements.

While visibility into and forecasting of spend are critical to any procurement category, they are particularly important to cloud given it is a continuously sourced (“consumed”) service. Capturing value from cloud **requires a clear understanding of actual usage costs** in order to stem any value leakage from excessive or miscalibrated consumption. However, enterprises often find themselves mired in an intractable sprawl of cloud services with inadequate visibility into the corresponding spend. The large and growing range of cloud offerings and pricing arrangements in the marketplace - as well as often obsolete managerial processes - do not make this problem easier. To gain greater control of their cloud spend, top performing enterprises focus on developing three capabilities: understanding the business and technical drivers of consumption, then establishing granular visibility to monitor and track cloud spend, often assisted by internal analytics or third-party tools - deriving the unit-cost economics according to the hierarchy of business and technical drivers, based on detailed historical analysis of consumption patterns, then developing the analytical model and governance to accurately forecast consumption - optimizing consumption (through economic drivers such as reserved instances, or architecture drivers such as spot fleet) to inform business decisions (for example, through deriving cloud cost per subscriber or product)

Given the complexity and differentiated nature of cloud economics, existing capabilities and organizational constructs cannot fully capture the value at stake. For many companies, sourcing organizations can bring financial and process discipline, but they often lack the technical depth and ability to stratify business demand in sufficient detail. This often leads to rigid sourcing standards that delay and constrain flexible capacity deployment. On the other hand, entrusting product or technology teams with the task can maximize agility and grant developers the freedom to flexibly and rapidly stand-up capacity; however, many organizations have observed that this approach leads to fragmented decision making, poor spend visibility, and insufficient financial discipline. Top-performing enterprises instead are deliberate about bringing together technical, financial, and sourcing talent into a cross-functional cloud financial-operations team to manage cloud sourcing and consumption. In many cases, companies can be successful by supplementing their existing sourcing or technology functions with **relevant talent**. This team is then empowered to orchestrate across stakeholders, translate the business’s consumption needs into optimal cloud offerings and pricing arrangements, oversee and make rapid decisions around resource allocations and cloud usage, and track enterprise-wide cloud spend to ensure financial discipline. Importantly, this cloud-management team is provided with the right analytics, tooling, and automation, such as automated dashboards to better track cloud consumption in real time and advanced analytics to help project demand. As enterprises progress along their cloud journey, transforming the way enterprises source and consume cloud will make the difference between value capture and value leakage.

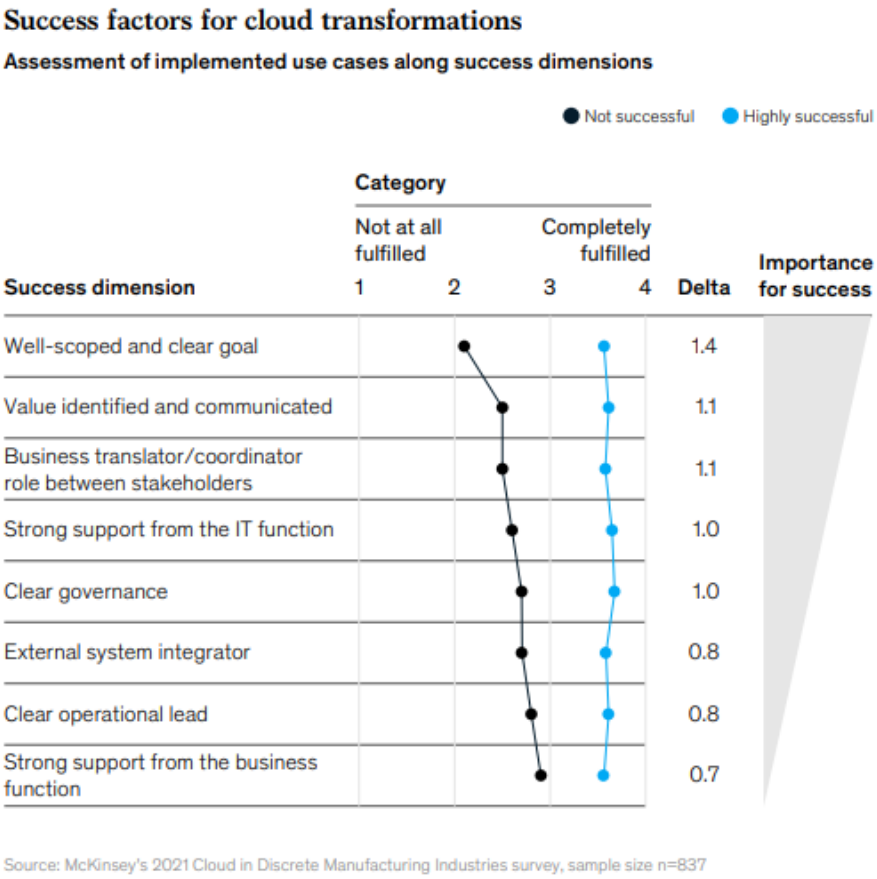

Figure 4 Success factors for cloud transformation

Success will require a mindset shift toward a dynamic model that appreciates the nuances and complexities of cloud economics, the importance of deeply understanding demand, and the benefits of a revamped organizational approach to sourcing and optimizing the consumption of cloud.

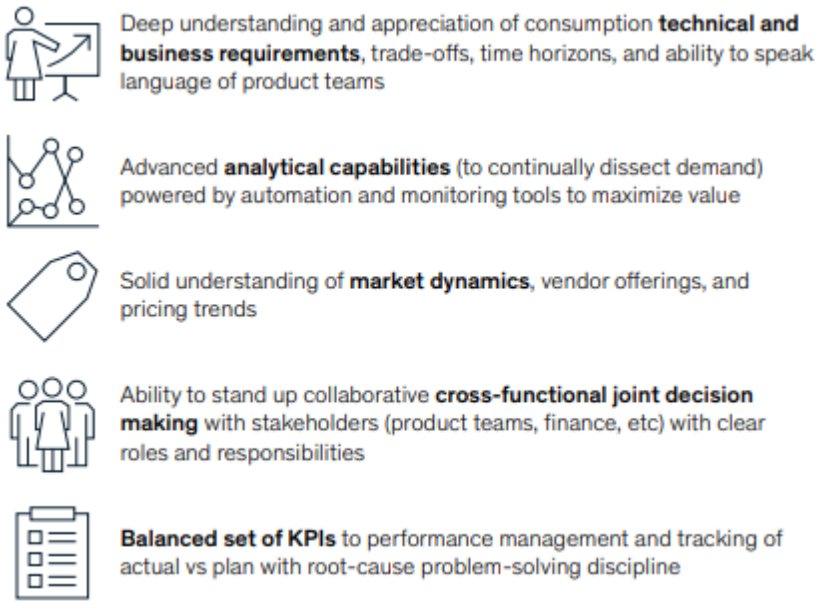

Figure 5 Key guiding principles for cloud operation teams

Traditional sourcing organization focused on contracting and tendering. That lads to fragmentation of stakeholders across sourcing, finance, engineering, and product teams which leads to fragmented cloud consumption across the enterprise, with no coordinated decision making or planning. Such challenges have to be monitored and managed in proper way.

2.2. Cloud myths

Conversations with numerous of CEOs and CIOs have revealed a consistent set of myths that lead to the roadblocks and questions, hampering progress and adoption. Companies that have effectively counteracted these myths are the ones that have derived the greatest rewards from their move to cloud.

Myth #1: Cost and value. The main value of cloud business cases is IT cost reductions. The common industry introduction to cloud refers to the replacement of key IT activities, access to on-demand infrastructure, provisioned compute, storage, database services, and more. While all these descriptors are accurate, organization leaders often hear them and lose sight of the broader impact cloud can have on transforming the full IT operating model and, most importantly, on the business. Consequently, when they set out to write a business case, they spend months analysing on-premises costs compared with cloud costs and focus much less time on the main value driver of cloud: the business benefits. The reality is that the aggregation of business benefits can swamp IT cost efficiencies in cloud. Cloud can improve almost every aspect of an organization's products, services, or processes. Superior computing power can lead to a greater understanding of customer needs, for example, while extra processing capacity can be used to run more complex analytics or to create differentiated business insights. Innovation is quicker and less risky because experimentation and testing of new ideas cost less and take less time.

Myth #2: Cloud computing costs more than in-house computing. Cloud economics is one of the most contentious current questions in enterprise IT. The reality is complicated, as cost is highly dependent on a company's starting point—and its ability to govern and optimize cloud consumption once there. For example, one financial institution runs on expensive proprietary UNIX systems at about $25,000 to $35,000 per operating system instance (OSI). It anticipates up to 75 percent in savings from cloud adoption. In the next five years, by migrating 50 percent of its workloads to cloud, it expects to lower unit costs to $15,000 to $22,000 per OSI. On the other hand, an insurance company found that through a combination of re-tiering and sourcing, it was able to improve unit-cost economics in its private environment, making a migration to cloud less attractive. Other starting-point differences we see are companies' maturity in on-premises life cycle, license commitments, and types of workloads. Companies facing large data-center upgrades, for example, will find cloud adoption attractive as a way of avoiding large capital expenditures on assets they may not fully utilize for years and that risk being deprecated faster than in the past. Where the shared-resource model does not translate into total-cost-of-ownership (TCO) savings, it is often because companies lack correct resource governance, or they migrate applications designed to run internally without adjusting their resource consumption models. Such applications will not fully leverage the benefits of autoscaling and are more costly to administer and maintain than cloud-native applications. Therefore, to keep running costs low and maximize benefits, companies should assess their applications' architectures, remediate their portfolio where needed, and establish new transparency and governance processes. The core question for cloud economics is whether the reduced run-rate cost on cloud justifies the up-front cost of remediation, assuming all configuration and governance are done correctly.

Myth #3: The security I can set up and control in my own data centres is superior to the security on cloud. Historically, executives have cited security of public cloud infrastructure as one of their top concerns and a barrier to cloud adoption. In recent years, however, all major CSPs have made significant investments in their underlying security capabilities. A CSP's business model depends on best-in-class security, and they have each invested billion in cloud security and in hiring thousands of the top cyber experts. Gartner, predicts that, through 2025, 99 percent of cloud security failures will be the customer's fault, not the security provider's. Developers, therefore, must be retrained to follow carefully defined governance and policies on how to configure the right security controls. For these new policies to be successful, cloud requires companies to adopt a DevSecOps operating model, where security is a key element of every software project. IT organizations should automate security services across the full development cycle and make them available using APIs or risk vulnerable configurations. More than one large financial institution has had to put its public cloud program on hold due to poor operating-model and configuration decisions. These institutions are now backtracking to invest in automated security controls for future applications, having discovered, like many other organizations, that they can no longer rely on manual security controls and traditional operating models if they

want to transition successfully to cloud. The key question for companies, therefore, is not whether cloud is more secure to begin with, but what measures they need to take themselves to enhance their cloud security. Companies that define the correct policies, adopt a secure DevSecOps operating model, and train or hire the right talent can actually achieve safer operations in their cloud environments than on-premises.

Myth #4: There is greater latency among applications running on cloud providers' networks than there is on in-house networks. Some organizational leaders fear that when they transition to cloud, they will experience higher latency on a CSP's network than on their own. Latency, however, is often the result of the IT department attempting to backhaul its data through in-house data centers. Backhauling, or routing traffic through internal networks, creates higher latency, extra complexity, and poor user experience. IT departments that choose to backhaul usually either lack experience or trust with cloud security (believing they will have greater control by backhauling) or need to access critical data or apps that are in on-premises data centres. It is important for IT departments that are backhauling for increased security to realize that CSPs now offer strong perimeter options and that there is no need to tolerate latency for security. In fact, companies may even experience lower latency in cloud, due to CSPs' advantages in content delivery. With their diverse, global footprint of data centers and their heavy investment in content-delivery-network services, CSPs can provide content at optimal speed, depending on location, content request, and server availability, on a scale that companies would be hard-pressed to achieve in-house. Given both the advantage CSPs have in content delivery and the shift away from backhauling, companies should not fear high latency during their move to cloud.

Myth #5: Moving to cloud eliminates the need for an infrastructure organization. The idea of infrastructure as a service (IaaS) - that an external provider will manage your underlying network, hardware, and resources - is an exciting proposition for many organizational leaders. The misconception arises, however, when leaders interpret IaaS as a full replacement for their infrastructure organization. While cloud radically changes the activities, talent, and operating model required in an internal infrastructure group, and beyond it, it does not altogether replace the need for infrastructure management. When companies transition to cloud, they will encounter hundreds of services that can be combined and configured to affect performance, security, resiliency, and more. They need an infrastructure team that can build and manage standard templates, architectures, and services for use by their development teams. Shifts in infrastructure are not only helpful in managing cloud but also necessary in order to see the full range of cloud benefits. A large entertainment company saw that when it shifted to a cloud-compatible operating model, its infrastructure team could deploy to production on demand, support a larger infrastructure footprint with leaner teams, and improve time to market, going live in six new locations in record time. In general, traditional infrastructure teams running cloud would be too large and too costly and would miss the benefits of having app teams own shared responsibility for the run costs they incur. On the other hand, having no infrastructure team at all would wreak havoc on an organization's ability to manage and benefit from cloud. Instead, a leaner, more specialized infrastructure organization is required to achieve the full range of agility, innovation, and performance benefits of cloud.

Myth #6: The most effective way to transition to cloud is to focus either on applications or on entire data centres. It is a common misconception that an organization must opt for one of these two extremes to transition successfully to cloud. In the application-by-application approach, organizations face unattractive scale dynamics. They will continue to pay for on-premises data centres and IT support, while simultaneously paying CSPs for hosting a subset of applications. Moving a subset of applications also does not lead to business benefits if those applications constitute only part of a business domain's portfolio. For example, if a business moves a set of applications within the customer-onboarding domain to cloud, but leaves behind the application that generates and stores user profiles, the time-to-market benefits of cloud cannot be fully realized. On the other hand, organizations that move an entire data centre to cloud may face substantial up-front investment and risk. Many of the hundreds of applications in a data centre probably were not designed to run in cloud. Companies will need to invest in various forms of remediation, which can become expensive and risky when executed all at once. Instead, organizations should look to move business domains to cloud (such as customer onboarding, early-stage drug discovery, consumer payments). By transitioning the business domains, companies will experience the full range of potential cloud benefits: faster time to market, greater agility, stronger reliability, and more. In addition to the business benefits, moving a business domain is a much smaller lift than moving an entire data centre, meaning that cost and risk will be more manageable. Once one business domain begins to experience these improvements in time to market, agility, and reliability, it will be easier to make the business cases for the remaining domains.

Myth #7: To move to cloud, you must either lift and shift applications as they are today or refactor them entirely. When companies make the commitment to move to cloud, they often face pressure to move fast,

minimize costs, and maximize business benefits. As a result, leaders feel they must choose between a quicker and cheaper “lift and shift” transition strategy (to move fast and minimize costs) and a time-intensive and costly refactoring strategy (to capture business benefits). While lift and shift - virtualizing the application and dropping it into cloud as is - can be a faster and more cost-effective way to move many applications into cloud at once, it fails to harness the majority of cloud’s benefits. That’s because there is no change to the application’s architecture, which is often not optimized for cloud and so won’t benefit from features like autoscaling, automated performance management, and more. Furthermore, the non-native application will likely face higher latency or other performance issues, and its pre-existing problems will now simply sit in a CSP’s data centre rather than the company’s. On the other hand, a complete refactoring of the application and its architecture to optimize for cloud takes a lot of time, skill, and money. It achieves the benefits that lift and shift ignores, but so slowly and at such great cost that breakeven is often impossible. It also puts the transition at greater risk of error during complex recoding, configuration, and integration. Many companies find they are better off using a “best of both worlds” strategy that takes advantage of specific techniques such as automation, abstraction, and containerization. These techniques are less costly and time consuming than full refactorization but still allow companies to achieve the business benefits of greater agility, faster time to market, and enhanced resiliency.

Thanks to **driving enterprises toward cloud**, the cloud market will likely emerge in after-pandemic time stronger than ever. Cloud providers and related stakeholders in the ecosystem have the opportunity to capitalize on increased usage to grow and flourish, while cloud users can seek to explore new ways for cloud to create value. Already, cloud has become much more than an alternative computing approach; in the near future, it is poised to become standard operating procedure for all types of businesses.

2.3. Key benefits of cloud computing

Key benefits of cloud computing are aligned with demands and values for modern IT world, where digital technologies are changing the landscape of business. In a world where customers demand personalized marketing and instant and impeccable service, cloud is fast becoming not just the best way to drive successful and innovative businesses, but the only way.

Cloud computing’s **key benefits** can be structured as follows:

Benefit#1 Time saver. With cloud computing, time investments for getting the system up and running are minimal. There is no equipment to set up and there is no equipment to maintain. Cloud providers handle the maintenance of physical components, as well as security and software updates.

Benefit#2 Instant access to critical data. One of the most time-consuming bottlenecks in business today is getting data into the hands of team members who need it right now. With cloud computing, every person in your company has access from devices they already use, anywhere they need it. Your team is up to speed at all times, which ensures faster collaboration.

Benefit#3 Little to no upfront investment in tech. There’s no hardware or equipment to buy, no software to install, and no licensing fees.

Benefit#4 Faster recovery. Cloud computing providers offer redundant storage (generally in multiple data centres), bolstered security, and faster recovery.

Benefit#5 Simplified scalability. You only pay for what you need. Add tools and resources for a growing team or scale back when you need to.

Benefit#6 Improved internal communication. Align company objectives using messaging resources across your various business platforms.

Benefit#7 Improve overall efficiency. While time savings boost productivity, and by extension your bottom line, cloud computing has financial benefits that are more direct.

Benefit#8 Improved Data security. With cloud computing, security is handled by your provider both online and physically at their data centres. Customer security is the foundation of customer success, so the company continues to implement the best possible practices and technologies in this area. Cloud providers offer safety

recommendations on the best approaches to deal with security issues and to collaborate in combating these challenges.

Benefit#9 Redundant storage with ease. Cloud computing providers offer redundant storage options that greatly reduce your risk of loss. All data and services are stored on multiple servers. If one server has an issue, a redundant server immediately takes over so your website or IT infrastructure sees no downtime. The power of cloud computing is amplified when paired with mobile technology. Because there's no physical equipment or software to install, you can sign in and work from any computer, anywhere. With apps, you can access important files from mobile devices, so wherever you go, higher productivity follows.

Benefit#10 Advanced analytics with ease. One of the aspects offered by leveraging cloud computing is the ability to use big data analytics to tap into vast quantities of both structured and unstructured data to harness the benefit of extracting business value. Retailers and suppliers are now extracting information derived from consumers' buying patterns to target their advertising and marketing campaigns to a particular segment of the population. Social networking platforms are now providing the basis for analytics on behavioural patterns that organizations are using to derive meaningful information.

Benefit#11 Sandbox with ease. One of the best scenarios for the use of a cloud is a test and development environment. This entails securing a budget, and setting up your environment through physical assets, significant manpower, and time. Then comes the installation and configuration of your platform. All this can often extend the time it takes for a project to be completed and stretch your milestones. With cloud computing, there are now readily available environments tailored for your needs at your fingertips. This often combines, but is not limited to, automated provisioning of physical and virtualized resources.

2.4. Types of cloud computing

There are many **types of cloud computing**, including Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

Type#1 SaaS. Software as a Service (SaaS) is a form of cloud computing in which users can access software applications without needing to download, install, or store that software and its various components on their devices or hard drive. Most cloud computing software of this kind is subscription-based with an annual or monthly fee. In return, users get seamless solutions and features without needing hardware, being bogged down by installing updates, or other maintenance tasks.

Type#2 PaaS. Platform as a Service (PaaS) is a cloud computing solution that provides developers with an easy-to-use platform to create their own software, web applications, or other programming projects. Businesses use PaaS to create proprietary apps and programs without the need for servers or special testing environments.

Type#3 IaaS. Infrastructure as a Service (IaaS) provides companies with access to servers, firewalls, virtual machines, storage, and other infrastructure. It is ideal for companies that create highly specialized or unique proprietary applications, but don't want to spend time or other resources buying, storing, setting up, or maintaining the necessary equipment. Instead, they access ready-to-use infrastructure over the internet.

2.5. Most common strategies in cloud computing

What makes this technology work is that it can take many forms, and your cloud strategy depends on company end goals. Cloud infrastructure can be organized in several ways including: Public cloud, Private cloud, Community cloud and Hybrid cloud.

Strategy#1 Public Cloud. This is a cloud that services many different companies (often in the hundreds or thousands) from the same server or infrastructure. A public cloud maintains privacy and separation for each organization it services. Settings are generalized and useful to a variety of organizations, from small- to enterprise-size businesses, academic institutions, or government offices. As with most cloud computing options, the cloud provider handles all maintenance, security, flexibility, and scalability for each organization.

Strategy#2 Private Cloud. Conversely, private clouds serve a single organization. These clouds are more common among larger or enterprise-level organizations because the businesses that use them typically service and maintain them in-house; the organization's own IT team procures and sets up the necessary equipment, parses out computing resources, and keeps up with security and software updates.

Strategy#3 Community Cloud. While smaller organizations may not have the resources to maintain their own private cloud, many still require something similar. For these organizations, community clouds are a great option. In this system, companies with similar needs, such as hospitals and medical insurance companies, use the same cloud so more specialized settings and requirements can be incorporated.

Strategy#4 Hybrid Clouds. These are composed of two or more different cloud structures. In a hybrid system, each remains a unique entity and standardized or proprietary technology allows them to consolidate their resources (for load balancing or cloud bursting, for example).

2.6. Factors important for cloud migration

For their part, cloud users should consider the following factors as they continue to migrate to cloud.

The cloud migration strategy. Cloud migration is not just about moving to the cloud; it entails a state of continuous reinvention if cloud is to reduce costs and create new opportunities. Pre-pandemic cloud migration was already often complex. Even a single application could be tied to multiple business processes, affecting vendors, balance sheets, and regulatory compliance, and different stakeholders could have different motives and expectations from the migration. A simple process could often turn into a fog of conflicting goals, broken dependencies, and cost overruns. Post-pandemic, all of these factors will likely be even more challenging. It is critical to "disrupt your market without interrupting your business" during the migration.

Cloud, security, and COVID-19. As noted above, increases in cloud usage mean increases in the cyberattack surface, making security more important than ever—especially given the growth in usage driven by COVID-19. In an April 2020 survey of security professionals, 94% believed that the pandemic increases the level of cyberthreat. Almost a quarter said that the increased threat is "critical and imminent". Only 15% believed that the cyberthreat will return to previous levels post-pandemic, while five out of six believed that the new threat level is permanent.

Cloud costs and benefits. As multiple enterprises shifted rapidly to cloud during the pandemic, some saw costs balloon. Some companies saw costs rise by 20% to 50% just from the increase in usage, even without adding in the cost of new applications or data? As organizations migrate, there is also a cost of duplication, with organizations paying for both cloud and legacy systems at the same time as well as the cost of synchronizing data between them. Going forward, companies should think about cost planning (for instance, to take advantage of reserving instances at a discount), which can reduce expensive fixes due to rushed deployments. Cost governance systems can also help maintain control over expenses. To conduct a cost-benefit analysis, companies can use a cloud value calculator to evaluate the gaps between the current state and potential future opportunities. This can help optimize infrastructure, increase staff productivity, and enhance business value".

New opportunities for value. Moving to the cloud is not only allowing organizations to recover but positioning them to thrive post-pandemic, increasing resilience and supporting business continuity at first, and then allowing to them to do new things and offer new services. Going forward, cloud can support benefits including

collaboration, automation, scale, innovation, and agility. For example, with regard to innovation, two-thirds of respondents in a 2018 Deloitte survey said that cloud fully allowed them access to the newest technologies. Another study showed that 93% of companies surveyed used the cloud for some or all of their Al needs, requiring less investment in infrastructure and expertise.

3. DIHUB Cloud skills

Cloud computing means having the ability to store and access data and programs over the internet instead of on a local computer. This means **businesses and organizations of any size can harness** powerful software and IT infrastructure to become bigger, leaner, and more agile, as well as compete with much larger tasks and challenges. Unlike with traditional hardware and software, cloud computing helps businesses and organizations stay at the forefront of technology without having to make large investments in purchasing, maintaining, and servicing equipment themselves.

With the need for cloud computing on the rise, organizations across the world **are seeking to hire cloud experts at an unprecedented rate** (Indeed research 2021 job data).

“Throughout the last decade, Amazon, Google and Microsoft, among others, have invested heavily in building vast infrastructure and useful services, all while competing with one another to improve pricing, performance and reliability. Essentially every meaningful consumer application or service that you can think of today is based on cloud technology. As a result, the demand for cloud talent has shot up.” (Scott Bonneau, vice president of global talent attraction at Indeed)

From March 2018 to March 2021, the **share of cloud computing jobs** per million increased by a 42% percent, according to data from Indeed. During the same time period, searches per million for cloud computing jobs grew by nearly 50 percent.

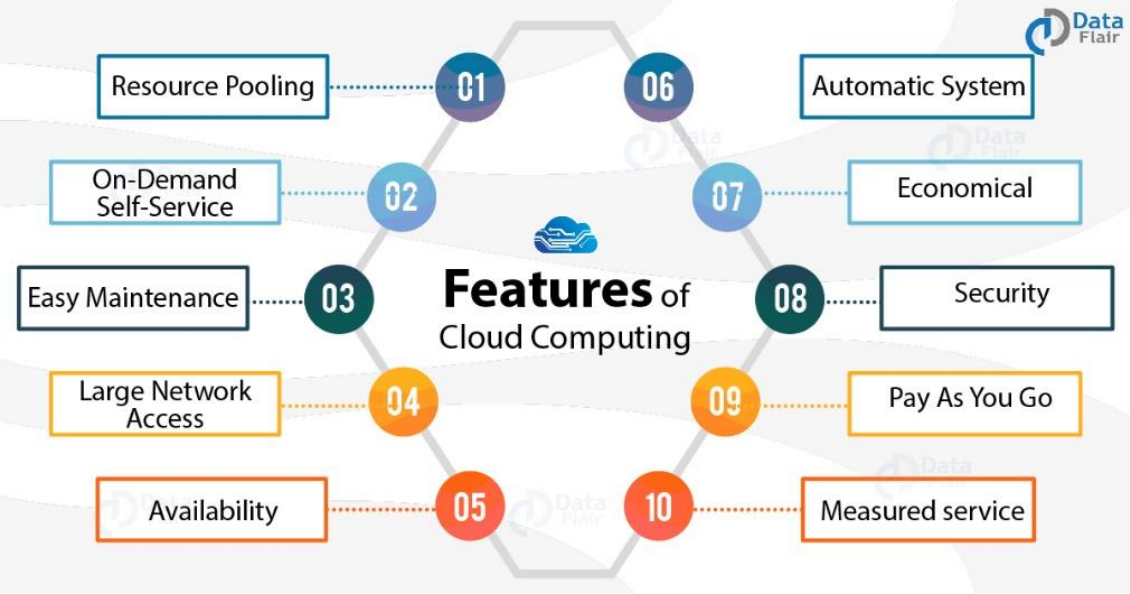

Figure 6 Features of cloud computing

Cloud computing is a system of databases and software, typically operated in data centres and warehouses. It enables users and businesses to access digital information over the internet from anywhere, rather than having physical servers in a network closet in a back office. Cloud computing offers businesses reduced IT overhead costs, which is especially important for small businesses and startups that may not have the capital to invest in an extensive on-premises IT department. Nearly every aspect of modern life involves interacting with cloud technology, whether as a consumer or an IT professional. On the consumer side, a reduction of physical media and video games has led to the rise of on-demand streaming services. This requires remote storage options that can support large amounts of data to be delivered accurately and immediately. In the IT field, advancements in artificial intelligence, machine learning and IoT compatibility have driven enterprises to seek the agility and flexibility that the cloud offers.

3.1. Who is who in cloud: identification of cloud experts and specific cloud related jobs across cloud ecosystem

Cloud computing technology gives **users** access to storage, files, software, and servers through their internet-connected devices: computers, smartphones, tablets, and wearables. Cloud computing **providers** store and process data in a location that's separate from end users. **Companies** invest and adopt cloud technologies to improve their operations. **Governments** include cloud strategies in their policy plans to improve public services and make them more secure, available and close to modern citizens.

Our journey starts with identification of experts and specific jobs that are pertinent for various aspects of cloud technologies across cloud ecosystem.

Such a complex system **requires specific knowledge and skills, which in turn call for specific training and requirements**. However, to adopt such technology into organization, managers need to understand and support potential and investment through larger period of time, until all elements (technology, human capital, knowledge and market) fits into balanced position.

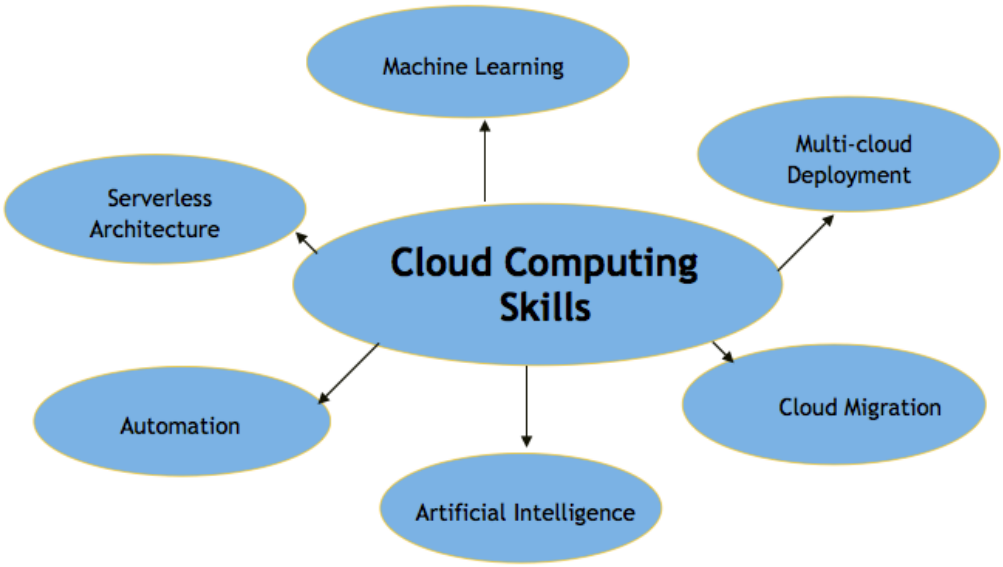

Figure 7 Cloud computing skills (selected)[6]

There are a number of skills sets that can lead to a job within cloud computing. The more experience an expert has, the more likely she will land a role. With the advent of high-speed internet, cloud computing has become the most popular way of providing and distributing IT and analytical services, and for good reason.

Our research and DACUM analysis are focused on questions: what exactly is cloud computing from job perspective, how does it work and what is needed for cloud based role to be efficient? And most importantly, which are the best skills for jobs in cloud computing today?

Cloud computing basically means that the delivery of computing services happens over the Internet – this includes (but is not limited to) software, analytics, storage, hosting, databases and even intelligence. Thus, the switch to cloud computing entails adopting a whole new paradigm of doing business, which brings great benefits. These include: taking the business to a truly global scale, reducing costs by not having to invest in hardware and software anymore, enabling higher speed and productivity for all processes and last, but definitely not least, being able to rely on some of the best security out there. The popularity and rising demand for cloud computing has led to job creation and to considerable job growth in the field, with an increase of over 40% in job postings in the last two years.

[6] www.whizlabs.com, *https://www.whizlabs.com/blog/top-cloud-computing-skills/*

In order to determine what exactly is cloud computing from job perspective, how does it work and what is needed for cloud based role to be efficient, we interviewed various professionals whose jobs today are related to cloud. During process we faced challenge because cloud technologies (and therefore job and skill accordingly) are often horizontally positioned and hidden between overall skills that specific expert in company have. That leads to fact that it took us some time to widen up horizon while talking to various experts in order to find structure in content and to be able to separate cloud related topics which are part of their daily jobs from other, more general, technical aspects.

Our process was focused on who, what, how and why principle, aimed to capture wide horizon of experts activities and to look for patterns among different roles.

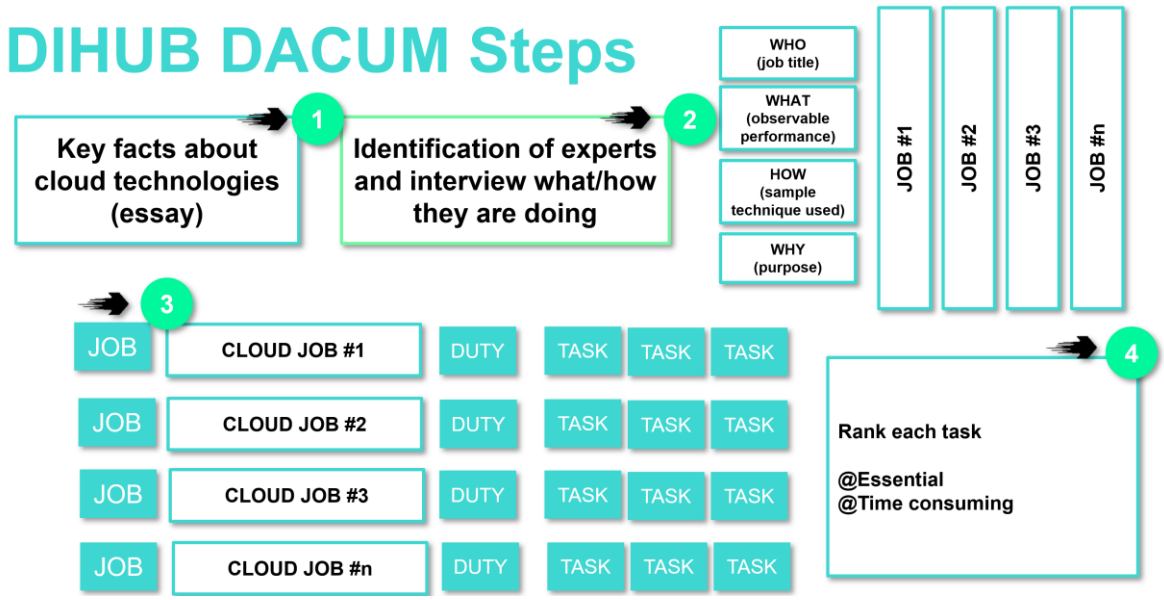

Figure 8 DIHUB DACUM steps

Discussions on tasks that have to be performed during daily activities is briefly captured in next paragraph.

Web designer, UX professional job roles were often combined with **frontend developer** job role. When analysed from cloud perspective, this job role creates an appealing packaging for the backend functionality, enabling the user to interact with it efficiently. This transcends into designing web page structure, combining aesthetics with functionality, and ensuring responsiveness to mobile platforms.

System administrators are focused on infrastructure for cloud service which include assurance that software systems are properly maintained and operate at optimum levels. Tasks include configuration and test operating systems and software applications, plan and implement system automation tools and oversee the development of customized software and hardware.

Special parts of services code today are commonly written in Java or Python. As the task title obviously suggests, job role related is called **Java developers**, programmers who are proficient with coding in Java. They design, develop, implement and manage Java-based applications, which are quite versatile and can be used in a wide variety of products and projects.

When programming, **cloud engineer** job role develops, maintains, inspect and constantly improve software systems to meet the client's needs or the guidelines of the system analyst or software architect. The engineer writes and tests code, designs new software and integrates existing software, creates technical specifications and operational documentation and, perhaps most importantly, explores new technologies and the ways to apply them.

Cloud environment also provide great data playground. Dealing with data include **data analysts** and **data scientists**. Their role is to master data processing, to analyse the data in order to identify trends and build algorithms to make raw data more useful for the company.

Next job role is data engineer. **Data engineers** have excellent knowledge of algorithms and data structures, while also being highly proficient in SQL, ETL tools, machine learning, data APIs and programming languages including Python, Java and Scala.

Dealing with data also means working in back end, data almost certain means back end. **Back end developer** job role includes writing a code that makes applications perform as intended, by providing the technology needed by frontend developers, UX professionals and designers. The backend developer also creates API's and web services.

To put it all together, we need to introduce devo's job role. **DevOps** need to assure operations and aligned and in place meaning to collaborate with system operators and software developers to handle code releases. Basically, DevOps plan and test, by merging operations, software development and testing. Tasks also include working with both the frontend and backend of applications and websites, helping clients with the planning of projects, develop servers and databases, design user interactions and write code for mobile platforms.

Moving towards strategic tasks, **architecture planning experts** are often to be most crucial ones. Providing top level support, tasks in architecture planning include design and develop software systems and applications, but they are also involved in executive-level decision making and communication, taking on the top role in the project.

Strategy needs to be followed by **operation experts** and **cloud project managers** who deliver designs, plans, implements and manages cloud-based solutions for businesses. This includes developing and implementing applications, migrating existing systems to the cloud, debugging and providing support.

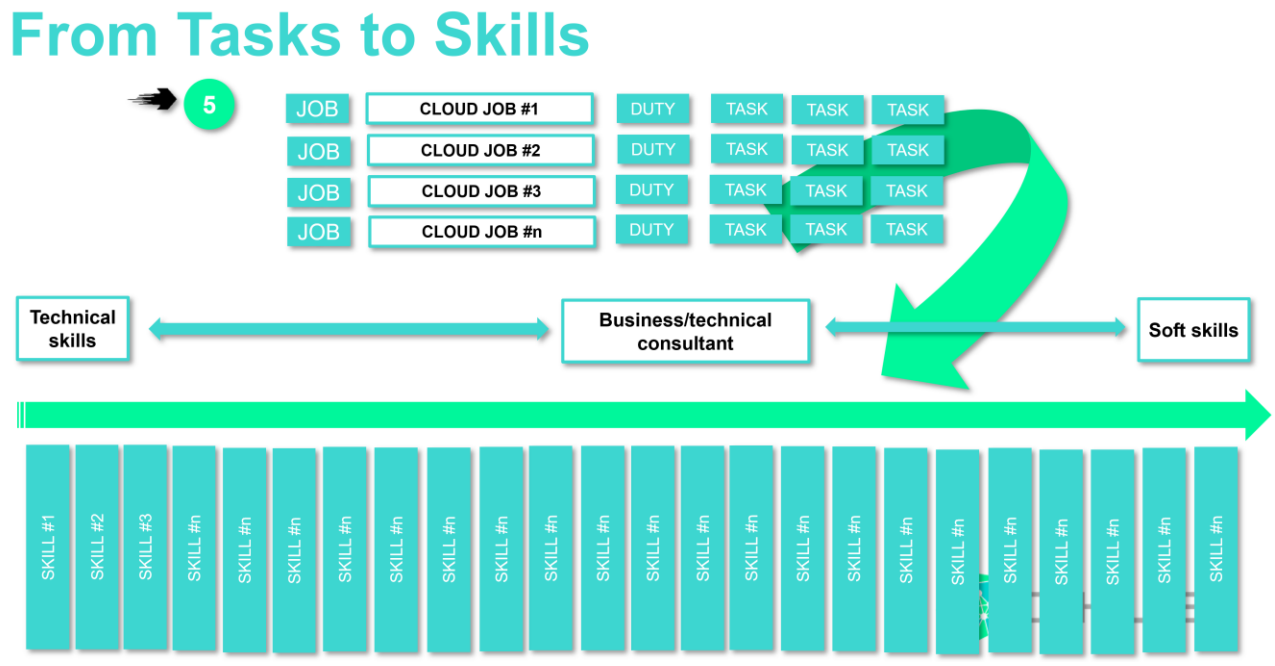

Figure 9 From tasks to skills

While it is true that all of these jobs have a lot in common and that they intersect in many places, it crucial to make efficient structure and to cover all aspects providing clear professional and EDU path.

Our next step is to create structure in job description scopes and to define relevant skills and skill groups which will lead us to job/skill matrix and finally to relevant cloud jobs selection.

Based on best practices, we will describe overall cloud ecosystem, using technical, business and soft skills in order to define relevant jobs that will be easy to understand and easy to relate to once someone decide to look for way to enter into or to improve ones cloud technology skills. During our process we will combine bottom up process with top down validation in order to keep focus and assure relevancy both from strategic and operational perspective.

3.2. Relevant skill groups

Cloud computing career requirements depend on current tech development stage and ability to understand adoption potential of using cloud technologies in organization. Regardless of what stage of career professional is in at the moment, the **skills** required for cloud computing are likely to be the same and can be structured as follows.

Skill group#1: Programming languages. Specific languages include Java, JavaScript and Python. Database management and programming. Those familiar with SQL, NoSQL and Linux will have the advantage.

Skill group#2: Artificial intelligence and machine learning. These two technologies aid businesses' agility and efficiency by processing and analysing patterns, making insights based on that data, and facilitating faster, more accurate decision-making.

Skill group#3: Understanding of cloud technologies and cloud providers. Some of these vendors include Amazon Web Services (AWS), Google Cloud Platform, Microsoft Azure and Oracle.

Skill group#4: Soft skills. As with any IT specialty, you also need to be curious, analytical and willing to stay on top of rapidly changing user needs that drive technological innovation.

3.3. Relevant jobs

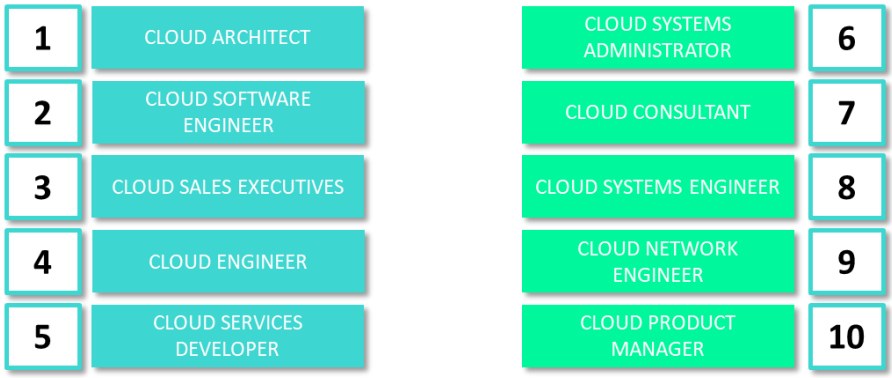

Figure 10 Most in-demand cloud computing jobs[7]

Job versus skill matrix can be developed with following jobs in mind.

Job#1: Platform Engineer. A cloud platform engineer is responsible for any technical duties associated with cloud computing such as design, planning, management, maintenance and support. Platform engineers write the code that bridges the gap between software and hardware inside an organization, while also testing the system so that it runs as effectively and efficiently as possible.

Job#2: Data Engineer. Data engineers are tasked with transforming data into a format that can be easily analysed inside a business. Data engineers develop, maintain and test infrastructures and an organization's IT environment for data generation. Data engineers work closely with data scientists and are largely in charge of architecting solutions for data scientists that enable them to do their jobs

Job#3: Full-Stack Developer. A full-stack developer can be a web developer or engineer who works with the front and back ends of a website or application that handle projects involving databases, building user-facing websites or even working with customers during the planning phase of projects. Full stack can apply to a web stack, mobile stack or a native application stack. Some full-stack developers specialize in a particular programming language like Ruby or Python.

[7] *www.fieldengineer.com, https://www.facebook.com/fieldengineers/photos/10-most-in-demand-cloud-computing-jobslisted-at-httpbitly2s4dmmncloud-computing-/1634981489978449/*

Job#4: Software Engineer. A cloud software engineer is a software developer who is responsible for designing internet-based computer information systems with duties including designing and distributing software application programs and developing internet application services. A software engineer's expertise with specific coding languages and frameworks is what sets engineers apart. Some of the most in-demand skills for software engineers today are around Amazon Web Services and Google as well as Kubernetes and Scala.

Job#5: Software Developer. A cloud software developer creates applications that are served on the cloud. The work is similar to a typical software engineer except that the programs cloud developers make run on virtual systems, which adds more complexity around security and efficiency. Cloud developers analyze customer needs, design systems and solutions, code and debug.

Job#6: Senior Software Engineer. Senior software engineers are more experienced employees who usually take the lead in projects related to software development. These senior leaders are in charge of determining the IT needs of the organization, constantly updating a company's technology environment, and creating plans for the development of various software solutions.

Job#7: Development Operations Engineer. Development operations engineers have in-depth knowledge of operational issues and technology and are typically tasked with studying and observing functioning systems and recording the performance results of an organization. These IT experts are responsible for configuring operational priorities, determining project objectives and developing operations solutions by defining, studying, estimating and screening alternative solutions.

Job#8: Cloud Consultant. Cloud consultants need to be well-versed in existing cloud products and in creating and modifying programming code. Cloud consultants start out by examining the typical duties and operations of a customer, followed by analysing data to determine which cloud solutions would best meet customer needs. Consultants then make recommendations based on their analysis and can even implement the selected cloud systems along with customization.

Job#9: Software Architect. A cloud software architect develops a company's computing strategy that incorporates cloud adoption plans, cloud application design as well as cloud management and monitoring. Other responsibilities include support for application architecture and deployment in cloud environments. A cloud architect draws on solid knowledge of a company's cloud architecture when designing and developing solutions while also knowing all the moving parts involved in continuous integration and delivery.

Job#10: Cloud Engineer. Cloud engineers are responsible for managing an organization's cloud-based systems and processes. A cloud engineer's tasks can include setting up architectures using cloud providers like AWS, Microsoft Azure and Google Cloud, migrating existing on-premises infrastructure to cloud-based systems, as well as managing security and access. Top skills companies are looking for cloud engineers to have today include Cloud Foundry, DevSecOps, Docker software, agile development and AWS Elastic Compute Cloud.

Job#11: Cloud project sponsor. The project sponsor's official role begins right at the start of the process, during the project initiation phase. At this point they need to put the business case together to authorize the project. To do this they will carry out an analysis of the likely success or failure rates of the project and justify the reason for undertaking the project. This should include factors such as the benefits, the costs, the risks and the alternative options that could be undertaken. Once the project is underway, the project sponsor will need to check that the project is on track and that the business case is still valid. Ultimately, it is their responsibility to achieve the outcomes that have been documented and agreed, so this is undoubtedly a key part of their role.

3.4. Job/skill matrix

Coronavirus pandemic made cloud services **more important than ever**. Although, infrastructure potential was raising years before, business community lacked prominent and strong use cases that can be widely used among industries. Decrease in cost for on-premise systems also slowed down adoption rate of cloud technologies. Whether it was the mass adoption off videoconferencing services such as Zoom or more dependence on automated software, the cloud played a big part in 2020 and, as such, was one of the few sectors that continued hiring.

With horizontal nature of use cases, **IT experience and technical skills have to be combined with project management and business skills to support a career in cloud computing**. What is even more more, it is an industry that is constantly evolving; thus, making a move towards cloud technologies related skills seems like almost a future-proof career move.

As we pointed out, the industry has a **diverse range of job titles**, including some very niche and experimental fields, and can accommodate all manner of skill sets. New recruits can work on internet connections, servers and storage, analytics, software and much more. Digital transformation is not necessarily a one-time affair and the use case for cloud expand and grow constantly. Global spend on cloud tech could reach around $150 billion over the next three years, according to Gartner - this just to give an insight into the potential for job creation within the sector.

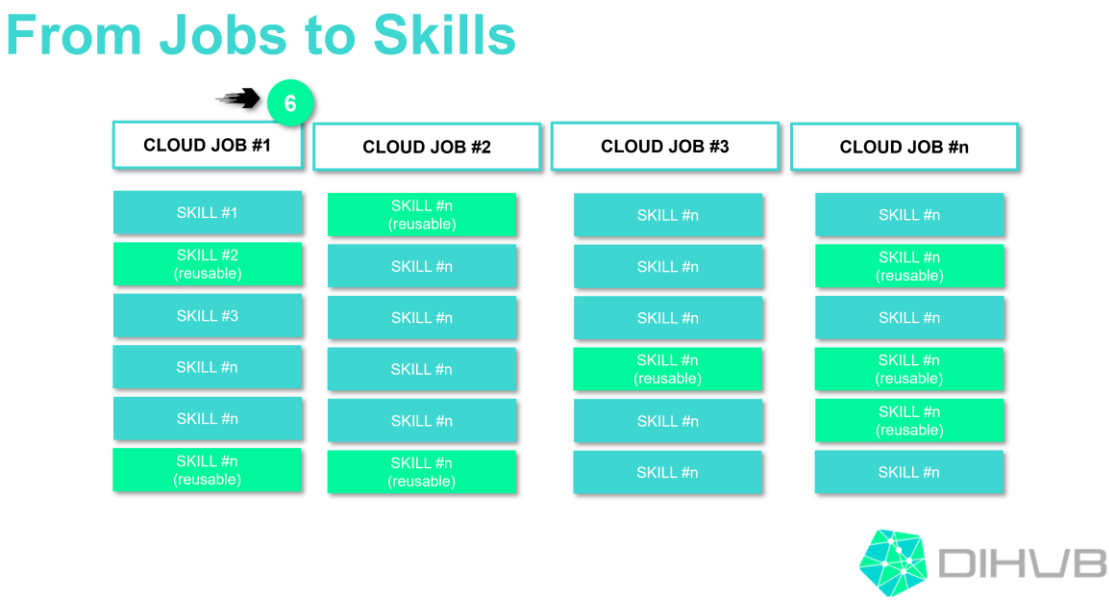

Figure 11 From jobs to skills

The cloud, whether it is platform as a service, infrastructure as a service or software as a service, has been the area of growth for over a decade now. The Covid-19 pandemic further hard-pressed for this growth by pushing for immediate decisions and actions on the movement towards cloud. Companies are currently investing far more than the traditional IT spending in cloud infrastructure and this is expected to keep growing faster. Very naturally, this led to a high demand for cloud enabled engineers across the globe. More companies are either aggressively rescaling on existing resources or on the lookout for skilled resources in the space.

But then, with this demand also comes the **responsibility of understanding what the best ways are to get the right skills or right resources with suitable skills**. For the people who are looking at the opportunities in this space, they need to understand what the best skills are that they can have in order to enter this ever-growing industry of cloud with huge number of opportunities.

Some of the things which come along with cloud are not only the technology skills, but companies today recruit and enable people on certain set of technical skills which are required for a resource to be able to be a good cloud engineer. It is also true that most companies are realizing the fact that, with the ever-growing and rapidly changing technologies and cloud environments, the kind of people that you need to look for or skill for is not only about skilling them on technology but also skilling them on rapid learning. The practice of continuous learning and evolution should become a habit for people. So, finding these kinds of people who can skill quickly and understand continuous changes are very much required. Though the demand is there, there Is basically a shortage of this in the present day. So today, companies are actually recruiting and then training people on these skills and are also ensuring that learning becomes a habit and people are able to adapt to evolving towards changing technologies in the environment of cloud.

The problem with the industry is that, with the cloud growing, the amount of experienced people in this space is becoming lower day by day. Most companies are looking at picking up people from infrastructure domain

and skilling them on cloud. So, people who are basically skilled in infrastructure and are good with administration of operating systems, web servers and can understand virtualization, could be the core people and can benefit first from this ever-growing demand of cloud.

There is no doubt there will be **increase in recruitment demand** of companies of all sizes for people who are cloud experts and are well versed with either infrastructure or at least understand cloud to certain extent. Colleges, universities and institutions of life-long learning can start adapting a multi cloud culture as most customers today who are using cloud and are moving towards hybrid cloud, where they use multiple public cloud providers. This is to ensure that the resources are well equipped to handle any of the public cloud offerings that are available in the market today. Or indeed they can at least focus on the top three cloud providers if not all.

4. DIHUB Cloud jobs

A basic definition of cloud computing can be summarized as acting in situation when company move physical information technology (IT) activities, such as file storage and on-site servers, to a virtual environment. As a person whose job is related to activities in such situation, one fit into general job role of cloud computing specialist. Such specialist will utilize these virtual environments to create streamlined operations for companies.

More focused description will put cloud computing specialist into situation to help companies migrate their information and services into the cloud. For cloud environment and therefore for adequate job skills, it is essential that there is no interruption in services during this migration (called service continuity). Specialist will support business continuity by analysing a company's needs and helping them select the appropriate cloud technology. Your responsibilities may involve providing design input, collaborating with customer service and analysts on project milestones, and analysing weaknesses and recommending system improvements. As a cloud computing specialist, one must also be able to effectively weigh the potential risks of IT solutions against a company's IT needs.

Our DACUM process continue with common cloud jobs definition and description we found relevant across cloud landscape. DIHUB cloud jobs include:

DIHUB Job#1: Cloud manger/administrator
DIHUB Job#2: Cloud migration expert
DIHUB Job#3: Cloud strategist and monetization expert
DIHUB Job#4: Cloud service/content creator

All are empowered by selected softs skills. Once we defined relevant jobs we will continue with top down approach in order to validate skills and skill groups among defined jobs.

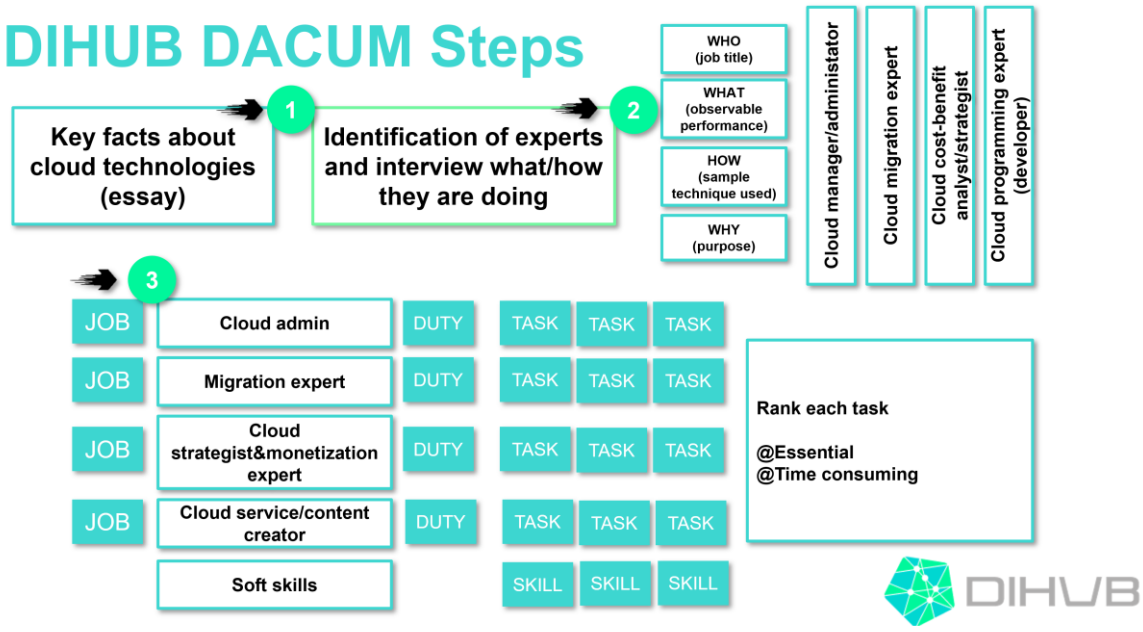

Figure 12 DIHUB DACUM decomposition

From the skillset perspective, DACUM analysis provides insight into overall skill perspective followed by structure in which skills are divided and aligned between technical skills, through business/technical consultancy skills to soft skills, slightly more aligned towards technical.

Selected skills from perspective of relevance and with clear goal to be supported in educational learning outcomes are:

DIHUB Skill#1 Virtualization (most technical one)
DIHUB Skill#2 Database management
DIHUB Skill#3 Serverless architecture
DIHUB Skill#4 Security
DIHUB Skill#5 Cloud deployment including multicloud
DIHUB Skill#6 Hybrid cloud
DIHUB Skill#7 DevOps
DIHUB Skill#8 Application migration strategies
DIHUB Skill#9 Programming
DIHUB Skill#10 Artificial intelligence and Machine learning
DIHUB Skill#11 Automation
DIHUB Skill#12 Adaptability
DIHUB Skill#13 Performance testing
DIHUB Skill#14 Change management
DIHUB Skill#15 Scalability
DIHUB Skill#16 Migration alternatives
DIHUB Skill#17 Cloud TCO
DIHUB Skill#18 Cost control and cost factors
DIHUB Skill#19 CAPEX vs OPEX
DIHUB Skill#20 Vendor selection
DIHUB Skill#21 Teamwork
DIHUB Skill#22 Ethics
DIHUB Skill#23 Communication
DIHUB Skill#24 Presentation (most horizontal soft skill)

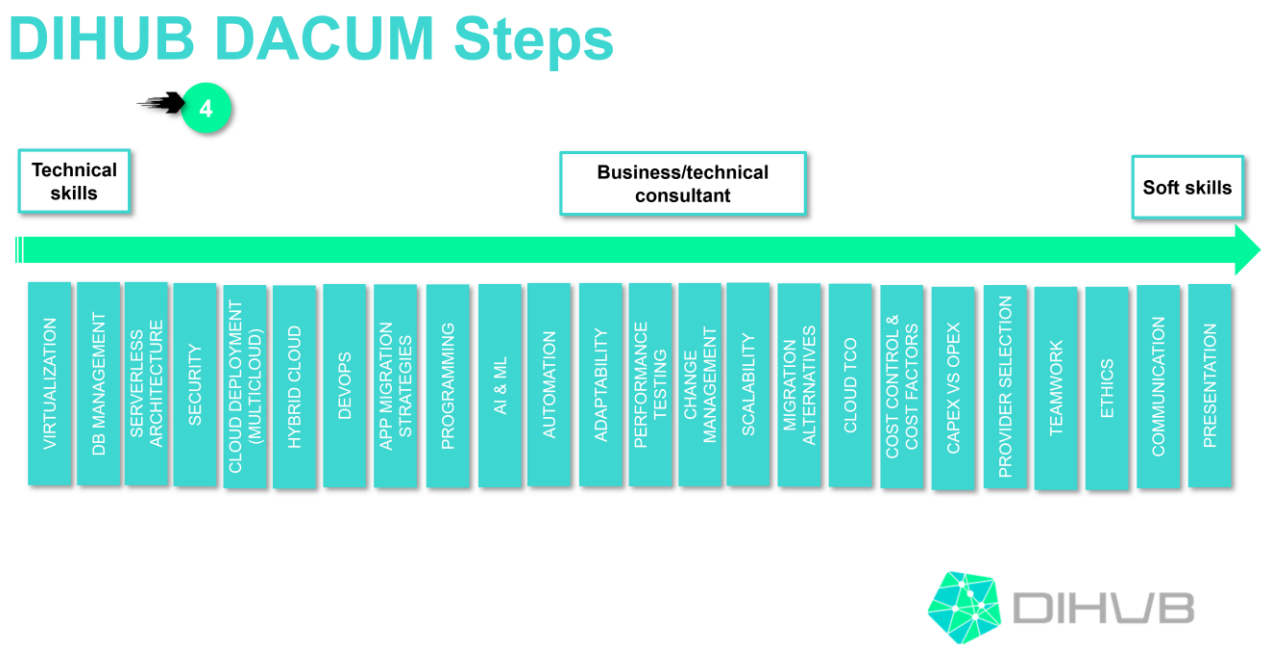

Figure 13 DIHUB list of cloud skills

4.1. Description of identified jobs in the "tasks/skills" matrix

DIHUB Job#1: Cloud manger/administrator

A Cloud manager/administrator is responsible for working in a mixed software environment. The responsibility of the individual is to manage the instances of the cloud infrastructure services and the multiple cloud servers. The professional also leads, oversees and maintains, multiuser computing environment as per the requirements of the organization. The individual in this position must have strong technical knowledge of virtual machines (IaaS, Writing Code (PaaS) and Software as a Service (SaaS). The cloud systems administrator will

have to develop, configure, implement and manage the systems that comprise the underlying cloud platform. The professional assists in setting up public or private cloud systems. They have to learn how to balance workload and deploy them in an automated way. The individual should monitor and alter the systems as per the prescribed methodology. The Cloud manager/administrator is the one who establishes and executes the cloud operations as per the specifications and parameters. They should select the cloud providers as well keeping in mind the requirements. The technicians must implement cost-effective cloud-based systems that will fulfil the technical requirements of the organization.

DIHUB Job#2: Cloud migration expert

The key objective of this position is to lead and drive the company's Cloud expert projects to successful completion. A Cloud Migration Specialist and Lead has the overall responsibility of designing and executing a cloud migration strategy; defining delivery architecture, creating the migration plans, designing the orchestration plans, and more. This position works closely with technology consultants, cloud architects and engineers in translating the company's cloud strategic goals, roadmaps, and business requirements into future state architectures designed to leverage the cutting-edge functionality delivered through commercial cloud service providers.

DIHUB Job#3: Cloud strategist and monetization expert

The primary focus of the Senior Cloud strategist is to provide customers with in-depth knowledge and execution of cloud advisory services, focusing on assessment of current state and planning for migration activities. As a Monetization expert, expert will proactively identify new opportunities, develop, manage, and maximize growth opportunities from developers using technology products. Expert will use your influencing and relationship-building skills, product knowledge, industry insights, and sales skills to provide relevant solutions and client services. Job role include close work with sales, marketing, and data intelligence teams, gain industry insights, build sales strategies, and put them into practice, with the goal of expanding engagement with ad monetization solutions. Finally, role includes ideation and execution on exciting long-term strategic priorities in order to grow the web ecosystem.

DIHUB Job#4: Cloud service/content creator - developer

Cloud Developers are essentially software engineers with a specialization in cloud computing. That means on top of development experience, Cloud Developers must have a solid understanding of cloud systems — not only how they operate, but how to deploy them securely, efficiently, and with little-to-no downtime.

In the final stage of DACUM analysis, skills are structured into job descriptions with special attention on intersection and skills shared between roles (light green).

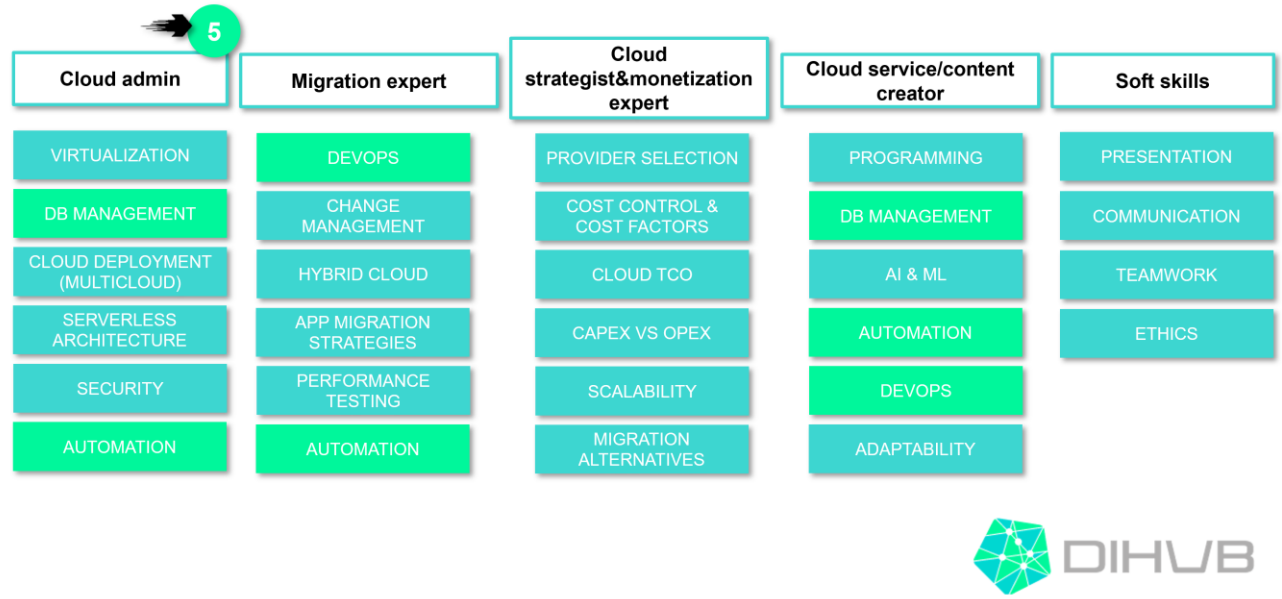

Figure 14 DIHUB jobs/skills matrix

A task/skills matrix is a framework used to map employees' skills and their levels. It is a grid that contains information about available skill and their evaluation. It is used to manage, plan, and monitor existing and desired skills for a role, team, department, project, or an entire company.

5. DIHUB Learning programs for cloud

Our goal in this stage was to use all research materials and create well balanced and relevant learning programs for future use, to provide foundations for micro credential certification and to provide relevant foundations for future connectivity to ESCO classification.

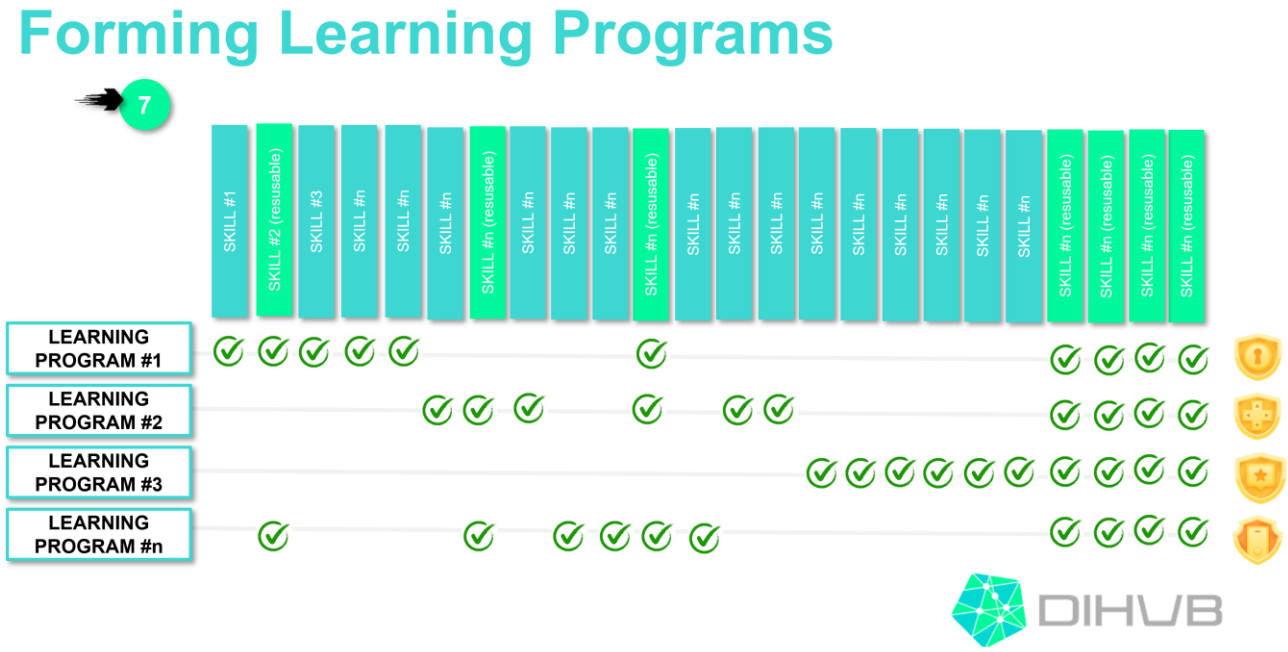

Figure 15 DIHUB learning programs

A micro-credential is a qualification evidencing learning outcomes acquired through a short, transparently-assessed course or module. Micro-credentials may be completed on-site, online or in a blended format. The flexible nature of these qualifications allows learning opportunities to be opened up to citizens, including those in full-time employment. This makes micro-credentials a highly flexible, inclusive form of learning allowing the targeted acquisition of skills and competences. Micro-credentials are offered by higher and vocational education and training (VET) institutions, as well as by private organizations.

They can be particularly useful for people want to:

1. build on their knowledge without completing a full higher education program
2. upskill or reskill to meet labour market needs or to develop professionally after starting work

5.1. Life-long learning and micro certification programs

DIHUB DACUM team insights provide the following structure to be recommended, used and certified under EU micro credentials program. Goal is to create four **program tracks**:

TRACK#1 Cloud admin
TRACK#2 Cloud migration expert
TRACK#3 Cloud strategist
TRACK#4 Cloud content creator

Each program track contains or shares selected relevant skills which carefully intersect to assure full coverage of cloud technologies ecosystem.

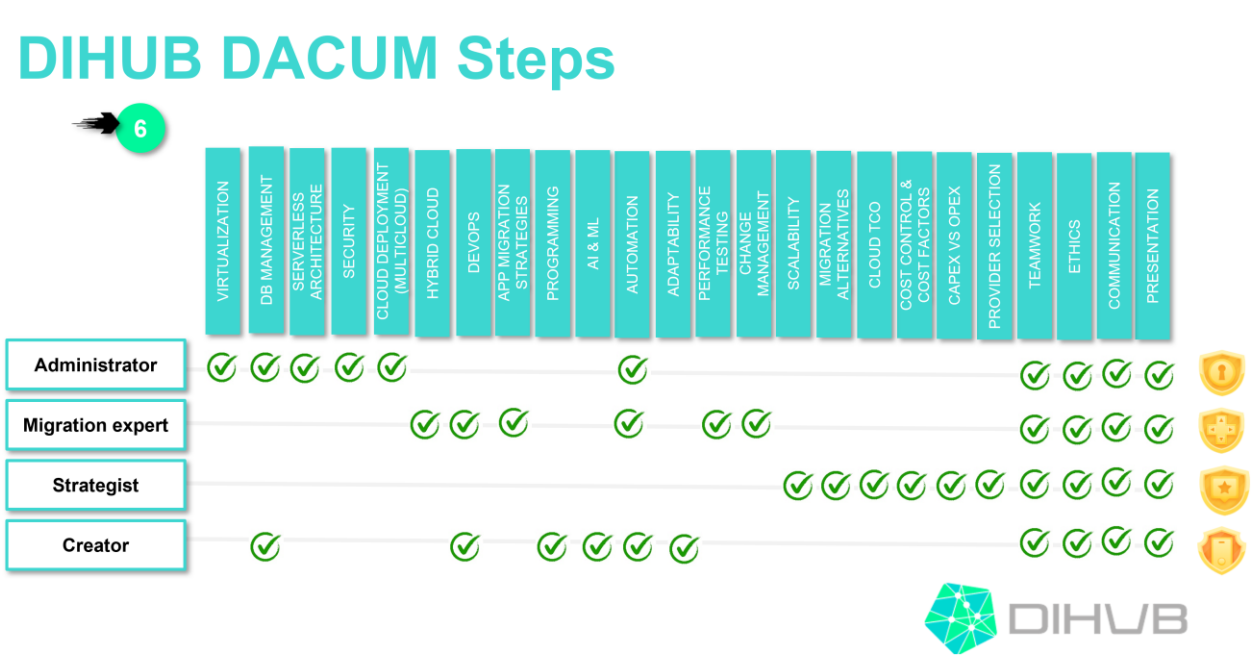

Figure 16 DIHUB certification paths

With clear aim to make programs open and attractive to wide audience as part of formal but also lifelong learning paths, training effort estimate is targeted to 48 hours of lectures, 48 hours of practice combined 30 hours of individual work for cloud skills and 8 hours of lectures combined with 20 hours of practice workshops for soft skill. All combined into attractive program (certification path) which lasts 154 hours during 15 weeks (10 hours overall candidate effort per week), resulting with 10 ECTS per path.

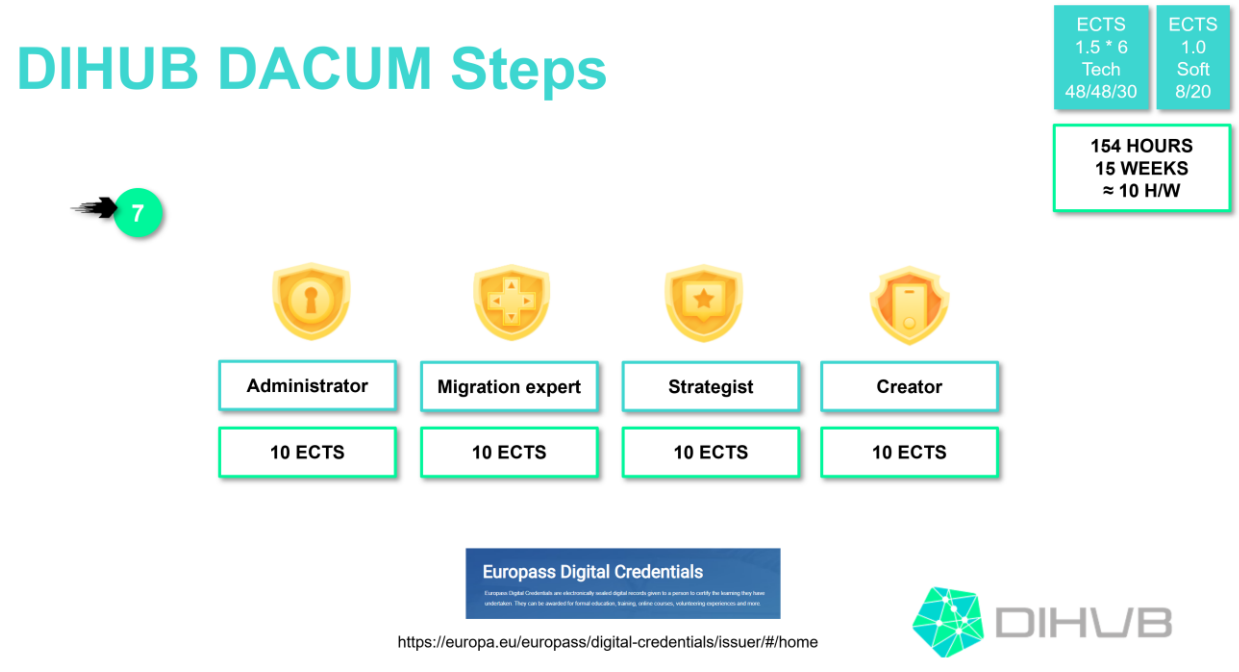

Figure 17 DIHUB micro-credentials

This approach assures perfect balance between practice and theory, provides great educational content both for school-to-work or work-to-work learning individuals but also provides strong foundation and structure to be used, accredited and structured into industry certification path and/or EU micro credential program.

5.2. Life-long learning and ESCO

ESCO[8] (European Skills, Competences, Qualifications and Occupations) is the European multilingual classification of skills, competences, qualifications and occupations.

ESCO works like a dictionary, describing, identifying and classifying professional occupations and skills relevant for the EU labour market and education and training area and systematically showing the relations between those occupations and skills. It is available in an online portal where its dataset of occupations and skills can be consulted and downloaded free of charge. Its common reference terminology helps make the European labour market more effective and integrated, and allows the worlds of work and education/training to communicate more effectively with each other.

Following credential mapping our goal is to prepare comparison with intersections to be presented to ESCO committee with the aim to be included as relevant for cloud-based technologies and cloud based services.

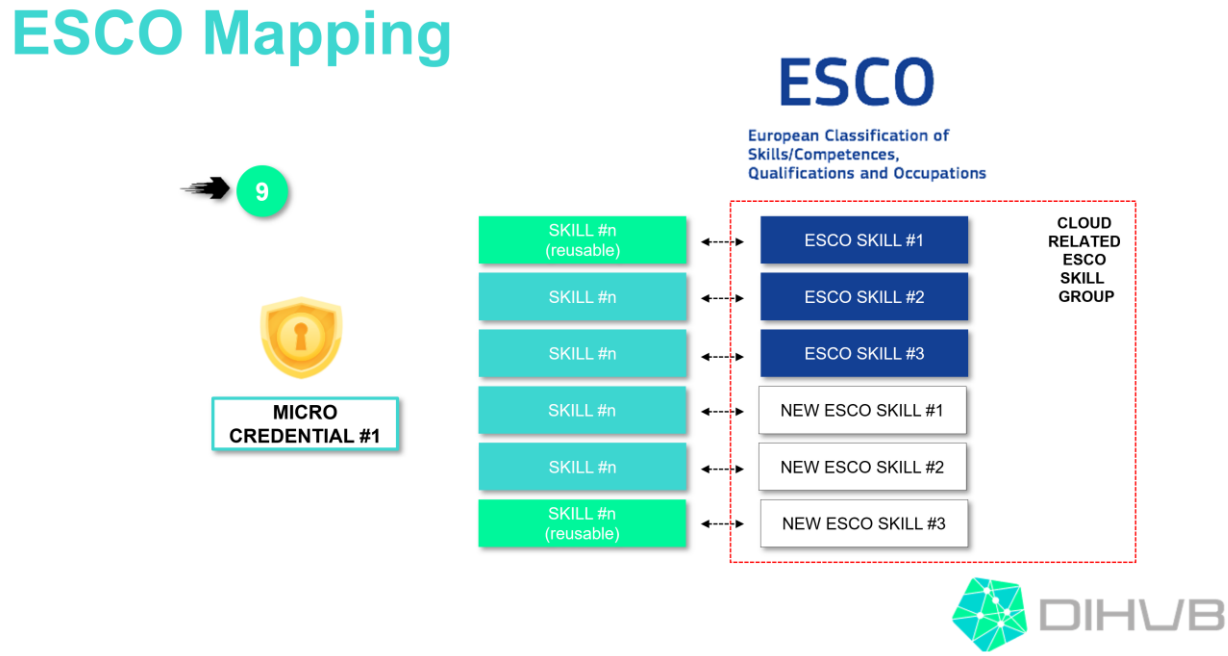

Figure 18 DIHUB cloud certification paths and ESCO

The ESCO skills pillar distinguishes between i) skill/competence concepts and ii) knowledge concepts by indicating the skill type. There is however no distinction between skills and competences. Each of these concepts comes with one preferred term and a number of non-preferred terms in each of the 27 ESCO languages. Every concept also includes an explanation in the form of description. The skills pillar of ESCO contains 13,485 concepts structured in a hierarchy which contains four sub-classifications. Each sub-classification targets different types of knowledge and skill/competence concepts:

1. Knowledge
2. Skills

[8] *https://ec.europa.eu/esco/*

3. Attitudes and values
4. Language skills and knowledge

Following the track structure mapping towards ESCO skills and grouping, suggestions based on DACUM analysis are as follows. For this document we used ESCO version v1, official version at the time this document was prepared.

Micro credential: Cloud manager/administrator
TRACK#1 Cloud admin

Table 1 Micro credential: Cloud manager/administrator

DIHUB Skill	ESCO Concept
DIHUB Skill#1 **Virtualization**	manage ICT virtualisation machines http://data.europa.eu/esco/skill/ae4f0cc6-e0b9-47f5-bdca-2fc2e6316dce
DIHUB Skill#2 **Database management**	manage database http://data.europa.eu/esco/skill/29fb0fb5-dfc4-4098-ac9b-3a712000f48f
DIHUB Skill#3 **Serverless architecture**	ICT architectural frameworks http://data.europa.eu/esco/skill/c453cf81-6197-428e-84c6-70c773b63f27
DIHUB Skill#4 **Security**	ICT security standards http://data.europa.eu/esco/skill/3ff589b7-68df-4ea5-ae41-b395bdb2378f
DIHUB Skill#5 **Cloud deployment including multicloud**	solution deployment http://data.europa.eu/esco/skill/1d86f05e-e9cc-40ce-99d8-2b21cc71b16b
DIHUB Skill#11 **Automation**	(TO BE DEFINED - NEW SKILL)
DIHUB Skill#21 **Teamwork**	teamwork principles http://data.europa.eu/esco/skill/a5b0cd5c-e13a-4ab3-8d93-4d242adcfb01
DIHUB Skill#22 **Ethics**	ethics http://data.europa.eu/esco/skill/cef5c0f8-1e40-4c09-b6a7-aa7811849e5d
DIHUB Skill#23 **Communication**	Communication http://data.europa.eu/esco/skill/15d76317-c71a-4fa2-aadc-2ecc34e627b7
DIHUB Skill#24 **Presentation**	prepare presentation material http://data.europa.eu/esco/skill/1ba59ce0-7fec-434b-8d5c-9b275250a26c

Figure 19 TRACK#1 Cloud admin

Micro credential: Cloud migration expert
TRACK#2 Cloud migration expert

Table 2 Micro credential: Cloud migration expert

DIHUB Skill	ESCO Concept
DIHUB Skill#6 **Hybrid cloud**	hybrid control systems http://data.europa.eu/esco/skill/a2b566b0-1070-47a4-adc8-88839942ce25
DIHUB Skill#7 **DevOps**	DevOps http://data.europa.eu/esco/skill/f0de4973-0a70-4644-8fd4-3a97080476f4
DIHUB Skill#8 **Application migration strategies**	develop automated migration methods http://data.europa.eu/esco/skill/0b0335f3-0aa1-491e-895e-81fc8774a300
DIHUB Skill#11 **Automation**	(TO BE DEFINED - NEW SKILL)
DIHUB Skill#13 **Performance testing**	perform business analysis http://data.europa.eu/esco/skill/27ed854c-15b8-4ba2-90e9-ae888a219703
DIHUB Skill#14 **Change management**	apply change management http://data.europa.eu/esco/skill/3c03ee71-4a23-448f-b79e-81fd75d27dca
DIHUB Skill#21 **Teamwork**	teamwork principles http://data.europa.eu/esco/skill/a5b0cd5c-e13a-4ab3-8d93-4d242adcfb01
DIHUB Skill#22 **Ethics**	ethics http://data.europa.eu/esco/skill/cef5c0f8-1e40-4c09-b6a7-aa7811849e5d
DIHUB Skill#23 **Communication**	Communication http://data.europa.eu/esco/skill/15d76317-c71a-4fa2-aadc-2ecc34e627b7
DIHUB Skill#24 **Presentation**	prepare presentation material http://data.europa.eu/esco/skill/1ba59ce0-7fec-434b-8d5c-9b275250a26c

Figure 20 TRACK#2 Cloud migration expert

Micro credential: Cloud strategist and monetization expert
TRACK#3 Cloud strategist

Table 3 Micro credential: Cloud strategist and monetization expert

DIHUB Skill	ESCO Concept
DIHUB Skill#15 **Scalability**	(TO BE DEFINED - NEW SKILL)
DIHUB Skill#16 **Migration alternatives**	perform business analysis http://data.europa.eu/esco/skill/27ed854c-15b8-4ba2-90e9-ae888a219703
DIHUB Skill#17 **Cloud TCO**	cost management http://data.europa.eu/esco/skill/7d35602d-bc94-4975-aa7c-f4e8e05ce8e0
DIHUB Skill#18 **Cost control and cost factors**	compare production forecasts with actual results http://data.europa.eu/esco/skill/1ba35185-09cc-4b54-a3c5-57b87be4d9d1
DIHUB Skill#19 **CAPEX vs OPEX**	make investment decisions http://data.europa.eu/esco/skill/0c9da986-721e-4f75-b566-0c6c212a8f60
DIHUB Skill#20 **Vendor selection**	market research http://data.europa.eu/esco/skill/8770350e-746f-4adb-9556-18ca68104be6
DIHUB Skill#21 **Teamwork**	teamwork principles http://data.europa.eu/esco/skill/a5b0cd5c-e13a-4ab3-8d93-4d242adcfb01
DIHUB Skill#22 **Ethics**	ethics http://data.europa.eu/esco/skill/cef5c0f8-1e40-4c09-b6a7-aa7811849e5d
DIHUB Skill#23 **Communication**	Communication http://data.europa.eu/esco/skill/15d76317-c71a-4fa2-aadc-2ecc34e627b7
DIHUB Skill#24 **Presentation**	prepare presentation material http://data.europa.eu/esco/skill/1ba59ce0-7fec-434b-8d5c-9b275250a26c

Figure 21 TRACK#3 Cloud strategist

Micro credential: Cloud developer and content creator
TRACK#4 Cloud content creator

Table 4 Micro credential: Cloud developer and content creator

DIHUB Skill	ESCO Concept
DIHUB Skill#2 **Database management**	manage database http://data.europa.eu/esco/skill/29fb0fb5-dfc4-4098-ac9b-3a712000f48f
DIHUB Skill#7 **DevOps**	DevOps http://data.europa.eu/esco/skill/f0de4973-0a70-4644-8fd4-3a97080476f4
DIHUB Skill#9 **Programming**	ICT system programming http://data.europa.eu/esco/skill/b105ec9b-0857-41d6-8d07-a83e58b73d90
DIHUB Skill#10 **Artificial intelligence and Machine learning**	principles of artificial intelligence http://data.europa.eu/esco/skill/e465a154-93f7-4973-9ce1-31659fe16dd2 utilise machine learning http://data.europa.eu/esco/skill/8369c2d6-c100-4cf6-bd83-9668d8678433
DIHUB Skill#11 **Automation**	(TO BE DEFINED - NEW SKILL)
DIHUB Skill#12 **Adaptability**	adapt to changes in technological development plans http://data.europa.eu/esco/skill/f5308e60-d763-4ead-be95-88c96fb3e02b
DIHUB Skill#21 **Teamwork**	teamwork principles http://data.europa.eu/esco/skill/a5b0cd5c-e13a-4ab3-8d93-4d242adcfb01
DIHUB Skill#22 **Ethics**	ethics http://data.europa.eu/esco/skill/cef5c0f8-1e40-4c09-b6a7-aa7811849e5d
DIHUB Skill#23 **Communication**	Communication http://data.europa.eu/esco/skill/15d76317-c71a-4fa2-aadc-2ecc34e627b7
DIHUB Skill#24 **Presentation**	prepare presentation material http://data.europa.eu/esco/skill/1ba59ce0-7fec-434b-8d5c-9b275250a26c

Figure 22 TRACK#4 Cloud content creator

6. DIHUB Recommendations

This document brings devising sets of recommendation on integrating the learning programs in the EQF4, EQF5 and EQF6.

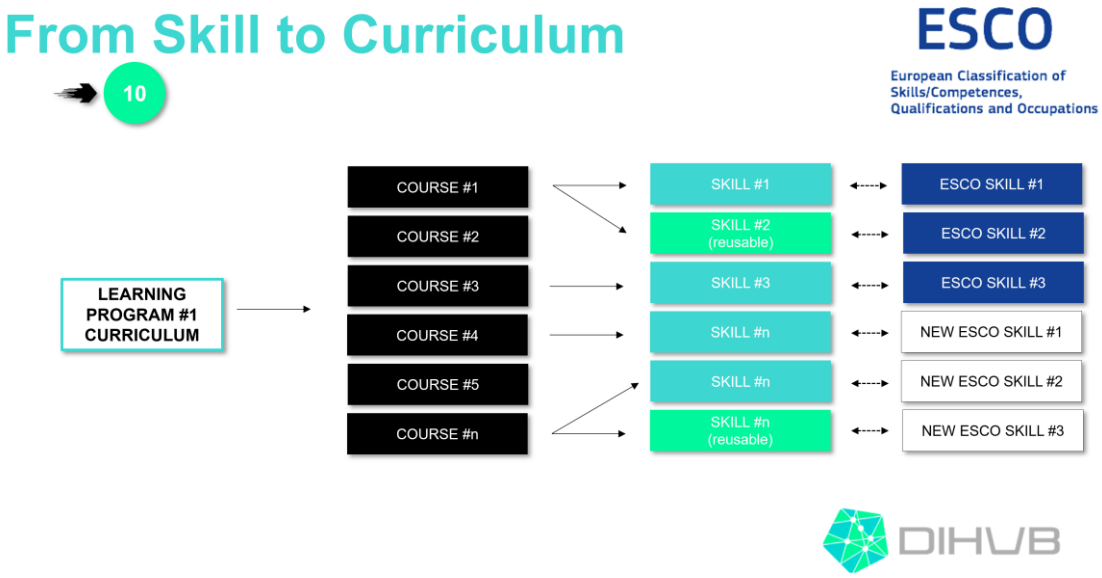

Figure 23 From skills to curriculum

6.1. DIHUB Recommendation#1

Cloud education/certification paths include several programs which describe cloud ecosystem from all aspects and assure integrity and consistency. Therefore, first DIHUB implementation recommendation is to follow principle of four **program tracks**, accordingly:

TRACK#1 Cloud admin
TRACK#2 Cloud migration expert
TRACK#3 Cloud strategist
TRACK#4 Cloud content creator

6.2. DIHUB Recommendation#2

For each program track, selection of relevant skills and skill groups is defined. Participants can easily relate to and asses their needs by looking into DIHUB cloud academy paths while looking for best match according their specific needs. Companies can also identify gaps and possible opportunities while looking for talents or looking for instructions on how to improve skills of their employees to better fit cloud technologies ecosystem.

Second DIHUB implementation recommendation include easy to understand educational paths which include certification job roles followed by skillset and EQF levels.

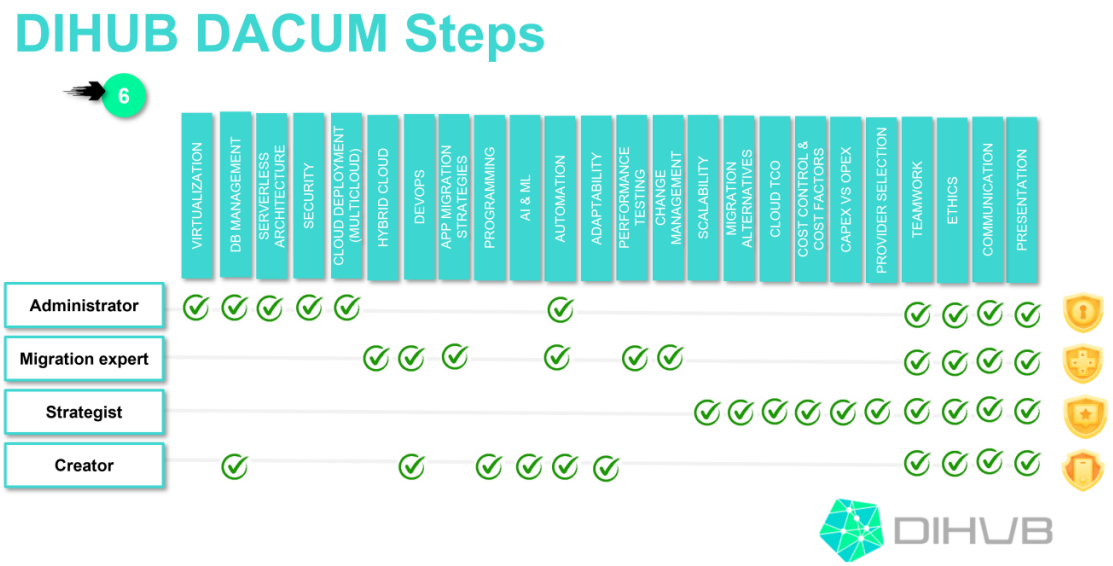

Figure 24 DIHUB Cloud Academy at glance

6.3. DIHUB Recommendation#3

Third DIHUB implementation recommendation include best practices regarding resources that participant can invest into education and certification. There are several layers included: estimation of time needed to explain knowledge, estimation of load dynamics that can be accepted by participants, overall time spent on lecture/practical work following standard similar curriculums and skill based approach which can be split into learning outcomes for simplicity and better knowledge flow.

All combined into attractive program extended to certification path, provide up-to-date approach in practices, learning-by-example principles and assure relevant time for practical work, essentially needed when dealing with cloud technologies.

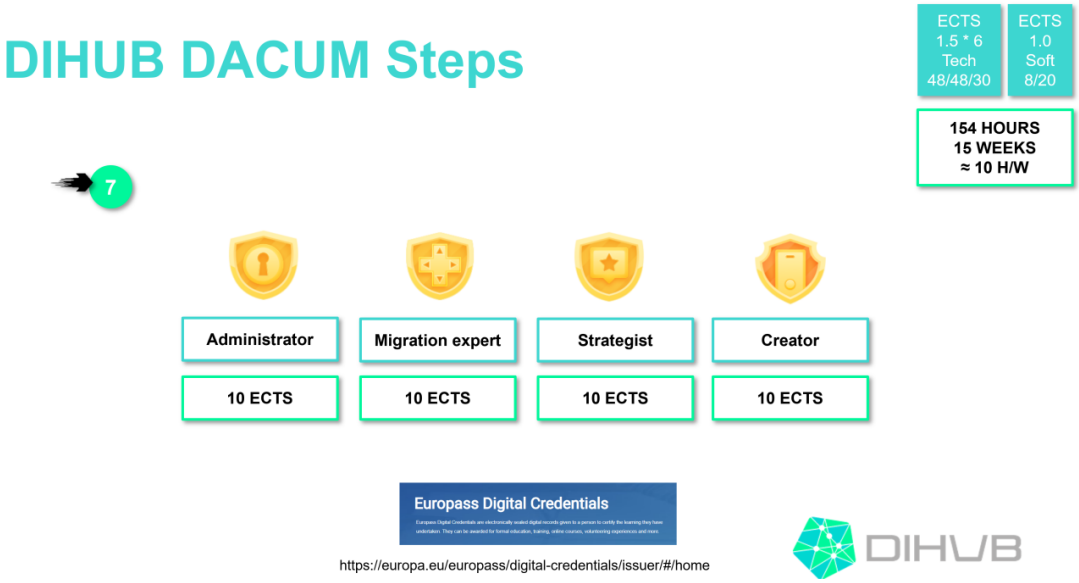

Figure 25 Certification paths workload

Using proposed approach, educational programs will be attractive to both for school-to-work or work-to-work learning individuals which will be welcomed and accepted as long expected standard.

6.4. DIHUB Recommendation#4

This DIHUB implementation recommendation is related to the growing need for standardisation of skills on the EU level. By defining skills and group of skills, the DIHUB team created fundamentals or base-bricks for future use and re-use of recommended approach. With aim to go step further, the DIHUB team compared defined skills with ESCO classification with two main points in mind:

1. to suggest to ESCO team how skills should be grouped for common use and to provide future insights/reports when analysing EU cloud labour market landscape;
2. to validate that DIHUB program tracks are relevant from industry, expert and policy perspective;
3. to suggest new skills that were identified during DACUM process which are currently not included into ESCO classification;
4. to improve interoperability and knowledge transfer between similar education providers and therefore to ease up talent mobility among EU education and labour market ecosystem;
5. and finally, to provide a relevant, well-rounded and useful tool for companies – something they will be able to use, irrespective of the level of current cloud literacy, as a clear vision support, showing that technological future will constantly challenge their technical capability. We believe that tools like this will be a highly useful support on their path towards business success.

The table below combines all relevant DIHUB cloud skills and match them with similar ESCO concept. Two skills are to be recommended for addition into ESCO as new concepts, while 20 cloud based and 4 soft skills are to be marked as cloud related.

Table 5 DIHUB Cloud Academy work-to-work transition

DIHUB Skill	ESCO Concept
DIHUB Skill#1 **Virtualization**	manage ICT virtualisation machines http://data.europa.eu/esco/skill/ae4f0cc6-e0b9-47f5-bdca-2fc2e6316dce
DIHUB Skill#2 **Database management**	manage database http://data.europa.eu/esco/skill/29fb0fb5-dfc4-4098-ac9b-3a712000f48f
DIHUB Skill#3 **Serverless architecture**	ICT architectural frameworks http://data.europa.eu/esco/skill/c453cf81-6197-428e-84c6-70c773b63f27
DIHUB Skill#4 **Security**	ICT security standards http://data.europa.eu/esco/skill/3ff589b7-68df-4ea5-ae41-b395bdb2378f
DIHUB Skill#5 **Cloud deployment including multicloud**	solution deployment http://data.europa.eu/esco/skill/1d86f05e-e9cc-40ce-99d8-2b21cc71b16b
DIHUB Skill#6 **Hybrid cloud**	hybrid control systems http://data.europa.eu/esco/skill/a2b566b0-1070-47a4-adc8-88839942ce25
DIHUB Skill#7 **DevOps**	DevOps http://data.europa.eu/esco/skill/f0de4973-0a70-4644-8fd4-3a97080476f4
DIHUB Skill#8 **Application migration strategies**	develop automated migration methods http://data.europa.eu/esco/skill/0b0335f3-0aa1-491e-895e-81fc8774a300
DIHUB Skill#9 **Programming**	ICT system programming http://data.europa.eu/esco/skill/b105ec9b-0857-41d6-8d07-a83e58b73d90

DIHUB Skill#10 **Artificial intelligence and Machine learning**	principles of artificial intelligence http://data.europa.eu/esco/skill/e465a154-93f7-4973-9ce1-31659fe16dd2 utilise machine learning http://data.europa.eu/esco/skill/8369c2d6-c100-4cf6-bd83-9668d8678433
DIHUB Skill#11 **Automation**	(TO BE DEFINED – NEW SKILL)
DIHUB Skill#12 **Adaptability**	adapt to changes in technological development plans http://data.europa.eu/esco/skill/f5308e60-d763-4ead-be95-88c96fb3e02b
DIHUB Skill#13 **Performance testing**	perform business analysis http://data.europa.eu/esco/skill/27ed854c-15b8-4ba2-90e9-ae888a219703
DIHUB Skill#14 **Change management**	apply change management http://data.europa.eu/esco/skill/3c03ee71-4a23-448f-b79e-81fd75d27dca
DIHUB Skill#15 **Scalability**	(TO BE DEFINED – NEW SKILL)
DIHUB Skill#16 **Migration alternatives**	perform business analysis http://data.europa.eu/esco/skill/27ed854c-15b8-4ba2-90e9-ae888a219703
DIHUB Skill#17 **Cloud TCO**	cost management http://data.europa.eu/esco/skill/7d35602d-bc94-4975-aa7c-f4e8e05ce8e0
DIHUB Skill#18 **Cost control and cost factors**	compare production forecasts with actual results http://data.europa.eu/esco/skill/1ba35185-09cc-4b54-a3c5-57b87be4d9d1
DIHUB Skill#19 **CAPEX vs OPEX**	make investment decisions http://data.europa.eu/esco/skill/0c9da986-721e-4f75-b566-0c6c212a8f60
DIHUB Skill#20 **Vendor selection**	market research http://data.europa.eu/esco/skill/8770350e-746f-4adb-9556-18ca68104be6
DIHUB Skill#21 **Teamwork**	teamwork principles http://data.europa.eu/esco/skill/a5b0cd5c-e13a-4ab3-8d93-4d242adcfb01
DIHUB Skill#22 **Ethics**	ethics http://data.europa.eu/esco/skill/cef5c0f8-1e40-4c09-b6a7-aa7811849e5d
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DIHUB Skill#24 **Presentation**	prepare presentation material http://data.europa.eu/esco/skill/1ba59ce0-7fec-434b-8d5c-9b275250a26c

7. DIHUB Process in Numbers

7.1. Companies and industries included in DACUM interviews

Ericsson Nikola Tesla
(telco)

Infobip
(software)

Ina
(energy)

Atos
(software)

AKD
(cybersecrutiy)

Reversing Labs
(cybersecurity)

Diverto
(cybersecurity)

APIS IT
(software/system)

Combis
(software/system)

Q Agency
(software)

Five
(software)

Storm Computers
(system)

O2
(system)

Optim IT
(software/system)

Photomath
(software)

Rimac
(hardware)

7.2. Number of interviews

6 interview rounds
total of 22 participants

more than 10 use cases
described using job role activities

more than 50 skills evaluated
druing DACUM process

7.3. Relevance on the local and EU level

Once we compiled all research results, it was clear that our company selection was relevant not only on the local/national level but also globally. All our interviewees are members of international teams, and they were able to provide insights and comparison of their jobs and global practices. This guided our decision that it is

possible to extrapolate the conducted DIHUB analysis on the EU level without any major adjustments (the analysis showed that cloud-related skills, jobs and activities have no local/national specific features).

DIHUB

www.dihubcloud.eu

PARTNERS

Helsinki Business College (Finland)

INOVA+ (Portugal)

Know and Can Association (Bulgaria)

Bulgarian-Romanian Chamber of Commerce and Industry (Bulgaria)

TICE.PT. Pólo das Tecnologias de Informação, Comunicação e Electrónica (Portugal)

Haaga-Helia University of Applied Sciences (Finland)

Helsinki Region Chamber of Commerce (Finland)

Algebra University College (Croatia)

Croatian Employers Association (Croatia)

TARTU CITY (Estonia)

BCS Koolitus (Estonia)

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