Individual Module e-Portfolio

Please access my e-portfolio using the following link: https://gesine-2000.github.io/gesine-linn.github.io/index.html

You can navigate to this module via the menu bar, or access it directly here: https://gesine-2000.github.io/gesine-linn.github.io/Cloud.html

Introduction:

In the module Cloud Operations and Management, we focussed, as the title of this module tells us on Cloud Computing. Cloud computing has transformed enterprise IT by enabling on-demand access to scalable and flexible resources delivered through service models such as IaaS (Infrastructure as a Service), PaaS (Platform as a Service), and SaaS (Software as a Service) (Schuhmacher, 2021; Harding, 2020). These models, offered by major providers including AWS, Azure, and Google Cloud, support both traditional infrastructure and modern cloud-native applications. Beyond the advantages of cost efficiency, elasticity, and global reach, cloud adoption also raises challenges around vendor lock-in, security, and compliance (Buyya & Dastjerdi, 2016). To address these, enterprises increasingly adopt hybrid and multi-cloud strategies, often supported by frameworks such as TOGAF and practices like Infrastructure as Code (IaC).

Weekly Reflections:

Introduction into Cloud Computing:

The introduction into Cloud Computing has been valuable for me as it worked as a bridge builder in between my theory and my professional experience. As a project manager working on a cloud application for product configuration (CPQ tool), I am already familiar with practical aspects of cloud deployment and delivery. However, gaining a structured understanding of the historical evolution of cloud computing, its service models (IaaS, PaaS, SaaS), and provider strategies has given me new perspectives on why certain architectural or strategic choices are made in practice. I was particularly engaged by the discussion forum on AWS versus GCP, as it highlighted how provider ecosystems not only shape technical decisions but also influence long-term agility, operational costs, and the availability of skilled resources. This discussion has helped me appreciate the strategic dimension of cloud adoption, showing that decisions go beyond technology and involve considerations of business alignment, scalability, and governance (Floerecke & Lehner, 2020).

AI in the Cloud environment

In week 3, we explored integrating AI into cloud platforms. Although AI is not yet implemented in the CPQ tool I am managing, I can see its potential for enhancing automation, predictive analytics, and personalisation (Zhang et al., 2020). Our vendor currently offers beta licences for a “smart optimization model” which can be a first step towards AI. Critically, AI adoption requires high-quality data, skilled personnel, and careful attention to governance (Russell & Norvig, 2021). Further, resource-intensive AI workloads can increase costs, and vendor lock-in remains a concern. Personally I think that when integrating AI-driven services in cloud environment, it is essential to remeain cautios about handling sensitive product data and regulatory compliance.

Cloud native tools

Week 5 focused on cloud-native tools, which are designed to fully leverage cloud environments for scalability, resilience, and rapid deployment. I could relate directly to this topic because our vendor uses containers and microservices to structure our application. Further we use Kubernetes to handle dynamic traffic loads during peak season like Christmas or Black Friday. Learning more systematically about tools like Kubernetes, Docker, and CI/CD pipelines helped me understand why teams adopt these technologies: they simplify deployment, make scaling easier, and support continuous updates without downtime (Burns et al., 2016).

A practical example I found useful is how Kubernetes automates the management of containerized applications. At work, we faced challenges with our vendor when deploying updates to our software. We can not accept delays or long downtimes, as we block the whole sales organisation from working. Understanding how Kubernetes orchestrates containers and automatically handles failures gives me insights into how we could improve operational efficiency and reliability (Burns, Beda and Hightower, 2019).

Edge Computing

In week 6, we explored edge computing, which brings computation and data storage closer to the sources of data, instead of relying solely on centralised cloud servers. This topic was particularly relevant to my work because in my software, low latency and fast response times are important when users interact with the CPQ tool. Although edge computing is not yet implemented in our system, I can see how it could improve performance by processing some data locally or near the user, reducing the need for all requests to travel to the central cloud (Mouradian et al., 2018).

A practical example I found interesting is the use of edge devices in retail. Some companies deploy local servers in stores to analyse customer behavior in real time, such as tracking which products are picked up or which displays attract attention. This allows faster decision-making and personalized services without relying entirely on cloud processing (Shi et al., 2016). Similarly, in manufacturing, edge computing can monitor machines on the factory floor to detect faults immediately, preventing downtime (Satyanarayanan, 2017).

Serverless Computing

In week 10, we studied serverless computing, which allows developers to run code without managing underlying servers, with resources automatically allocated on demand. At first, I was enthusiastic because serverless promises easier scaling, reduced operational overhead, and a pay-as-you-go model that can save costs (Baldini et al., 2017). From a project management perspective, this seems very attractive for cloud applications like my product configuration service, where workloads can fluctuate based on user activity.

However, being critical, I can see several limitations and risks. According to Chapin (2017) Serverless functions are not always suitable for long-running or resource-intensive tasks, and debugging can be more complex due to limited visibility into the underlying infrastructure. For example, if we were to migrate some of our computation-heavy pricing logic to a serverless function, cold-start delays could impact user experience, and tracing errors across distributed functions could slow down incident resolution. Additionally, vendor lock-in is a real concern (Adzic & Chatley, 2017).

Skills Development and practical application:

During my studies of this module, I developed a wide range of technical and professional skills, particularly in cloud architecture, automation, and security.

Reflecting on my week 2 forum post which was about a "ROCCA and TOGAF implementation in government agencies" (Hamberger, 2025) highlighted the importance of structured enterprise architecture frameworks. Although I am working in the private sector, I recognised similar challenges during a digital monitoring solution rollout. During this rollout TOGAF-style frameworks guided technical architecture but lacked measurable outcome tracking. Integrating a results-oriented perspective like ROCCA could have enhanced alignment between business objectives and technical design, a principle I now apply when planning cloud projects (Anggraini, Binariswanto & Legowo, 2019; Janssen & Kuk, 2016).

My forum post in week 3, on Microsoft Visio as a cloud design tool (Hamberger, 2025) reinforced my skills in structured architecture planning and collaborative design. Using Visio for early-stage cloud diagrams demonstrated how formal documentation supports compliance and auditing. While Lwakatare et al.(2019) argue that automated design tools offer faster iteration, I found that template-based modelling ensures clarity and accountability, particularly in regulated environments.

My hands-on skills were further developed through practical exercises. For example deploying a 12-Factor application on Kubernetes using Minikube allowed me to experience container orchestration and infrastructure-as-code principles. Initially, Minikube failed due to low system resources, but troubleshooting and deploying the app according to 12-Factor guidelines helped (Burns et al., 2016; Burns, Beda and Hightower, 2019). Similarly, in week 4, executing a Bash script to automate provisioning on an OpenStack cloud, reinforced my ability to create repeatable cloud deployments. While automation through scripting is widely recognised as essential for efficiency, yet Wettinger (2015) cautions against over-reliance on scripts without proper testing and error handling.

In week 6, my team submitted a development project which focused on cloud infrastructure and framework. Preparing the report required translating theoretical concepts into practical design choices, particularly when considering future edge computing integration. Although edge computing was not yet implemented, I critically evaluated potential benefits and trade-offs in terms of latency, cost, and complexity (Shi et al., 2016; Satyanarayanan, 2017).

My security skills were strengtened in week 7 through a forum post on auditing an OpenStack cloud application using OpenVAS (Hamberger, 2025). Conducting vulnerability scans and mapping findings to ISO/IEC 27001 controls, enhanced my practical understanding of risk management. While Greenbone (2023) emphasises technical fixes, authors like NIST (2018) and CSA (2021) stress embedding security into governance and continuous monitoring. This multi perspective highlighted that technical proficiency alone is insufficient.

In week 10, implementing a serverless function using OpenFaaS illustrated operational optimization and limitations of serverless computing (Baldini et al., 2017; Chapin, 2017). Deploying a greeting service reinforced skills in resource allocation, deployment automation, and troubleshooting, while also revealing challenges such as cold-start latency and vendor dependency (Adzic & Chatley, 2017). Critically, I recognized that serverless is not universally suitable, requiring careful evaluation of workload characteristics.

Finally, week 12’s discussion on AI, Blockchain, and Quantum Computing in cloud operations encouraged forward-looking and critical thinking (Zhang et al., 2020). Yet, Russel & Norvig (2022) differ on feasibility and readiness: Bernhardt (2020) argues AI integration is transformative and Mittelstadt et al. (2016) caution that implementation complexity, resource demands, and ethical considerations limit immediate practical use. Overall,this activity refined my ability to evaluate emerging technologies critically and consider their realistic application in enterprises.

Professional Skills	Before the Module	After the Module	Description
Cloud Architecture & Design	**	****	I gained strong knowledge of cloud frameworks (e.g., TOGAF & 12 – Factor design) and practiced structuring modelling using Kubernetes in one of the formative activities. This enabled me to translate business objectives into scalable technical architectures.
Automation and IaC	*	****	During one of the formative tasks, I developed bash scripting skills for OpenStack and practiced Kubernetes. This reinforced my understanding of automation in efficient deployment environments.
Security and Compliance in Cloud	**	***	I acquired practical skills in vulnerability scanning and learned how compliance frameworks integrate with governance. This skills will be highly relevant for my goal of becoming an international IT project manager, especially in highly regulated environments.
Risk Management in Cloud Projects	*	****	Understood operational risks (which helped me during a recent down-time of our cloud application)and learned to evaluate trade-offs between performance, maintenance and costs.
Hybrid Cloud Strategy	*	***	I developed the ability to evaluate trade-offs between private and public cloud, particularly for highly regulated industries like the medical sector. Further, I Developed awareness of how hybrid solutions support scalability while maintaining governance and cost efficiency across international contexts.
Emerging Technologies	**	****	I learned to critically evaluate emerging trends like AI, Blockchain and Edge Computing. This sharpened my ability to advise on realistic and future proof cloud strategies.
Professional Competences	***	****	I enhanced my professional competence in collaborating with diverse team. This skills will help me to mediate conflicts in high-pressure settings, Developed awareness of how hybrid solutions support scalability while maintaining governance and cost efficiency across international contexts.

Figure 1: Professional Skills Matrix (Hamberger, 2025)

<u>Application to Industry:</u>

Working in a large organisation with more than 21,000 employees, I have experienced first-hand both the potential and the limitations of applying cloud computing principles in practice. While our company uses many different cloud applications, we are far from being a “modern” cloud-native enterprise. This creates both opportunities and challenges when aligning theory from this module with real-world application.

One of the most relevant principles from this course is the hybrid cloud model. According to Buyya et al. (2008), hybrid approaches allow firms to combine the elasticity of public cloud with the control of private or on-premise solutions. In my industry, this is particularly important because many systems are deeply embedded in existing processes and cannot simply be moved “as-is”. A gradual migration strategy, supported by hybrid architectures, seems more realistic than attempting a full cloud transformation (Marston et al., 2011). Reflecting on my organisation, I see the risk that our size and complex approval structures can slow down adoption, but also the potential to leverage hybrid setups to modernise incrementally.

Automation was another important theme from this module. Mell and Grance (2011) highlight how on-demand self-service and rapid provisioning can improve operational efficiency. In my workplace, manual configurations and unclear approval processes often delay projects. Applying Infrastructure as Code (IaC) and automated pipelines could reduce errors and increase scalability (Burns, Beda and Hightower, 2019). However, such changes require not only technical training but also cultural acceptance. As I learned in class discussions this can be more difficult than the technology itself.

Security and governance also emerged as recurring challenges. In theory, cloud services offer strong security frameworks, yet in large companies concerns about compliance and vendor lock-in often dominate decision-making (Armbrust et al., 2010). From my perspective, this creates a paradox: while security is used as a reason to delay cloud adoption, the lack of modern cloud governance may actually increase risks. Developing centralised cloud policies and adopting recognised standards such as ISO/IEC 27001 (ISO, 2013) could help balance risk management with innovation.

Finally, this module highlighted the human dimension of cloud operations. In my team assignment, my peers valued my reliability and problem-solving but also encouraged me to show more flexibility with different working styles. This mirrors what I observe in my industry: cloud transformation requires technical excellence but also adaptability, as different stakeholders will always have competing priorities. For me, this reflection shows that successful cloud management in industry is as much about interpersonal skills and governance as it is about technology (Puklavec, Oliveira and Popovič, 2017).

Future Learning Goals:

My future learning will focus on strengthening expertise in cloud computing as well as broadening my competencies across IT management. While this MSc programme has provided a solid foundation, I aim to deepen my knowledge in governance, automation, and compliance, as these areas are critical for effective international IT project leadership. Building on the module units, I intend to explore serverless computing and AI-driven cloud services, which are increasingly central to scalable and cost-efficient solutions (Buyya, R., Vecchiola, C. and Selvi, S.T, 2013; Villamizar et al., 2015). I will also monitor emerging trends such as quantum cloud and edge computing, which are expected to reshape data-intensive industries in the coming decade (Perifanis and Kitsios, 2022).

Professionally, I plan to pursue IPMA Level D (ICB4) certification to consolidate my project management credentials, alongside expanding technical expertise through cloud provider certifications with AWS and Azure. One actionable step I intend to pursue to enhance my understanding of cloud services is exploring AWS Skill Builder. Further, I also recognise the importance of interpersonal growth. To improve, I will, as also stated by Castro et al. (2022), consciously integrate alternative approaches in collaborative tasks, balancing my commitment to high standards with openness to diverse perspectives.

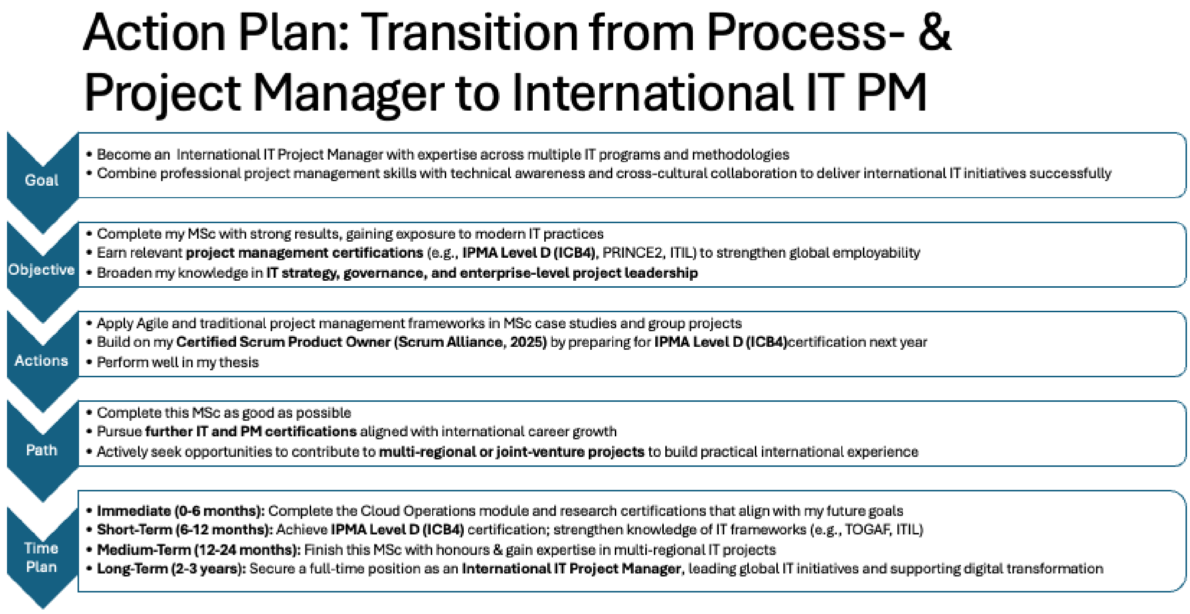

Figure 2: Action Plan (Hamberger, 2025)

In conclusion, the combination of technical and interpersonal growth will prepare me to lead complex, cross-border IT projects in the future and to deliver outcomes that meet stakeholders needs. Further I learned that applying cloud computing principles in a large, conservative organisation requires pragmatism. Overall, this module has helped me see cloud operations not just as a technical discipline, but as a holistic challenge involving people, processes, and strategy.

Wordcount: 2182

References:

Hamberger, G. L. (2025). Forum posts (weeks 2, 3, 7, 10).

Hamberger, G. (2025) Individual Module E-Portfolio. Cloud Operations Management 2025. Essay submitted to the University of Essex Online.

Adzic, G. and Chatley, R. (2017) 'Serverless computing: economic and architectural impact,' *Proceedings of the IEEE International Conference on Cloud Engineering* [Preprint]. https://doi.org/10.1145/3106237.3117767.

Anggraini, N., Binariswanto, N. and Legowo, N. (2019) 'Cloud Computing Adoption Strategic Planning using ROCCA and TOGAF 9.2: A study in Government Agency,' *Procedia Computer Science*, 161, pp. 1316–1324. https://doi.org/10.1016/j.procs.2019.11.247.

Armbrust, M. *et al.* (2010) 'A view of cloud computing,' *Communications of the ACM*, 53(4), pp. 50–58. https://doi.org/10.1145/1721654.1721672.

Baldini, I. *et al.* (2017) 'Serverless computing: current trends and open problems,' in *Springer eBooks*, pp. 1–20. https://doi.org/10.1007/978-981-10-5026-8_1.

Bernhardt, C. (2020) *Quantum computing for everyone*. MIT Press.

Borra, P. (2024) *Comparison and analysis of leading cloud service providers (AWS, Azure and GCP)*. International Journal of Advanced Research in Engineering and Technology, 15(3), pp. 266–278. Available at: https://iaeme.com/MasterAdmin/Journal_uploads/IJARET/VOLUME_15_ISSUE_3/IJARET_15_03_023.pdf (Accessed: 2 August 2025).

Burns, B. *et al.* (2016) 'Borg, Omega, and Kubernetes,' *Communications of the ACM*, 59(5), pp. 50–57. https://doi.org/10.1145/2890784.

Burns, B., Beda, J. and Hightower, K. (2019) *Kubernetes: up and running: Dive Into the Future of Infrastructure*. O'Reilly Media.

Buyya, R. *et al.* (2008) 'Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility,' *Future Generation Computer Systems*, 25(6), pp. 599–616. https://doi.org/10.1016/j.future.2008.12.001.

Buyya, R. and Dastjerdi, A.V. (2016) *Internet of things: Principles and Paradigms*. Morgan Kaufmann.

Buyya, R., Vecchiola, C. and Selvi, S.T (2013) *Mastering cloud computing*, *Elsevier eBooks*. https://doi.org/10.1016/c2012-0-06719-1.

Castro, M. *et al.* (2022) 'Do the Project Manager's Soft Skills Matter? Impacts of the Project Manager's Emotional Intelligence, Trustworthiness, and Job Satisfaction on Project Success,' *Administrative Sciences*, 12(4), p. 141. https://doi.org/10.3390/admsci12040141.

Chapin, M.Roberts.J. (2017) *What is serverless?*

Floerecke, S., Lehner, F. and Schweikl, S. (2020) 'Cloud computing ecosystem model: evaluation and role clusters,' *Electronic Markets*, 31(4), pp. 923–943. https://doi.org/10.1007/s12525-020-00419-2.

Greenbone (2023) *OpenVAS vulnerability Scanner*. https://www.greenbone.net/en/openvas-scan/ (Accessed: October 11, 2025).

Google Cloud (2024) *AWS, Azure, Google Cloud: service comparison*. Available at: https://cloud.google.com/docs/get-started/aws-azure-gcp-service-comparison (Accessed: 2 August 2025).

Gupta, D. (2024) *The cloud computing journey: Design and Deploy Resilient and Secure Multi-cloud Systems with Practical Guidance*.

Harding, C. (2020) *Cloud Computing for Business -The Open Group Guide*. Van Haren.

ISO (2013) *ISO/IEC 27001:2013 Information Security Management Systems – Requirements*. https://www.iso.org/obp/ui/#iso:std:iso-iec:27001:ed-2:v1:en (Accessed: October 11, 2025).

Janssen, M. and Kuk, G. (2016) 'The challenges and limits of big data algorithms in technocratic governance,' *Government Information Quarterly*, 33(3), pp. 371–377. https://doi.org/10.1016/j.giq.2016.08.011.

Lee, C., Kim, H.F. and Lee, B.G. (2024) 'A systematic literature review on the strategic shift to cloud ERP: Leveraging microservice architecture and MSPs for resilience and agility,' *Electronics*, 13(14), p. 2885. https://doi.org/10.3390/electronics13142885.

Lwakatare, L.E. *et al.* (2019) 'DevOps in practice: A multiple case study of five companies,' *Information and Software Technology*, 114, pp. 217–230. https://doi.org/10.1016/j.infsof.2019.06.010.

Marston, S. *et al.* (2010) 'Cloud computing — The business perspective,' *Decision Support Systems*, 51(1), pp. 176–189. https://doi.org/10.1016/j.dss.2010.12.006.

Megaport (2023) *AWS vs Azure vs Google Cloud: the big three compared*. Available at: https://www.megaport.com/blog/aws-azure-google-cloud-the-big-three-compared/ (Accessed: 2 August 2025).

Mell, P.M. and Grance, T. (2011) *The NIST definition of cloud computing*. https://doi.org/10.6028/nist.sp.800-145.

Mittelstadt, B.D. *et al.* (2016) 'The ethics of algorithms: Mapping the debate,' *Big Data & Society*, 3(2). https://doi.org/10.1177/2053951716679679.

Mouradian, C. *et al.* (2017) 'A comprehensive survey on FOG computing: state-of-the-art and research challenges,' *arXiv (Cornell University)* [Preprint]. https://doi.org/10.48550/arxiv.1710.11001.

Nielsen, M.A. (2015) *Neural networks and deep learning*.

Perifanis, N.-A. and Kitsios, F. (2022) 'Edge and Fog Computing Business Value Streams through IoT Solutions: A Literature Review for Strategic Implementation,' *Information*, 13(9), p. 427. https://doi.org/10.3390/info13090427.

Puklavec, B., Oliveira, T. and Popovič, A. (2017) 'Understanding the determinants of business intelligence system adoption stages,' *Industrial Management & Data Systems*, 118(1), pp. 236–261. https://doi.org/10.1108/imds-05-2017-0170.

Russell, S. and Norvig, P. (2021) *Artificial Intelligence: A Modern Approach, Global Edition*. Pearson Higher Ed.

Satyanarayanan, M. (2017) 'The emergence of edge computing,' *Computer*, 50(1), pp. 30–39. https://doi.org/10.1109/mc.2017.9.

Schumacher, D. (2021) 'Changing behavior with data: Gartner's 2021 technology trends,' *Gartner*, 12 January. https://www.ibsolution.com/academy/blog_en/gartner-technology-trends-2021.

Shi, W. *et al.* (2016) 'Edge computing: vision and challenges,' *IEEE Internet of Things Journal*, 3(5), pp. 637–646. https://doi.org/10.1109/jiot.2016.2579198.

Tian, Y. *et al.* (2024) 'An Edge-Cloud Collaboration Framework for Generative AI Service Provision with Synergetic Big Cloud Model and Small Edge Models,' *IEEE Network*, 38(5), pp. 37–46. https://doi.org/10.1109/mnet.2024.3420755.

Villamizar, M. *et al.* (2015) 'Evaluating the monolithic and the microservice architecture pattern to deploy web applications in the cloud,' *IEEE 8th International Conference on Cloud Computing* [Preprint]. https://doi.org/10.1109/columbiancc.2015.7333476.

Wettinger, J. *et al.* (2015) 'Streamlining DevOps automation for Cloud applications using TOSCA as standardized metamodel,' *Future Generation Computer Systems*, 56, pp. 317–332. https://doi.org/10.1016/j.future.2015.07.017.

Zhang, J. and Tao, D. (2020) 'Empowering Things with Intelligence: A Survey of the Progress, Challenges, and Opportunities in Artificial Intelligence of Things,' *arXiv (Cornell University)* [Preprint]. https://doi.org/10.48550/arxiv.2011.08612.