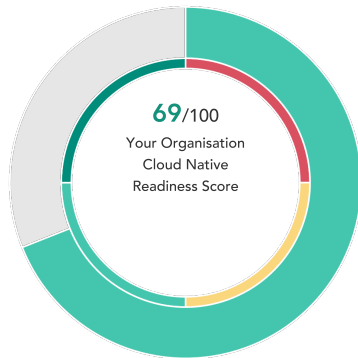


An initiative by

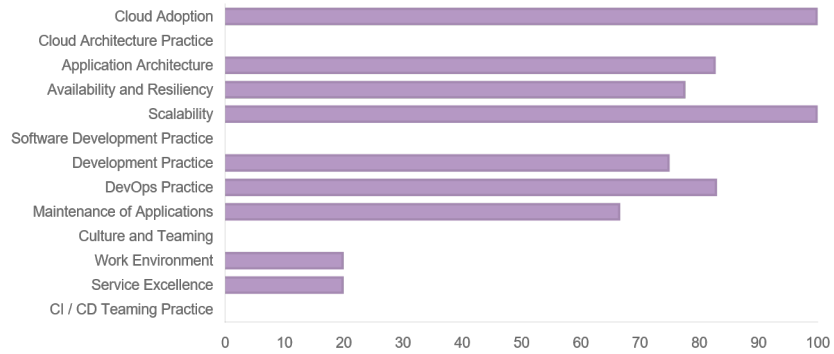


Tech Capability Assessment Tool (Cloud Native)

Cloud native technologies are used to develop applications built with services packaged in containers, deployed as microservices and managed on elastic infrastructure through agile DevOps processes and continuous delivery workflows.



Basic Developing Proficient Leading



Summary

Practice Level : Proficient

Business Strategy

Your organisation is assessed to be at the **Proficient** level of Cloud Native capability.

Your organisation's products are in the Cloud. Your organisation has begun to leverage Cloud Native architecture, practices and techniques to be more scalable, agile and responsive to your customers.

Your organisation can consider scaling up your capabilities by:

1. moving more of your products / services onto the cloud
2. developing new products / services using cloud technology

Please refer to the individual domains for more detailed recommendations.

Learning and Development

Some of your employees may already possess good or advanced knowledge in Cloud Native. Your organisation can consider conducting in-house cross-training to further develop cross-disciplinary skills and improve collaboration in the development of Cloud Native products / services.

Check out IMDA's [SG-DJIM Talent portal](#) for any other endorsed courses under CITREP+ programme for new employees, or additional courses to develop your employees to support the development of new products / services your organisation plans to offer.

Teaming and Partnerships

Your organisation is probably already working with one or more partners in the delivery of your products /services in Cloud Native, congratulations!

Your organisation may consider working closely with your Cloud partner(s) to promote or connect your products / services to other customers, market segments, and even overseas markets!

If your organisation has yet to partner with any organisation to better deliver your products / services in Cloud Native, it is timely to explore engaging an appointed [GoCloud Service Provider](#) under IMDA's GoCloud initiative.



Overall Practice Level: In the cloud

Overall Description

Congratulations! Your organisation is already using cloud services in part or in whole, to provide products / services to your customers. You would be able to experience:

1. Flexibility as you can scale your products/services easily to meet your customers' needs
2. Efficiency as you would be able to get your products / services to market quickly, without issues related to infrastructure costs and maintenance
3. Competitive advantage as cloud services can enable you to develop innovative products / services.

Key Actions to Take

Continue to deliver your products / services in the cloud and strive to maximise the full potential of cloud services!
To achieve this, your organisation may consider further improvements on your products / services in:

1. Flexibility, whereby your customers would be able to access mobile versions of your products / services. This would help your customers improve their productivity as they access your products / services from anywhere and any mobile device.
2. Efficiency, whereby you would be able to recover quickly from disruptions using automation tools in the Cloud. This will result in further improvements in your products / services availability.
3. Strategic value to your customers, whereby you would be able to leverage cloud services to enable data analytics to help your customers gain insights from the use of your products / services.



Overall Practice Level: **Advanced**

1 - Application Architecture

Overall Description

Your organisation is assessed to have strong competencies in:

1. **Cloud Computing.** Your employees are highly competent in designing products / solutions for deployment or migration into a cloud environment. Your employees also have in-depth knowledge / skills in the various cloud services, and applies them to optimise the development and deployment of your products / services.
2. **Microservices** architecture and software development techniques. Your applications are broken down into small modular components and independent of each other. With this, your organisation can share similar microservices across multiple applications, thereby optimising application development using Cloud Native architecture.
3. **Containerisation** to bundle your **Microservices** together. In this way, your application / software can run efficiently and be deployed quickly across different computing platforms.

Key Actions to Take

Congratulations your organisation is assessed to have strong competencies in Cloud Computing, Microservices and Containerisation!

Moving forward to keep pace with the digital economy and changing customers' needs, your organisation is encouraged to review these key areas:

1. **Microservice pipeline optimisation.** This will help build a more effective microservice pipeline of cloud applications through use of cloud services to automate your build, integration and testing processes.
2. **The Structure and Organisation** of your teams to better organise your talent resources so that they can be equipped to run effectively and efficiently to meet your customers' growing needs.

Your organisation is also encouraged to keep watch on technological advancements in Cloud Computing. Key technology trends are automated software test design and reporting, and continuous deployment tools with abilities to deploy the product / service in the best cloud platform and configuration.

2 - Availability and Resiliency

Overall Description

Your organisation is assessed to have a **Robust Recovery Plan** for application disruptions or network outages. The plan leverages cloud services to automate the recovery of application functionalities that enables your products / services to be highly available.

Key Actions to Take

Congratulations for having a robust recovery plan for your products / services.

Moving forward, we recommend that your organisation consider adopting a national standard for business continuity management, e.g. ISO 22301, to standardise your governance and practise.

Alternatively, your organisation may consider keeping a technology watch on incident response trends for capabilities to automate alerts and status reporting, role assignments and workflows for recovery.

3 - Scalability

Overall Description

Your organisation is assessed to be scalable and able to meet rapid changes to the IT requirements without disrupting existing services or functions. This is likely because your organisation is leveraging cloud-based services, resources and utilities which is able to scale rapidly. This would allow you to support your business changing needs without expensive changes to your existing IT systems. In this way, your customers would also be able to choose the right sized service (e.g. size of data storage) they need, and change that choices whenever necessary.

Key Actions to Take

Congratulations! Your organisation is likely able to meet the changing needs of your customers well and it can scale rapidly without disrupting existing functions.

To further improve on your organisation's ability to scale effectively, your organisation may consider exploring the use auto scaling features to maximise the benefits of your organisation's cloud environment (if the cloud platform has auto scaling features). Potential benefits are better reliability of your products /service and cost management in meeting the changing IT requirements.

Overall Practice Level: **Advanced**

1 - Development Practice

Overall Description

Your organisation is **practising Agile software development life cycle / process and has implemented at least one** of the following software development practices:

1. **Acceptance Test-Driven Development (ATDD)**. In this method, users, developers and testers collaborate closely and rely on short development cycle and testing. Through this method, your organisation's development team also practises code development using user requirements gathered. This typically translates into lesser amount of time spent on re-works and have higher chances of getting business and user requirements right.
2. **Behaviour-Driven Development (BDD)**. In this method, developers and businesses' perspectives are taken into consideration for code development. Subsequently, these perspectives are also used to derive specific test cases. In this way, your development team would focus on the business value in the design and delivery of the product / service, thereby building features that would meet the needs of your users.
3. Other Agile software development practices such as TDD, SBE, Stand-up etc.

Key Actions to Take

Congratulations! Your organisation is practising Agile software development practice/s.
To further enhance your organisation's ability in the practice, you may consider:

1. **Monitoring the capacity of your development team** to fix backlogs resulting from increasing customers' demands in features and innovation. This is to help your organisation maintain the ability to deploy new or enhanced products / services to your customers quickly.
2. **Improving knowledge sharing** to increase productivity gained through problem solving as a team. This would in turn, result in your organisation's ability to increase business value in your products / services and ability to meet the increasing complexity and needs of your customers. Overall, this effort would also encourage innovation and develop more competencies or skillsets in your employees.
3. **Seeking consultation** to improve your organisation's capacity to fix backlogs or knowledge sharing abilities by engaging with a suitable IMDA appointed [GoCloud Service Provider](#) under IMDA's GoCloud initiative.

2 - DevOps

Overall Description

Your organisation is assessed to have **strong DevOps Competency and Practice**. Your team has in-depth knowledge / skills in DevOps practices and can lead others in the practice. Your team exhibits the ability to use cloud services, automation and **Orchestration Tools**. This in turn results in **Short Iteration Cycles** to continuously integrate, deliver and deploy working products / services to your customers.

Key Actions to Take

Congratulations for having a strong DevOps competency and practice in your organisation!
To maintain this strong competency and practice, it is recommended that the toolchain supporting the DevOps pipeline be reviewed regularly and upgraded as necessary to improve performance when more advanced toolchain (including automation and orchestration) become available.

3 - Maintenance of Application

Overall Description

Your organisation is assessed to maintain a high level of after sales maintenance service, in that:

1. **Service Up-Time** is achieved more than 90% of the time.
2. **Patches / Enhancements** are rolled out very frequently.

To achieve this, your organisation is likely practising more than one of the following practices as part of product / service maintenance after the delivery of your products / services:

1. **Perfective maintenance**, whereby functional enhancements are made to improve the performance of your product / service further even when the changes have not been suggested by faults.
2. **Preventive maintenance**, whereby your product / service faults which are yet to be discovered, are being detected and corrected while it is still working so that it does not break down unexpectedly.
3. **Adaptive maintenance**, whereby modifications are being made to your product / service due to environment changes to keep the product / service usable.
4. **Corrective maintenance**, whereby issues with your product / service is identified, isolated and rectified and restored for it to be operational again.

Key Actions to Take

To improve the service level for after sales maintenance further, your organisation may consider reviewing the following:

1. **Reliability of backups, IT infrastructure/ architecture, incident response and recovery procedures**. This will help identify areas of improvement to increase service up-time.
2. **Patch management plan** to increase the frequency in rolling out your products' / services' patches and enhancements.

Overall Practice Level: Beginner

1 - Work Environment

Overall Description

Your organisation's working environment currently may not be conducive for innovation and practise of Agile as team collaboration is weak or absent; likely do not exhibit these traits:

1. **An innovative culture** where employees feel safe-to-fail and are motivated to challenge the norm to try out new things.
2. **A collaborative practice**, which encourages your development and operations teams to work collaboratively throughout the product / service development life cycle towards a common desired outcome.
3. **Agile practices** using methodologies such as Scrum or Kanban. Your organisation's employees may have limited autonomy to make decisions, discuss and share workload among members as work teams may be fixed. Your employees may possibly feel over-stretched and find work pace to be fast and hard to bear.

Key Actions to Take

To improve the work environment and prepare for journey towards Cloud Native, your organisation can consider the following key actions:

1. **Inculcating an innovative culture.** This can begin with building awareness on the importance of innovation and design thinking. Activities like suggestion schemes, work improvement programmes and innovation boot-camps can be organised. In addition, your organisation may consider reviewing policies and processes to provide a fail-safe environment for your employees to try new things.
2. **Establishing collaborative work environment.** Ideas, strategy and approach to establish a collaborative work environment would need to be curated and discussed with your organisation's management. It should address the support needed, in terms of organisational structure review, collaborative tools, use of work space and any other factors needed for successful work collaboration. In addition, considerations to support self-organising teams infused with autonomy in decision making and resource planning should be taken. Subsequently, pilot the selected plans and designs for implementation of the collaborative work environment. With feedback gathered from the pilot, constructive changes could be made for full implementation.
3. **Commencing or enhancing Agile practice.** More experienced employee/s could be identified to attend relevant Agile related certification courses. As they practise, they can be the internal Agile champion to drive some of the changes in practice. At the same time, use cases to implement Agile can be identified, in preparation for implementation by employees trained in Agile. Prior to commencing the practice across the organisation, training and coaching would need to be conducted to familiarise the other employees working in the agile team.
4. **Gaining knowledge** through relevant courses under CITREP+ programme and funding. The relevant courses could be found at IMDA's [SG-D LIM Talent portal](#).

Characteristics of the next level

At the next level, your organisation would have a relatively more conducive working environment for innovation and Agile practice, and may exhibit a more collaborative working culture. Overall, your work environment would be making improvements or in the process of implementing:

1. A safe-to-fail working environment where employees would feel safe and would be encouraged to try out new things, thereby inculcating **an innovative culture**.
2. A process where your development and operations teams could work collaboratively throughout the product / service development life cycle. Eventually, a **collaborative work environment** would be established.
3. Your organisation's managers would be able to organise the employees into teams to support Agile practices, and the teams would be able to make decisions autonomously, discussing and sharing workload among members. Essentially, your organisation would be practising **Agile**.

2 - Service Excellence

Overall Description

Your organisation may not be able to fully meet your customers' expectations. The following practices are lacking or absent:

1. **Continuous Delivery** to provide your customers with early and continuous deployment of working products / services
2. **Continuous Improvement** to gather feedback and lessons learnt during sprint reviews and retrospectives, which would be well used to improve future sprints or product / service development.
3. **Technical Excellence** using techniques to manage the quality of product / service development. Your employees are not trained in techniques such as Extreme Programming (XP), pair programming, refactoring, test-driven development and peer code review.
4. Use of **Collaborative Tools** for development work. Development processes would not have been adjusted to maximise the benefits of the collaboration tools. Your employees are not familiar with tools such as JIRA, VSTS, Spiriteam, Hygger, Active Collab, Agilo, Pivotal Tracker and GitHub. Your teams not being well versed with collaborative tools will not work productively, where:
 1. Ideas can be shared actively, thereby facilitating innovation
 2. Questions can be clarified quicker and learning as a team is encouraged
 3. Communication among members is enhanced with better user interface and experiences
5. **Team Communication** through face-to-face sessions, updating burn-up / burndown charts and monitoring work-in-progress through tools like Kanban boards, thereby encouraging transparency in work reporting and updates.

Key Actions to Take

To improve on Service Excellence, your organisation may consider the following key actions:

1. **Gaining awareness and knowledge in DevOps and its benefits.** Understanding DevOps and its benefits helps drive the need for **Continuous Delivery** and **Continuous Improvement**. This is because Continuous Delivery and Improvement are fundamental DevOps practices that focus on development, testing and feedback gathering processes to achieve the desired outcome. This could be achieved by:
 1. Desktop research
 2. Attending relevant seminars or conventions
 3. Attending relevant courses under CITREP+ programme and funding. The relevant courses could be found at IMDA's [SG:DIIM Talent portal](#).
2. **Identifying product / service quality issues** such as coding errors could help drive **Technical Excellence** as techniques to overcome the issues are being learnt and applied.
3. **Adopting and practising Agile methodology well** could improve **transparency and communication** amongst your organisation's employees. Implementing collaboration tools for communication would help to also improve productivity, thereby increasing speed to service delivery.

Characteristics of the next level

At the next level, your organisation would be improving and achieving an improved level of service excellence. It could display some the following characteristics:

1. **Continuous Delivery** of working products / services.
2. **Continuous Improvement** through regular feedback and proactively learning from projects and immediately applied in the next sprints of future projects.
3. Improved **Technical Excellence** with higher quality of products / services and practises in various techniques.
4. Use of **Collaborative Tools** for collaboration during development work.
5. Better team **communication and transparency** which comprises face-to-face sessions and use of tools like Kanban boards for monitoring work-in-progress and for reporting and updates.

3 - Teaming to practise Continuous Integration (CI) / Continuous Delivery (CD)

Overall Description

Your organisation has yet to practise **Continuous Integration (CI) / Continuous Deployment (CD)** where automation in software development is likely not adopted. Your organisation is likely not be able to:

1. Build new or enhanced products / services quickly and to maintain high quality codes
2. Deploy new or enhanced products / services earlier into the market and frequently for your customers.

Key Actions to Take

To start CI/CD practice, we recommend that your organisation consider:

1. Running a small-scale proof-of-concept before actual implementation of CI/CD so that it is quicker to learn and less risky.
2. Selecting a suitable CI/CD tool (for example, Jenkins, GitLab CI, Buildbot, Drone) for your current products / solutions as well as development process.
3. Preparing and commence practising CI/CD in stages with a targeted outcome in mind.
4. **Gaining knowledge / competency** through relevant courses under CITREP+ programme and funding. The relevant courses could be found at IMDA's [SG:DIIM Talent portal](#).

Characteristics of the next level

At the next level, your organisation would be able to build new or enhanced products / services faster and maintain high quality codes. Your developed codes or new builds could be integrated from different platforms or tools for automated testing and maintenance. Subsequently, tested codes could be pushed to another stage or environment in a pipeline. Your organisation would be more competitive because new or enhanced products / services could be deployed quickly. Essentially, your organisation would be practising CI/CD.