Cloud Computing - IaaS, PaaS and SaaS

Not long ago, companies had to buy their own servers and look after them day and night. Cloud computing changes this: instead of owning the machines, organisations rent computing over the internet from a provider. The US National Institute of Standards and Technology, known as NIST, published a widely used definition of cloud computing in 2011. It describes three service models: Infrastructure as a Service, Platform as a Service and Software as a Service, or IaaS, PaaS and SaaS. Understanding the difference helps managers choose the right model and know which tasks remain their own.

1. What Cloud Computing Is

NIST describes cloud computing as convenient, on-demand access over a network to a shared pool of computing resources, such as servers, storage and applications. According to NIST, a true cloud service has five essential characteristics: on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service. In plain words, we take what we need when we need it, from anywhere, and pay for what we use.

Example: Electricity at home works like measured service: we do not build a power station, we simply use power and pay for what the meter shows. In the same way, cloud customers pay for the computing that they actually use.

At work: Mahmoud is the IT manager of a growing chain of bakeries. During the holiday season, online orders rise sharply, and the old office server keeps crashing. With rapid elasticity in the cloud, extra capacity is added for the busy weeks and released afterwards.

2. Infrastructure as a Service (IaaS)

IaaS is the most basic service model. The provider supplies the basic building blocks: processing power, storage and networks, running in its own data centres. The customer does not manage the physical hardware, but controls almost everything on top of it: the operating systems, the applications and the data. This gives the most flexibility and control, but it also needs the most technical skill.

Example: Renting an empty flat is like Infrastructure as a Service: the owner provides the walls, the water and the electricity. We bring our own furniture and look after everything inside.

At work: Mahmoud chooses Infrastructure as a Service for the bakeries' stock system. He rents virtual servers and installs the same system that used to run in the office. The hardware is no longer his problem, but his team still updates the system and manages its security.

3. Platform as a Service (PaaS)

PaaS goes one level higher. The provider manages the infrastructure and also the platform: the operating systems, the databases and the tools needed to build and run applications. The customer brings only its own application and data, and controls their settings. The price of this convenience is less control over the technology underneath.

Example: A furnished flat is like Platform as a Service: the furniture and the kitchen are already there. We simply move in with our clothes and start living.

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At work: The bakeries want a new app for ordering cakes online. A developer in Mahmoud's team builds it on Platform as a Service, so she writes only the app itself. The app goes live within weeks, with no servers to install.

4. Software as a Service (SaaS)

SaaS is the model that most people use every day, often without knowing it. The provider runs a complete application, and users simply open it in a web browser or in a mobile app. Online email, video meetings and shared office tools are common examples. The customer does not manage the software or the servers, only the user settings and its own data. SaaS is quick to start and needs little IT effort, but it leaves the least room for change.

Example: A hotel room is like Software as a Service: the bed is made, the cleaning is done and breakfast is ready. We simply arrive and use the room.

At work: For email and office tools, Mahmoud picks Software as a Service. New staff in a new branch can work from the first day with only a username and a password. Updates arrive automatically, without any work from his team.

5. Shared Responsibility

Moving to the cloud does not move all the responsibility to the provider. Under the shared responsibility model, the provider protects what it manages, and the customer protects the rest. The higher the service model, the more the provider looks after: a lot in SaaS, less in PaaS and the least in IaaS. However, in every model the customer remains responsible for its data, its user accounts and who has access. Even a strong provider cannot protect a customer who shares passwords or leaves files open to everyone.

Example: Even in a well-run hotel, shared responsibility applies: the hotel guards the building, but the guests lock their own doors and keep their passports safe.

At work: Mahmoud checks the shared responsibility for each service. He switches on two-step sign-in for all staff and removes the accounts of people who have left. The providers protect their data centres, and his team protects the bakeries' accounts and data.

Conclusion

In summary, cloud computing lets organisations rent computing over the internet and pay for what they use. IaaS provides the building blocks, PaaS adds a ready platform for building applications, and SaaS delivers complete software that is ready to use. As we move from IaaS to SaaS, we gain convenience and give up some control. Whatever the model, responsibility is shared, and our data and our users always remain our job. The best choice is the model that matches the team's skills, its needs and the control that it wants to keep.

Sources

- NIST, Mell, P. and Grance, T. (2011). SP 800-145: The NIST Definition of Cloud Computing – https://csrc.nist.gov/pubs/sp/800/145/final
- Microsoft Learn: Shared responsibility in the cloud – https://learn.microsoft.com/en-us/azure/security/fundamentals/shared-responsibility
- AWS: Shared Responsibility Model – https://aws.amazon.com/compliance/shared-responsibility-model/
- Provider pages are listed only as background on shared responsibility; the explanations here are in our own words and do not recommend any provider.

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