Cloud computing is often characterised by virtualised computing resources, seemingly limitless capacity and scalability, dynamic provisioning, multi-tenancy, self-service and pay-for-use pricing. Enterprise architecture can help to make the shift to cloud computing smooth. Serge Thorn, CIO, Architecting the Enterprise, explains.

Cloud computing is a computing model by which users can gain access to their applications from anywhere, through any connected device. Thanks to a strong service management platform, the management costs of adding more IT resources to the cloud can be significantly lower than those associated with alternate infrastructures. Enterprise architecture is necessary regardless of changes to underlying technologies. If managed properly, enterprise architecture will iterate and adjust to the winds of change. Client/server, SOA, RFID, cloud and other technology developments should be considered as styles, but enterprise architecture is at the heart of change. In reality, cloud computing should have little impact on enterprise architecture.

It is the role of the enterprise architecture team to:

- investigate if any style is simply hype or whether it holds real business value;
- understand the benefits and risks of a specific style;
- communicate these to business and IT;
- develop an adequate governance framework;
- align the ‘style’ with business requirements;
- give guidance for sustainable innovation;
- support business transformation.

If cloud computing does not take enterprise architecture into consideration, it will result in ‘spaghetti clouds’ (aligned with ‘spaghetti architectures’).

For organisations focusing more on technology architecture, cloud computing could be a big hit. But for businesses that want to successfully adopt cloud computing in a way that aligns to their business strategy, enterprise architecture is imperative (refer to diagram 1).

Cloud computing may be a fit when the core of internal enterprise architecture is mature. This means:

- A well defined and layered:
  - business architecture;
  - application architecture;
  - data architecture;
  - technology architecture

Refer to diagram 2.
well defined interoperability (as an example Pi-OCL may be used);
• a low level of security agreed (during the initiation phase);
• web as a target;
• cost issues;
• new products and services.

Cloud computing may not be a fit when the core of internal enterprise architecture is immature. This means:

• business, application and data architectures are tightly coupled;
• low level of interoperability defined;
• high level of security required;
• when applications have proprietary interfaces;
• when solutions are legacy.

Where there could be a good fit, an enterprise architecture project should be ‘cloud architecture aware’. The enterprise architecture team drives the programme and works collaboratively with both the business and the IT department (refer to diagram 3).

As a prerequisite for the adoption of cloud computing it would be highly recommended to develop a strategy for the consumption and management of cloud services. This would include the delivery model and the type of service or services being delivered. The first dimension to consider when developing a cloud strategy is the delivery model to be employed. There are two primary cloud delivery models: public and private. A third model, is a combination of both.

A private cloud is one in which both the consumer of cloud services and the provider of those services exist within the same enterprise. The ownership of the cloud assets resides in the same enterprise.

A public cloud is one in which the consumer of cloud services and the provider of cloud services exist in separate enterprises. The ownership of the assets used to deliver cloud services remains with the provider.

A hybrid cloud combines multiple elements of public and private cloud, including any combination of providers. In that strategy we would also address topics such as semantic management, security and transactions.

The pathway to cloud typically begins with a business demand, a business problem or challenge. Enterprise architecture frameworks will support the gathering of the business requirements and identify potential business solutions. Stakeholders in a workshop may come from business and IT operations, procurement, PMO, data centre, development, COO/CIO/CTO. Interoperability as mentioned previously will be an important element of the phase. The enterprise architecture team will collaborate with the business to understand and scope the needs; align them with the strategic enterprise architecture (bringing to bear the existing technological capabilities that can satisfy those needs, thereby promoting, sharing, reusing or building new ones if needed).

Given the relatively low barrier to entry, in the scenarios where the business is not sure of the viability of their proposal, they could go straight to the cloud instead of ‘experimenting’ before solidifying their requirements. The result of this is that the business may embark on a path of no return. To avoid this, make sure that the business case is complete, refer to business solutions without referring to any architecture style.

When starting the architecture consider the four domains: business, data, application and technology.
A cloud reference model, reference architecture and reference implementation approach is an accepted approach for planning and implementing cloud computing.

At that stage, it is recommended that you consider a cloud reference model. This is a description of the appropriate cloud industry standards, the dimensions of the cloud problem space and the decisions and choices that apply to cloud computing for an organisation. A cloud reference model, reference architecture and reference implementation approach is an accepted approach for planning and implementing cloud computing. Different cloud reference models can be considered such as those published by

- the Open Cloud Consortium;
- the Cloud Security Alliance;
- the Cloud Computing Reference Model (CC-RM) and Reference Architecture framework from AgilePath;
- The Accenture Cloud Reference Model for Application Architecture with its seven -layers. Like the OSI Model for networks, this cloud model is layered to separate concerns and abstract details.

In data architecture, data integration may be an issue for cloud computing as it pushes information back into silos, which IT may not have direct access to. It is also recommended to determine data and privacy classification and to prioritise the risk criteria of what goes in the cloud and what stays on-premise.

During the project’s prioritisation there is a need to understand the cloud resources. A step will be dedicated to identify candidates’ services in the cloud. Instead of now having to provide standardised ROI or cost-benefit analysis justifying the products that need to be bought or charge-backs that need to be agreed upon upfront for shared assets, the business can provide operational expenditure outlines and may go out to the cloud to source their requirements. No surprises with CapEx, decreased new product introduction training line item expenditures (many products are 'standards', which means there are lots of books, documentation and e-learning available etc), different charge-back agreements between finance and business units (the organisation may have access to the service independently from his internal structure); in short, no need to conform to existing enterprise-wide reference architectures to meet individual project needs.

During the implementation and deployment, activities may also include

- business processes (process-as-a-service);
- applications (application-as-a-service);
- data (information-as-a-service and database-as-a-service);
- technical services (storage-as-a-service and infrastructure-as-a-service);
- Security and operations implementation will have to be taken into consideration during the relocation. Security can also be considered as security-as-a-service.

The development and deployment teams would now be sourcing from and conforming to the cloud API and services, without the enterprise architecture team becoming the policeman and enforcing the reference architectures or corporate standards at various checkpoints (compliance and dispensation activities will remain for internal new systems). With overarching cross-project oversight not relevant anymore, each project would tend to work in its own cloud development sandbox, partly engendered by the partitioning paradigm of the cloud itself.

Barring some exceptions, the enterprise architecture team has not been relevant to the operation side of the organisation, but with the cloud, that seems to be disappearing. The cloud providers will furnish the relevant tools for management and reporting and take away the onerous tasks of patch management, version upgrades, high availability, disaster recovery and the like.

New technology styles are exciting, but using technology styles just for the sake of technology does not bring a real value. Technology use should be driven not by its 'coolness factor', but rather by business requirements and an underlying enterprise architecture framework. Moving some applications to the cloud can make some infrastructures go away, but badly designed solutions won’t be improved by relocating to the cloud.