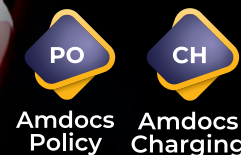


Built for Integrated 5G Policy & Charging Control



Introduction

As new and complementary approaches manifest including DevOps, microservices and Continuous Integration / Continuous Delivery (CI/CD), so too do richer capabilities that break down the traditional approach into more bite-sized value. A microservices approach removes the "fork-lift" type upgrade and introduces an "update" rather than "upgrade" method of evolution. It reduces "shocks" to the rest of the network and to services. Policy and Charging have become the ever more powerful "brain" and "treasury" respectively of an ever more powerful, open and backwards compatible 5G.

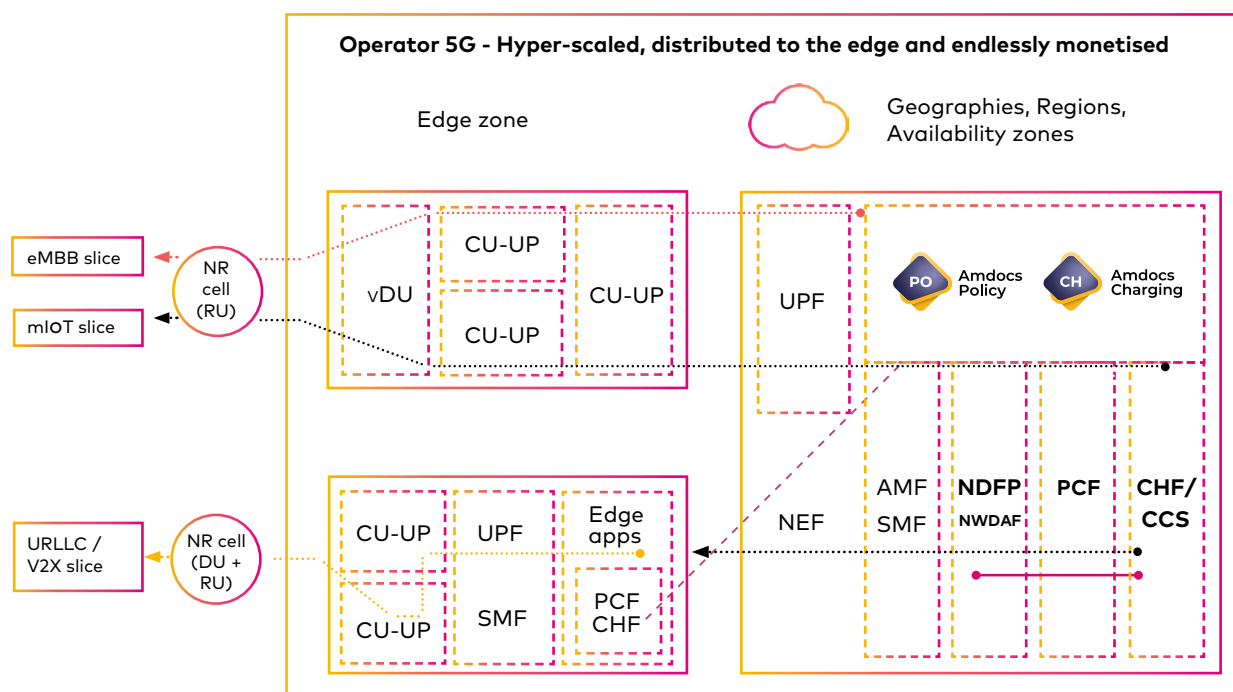


Figure 1: Hybrid Cloud for Service Providers with Amdocs PCC enabling 5G Slicing, Policy Control and Monetizing at the edge



Benefits

Amdocs microservices-based PCC allows multiple starting points for value creation and granularity of exposure across PCC that did not previously exist. It provides for more seamless, shared functionality and synergies across network control and IT. By doing so, it enables service providers with a more powerful focal point for service creation, differentiation, control and monetization. In turn, that allows more effective handling of a larger portfolio of new services that 5G will enable. It provides for faster time to deployment as well as shorter time to test, scale and manage that wider range of new services.

Microservices-based PCC ensures that downtime during updates of individual microservices can be removed and so removes the associated risks that previously existed. Microservices are cloud-based and scalable in whatever cloud (private, public, hybrid or multi-cloud) that works best for a service provider. All are deployable at the edge for release of enterprise and consumer use cases promised by 5G including various applications of VR/AR/xR, robotics and massive IoT.

Migration can be gradual and supported by the best specialist migration and service teams in the industry. Avoidance of forklift-style upgrades allows new business models for deployment of this technology that can in turn translate to new business model benefits for end-users.

Operationally, this new environment is exposed to teams via a UI using material design that is familiar and manageable for non-technical teams spanning network, IT and business focussed parts of a service provider. This further ensures organisational efficiencies and faster time-to-market at a pace that is ahead of competitors. These teams have a critical "single source of truth" across key functions of: control and monetization.

Significantly, this environment encompasses 5G as well as earlier generations. By doing so it ensures control across IT and network that also optimizes earlier investments as requirements extend increasingly towards 5G.

By definition, open source and open APIs ensure that a more powerful ecosystem is enabled that has the potential for ever more spontaneous and powerful partnerships for inclusion in the richer set of service bundles that consumers and businesses have come to expect.



Features

1. The Modular and Microservices-based architecture: Overview

Amdocs solutions have long been developed in a modular fashion, with modules and components integrated in a flexible manner which allows for multiple deployment scenarios both for multi-phase migration and final architecture. A number of core solutions (i.e. Profile Manager, Balance Manager, Offer Catalog etc.) are common to the entire Amdocs portfolio, meaning that future expansion and enhancement projects with Amdocs are simplified and synergies are easily accessible. Amdocs has built from the ground up as a set of microservices (Figure 2), where the fundamental principles of a microservice architecture allow for our services to be independently deployable and manageable. This separation of the solution into discrete services allows us to provide a higher level of availability, portability and scalability through being able to manage the lifecycle of each microservice separately.

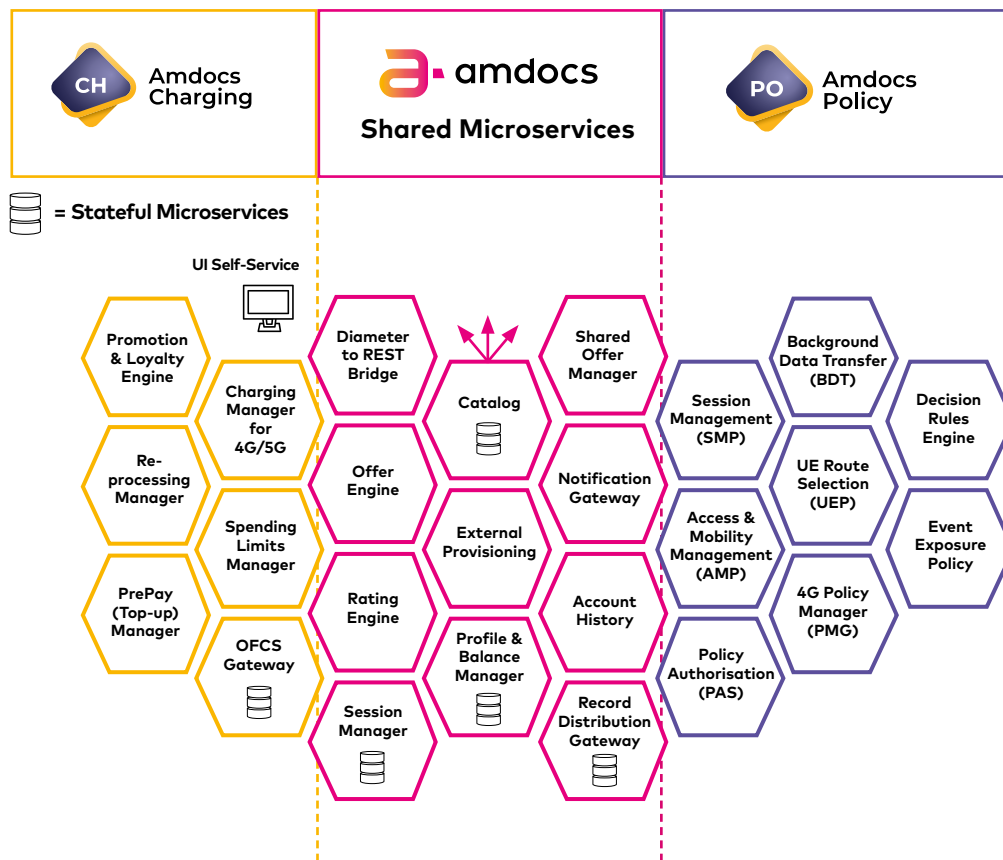


Figure 2: Summary of Microservices



2. Amdocs approach to Microservices Architecture

All microservices that comprise the overall PCC (Policy + Charging Control) utilise a modular architecture (Figure 3) where the functionality of the microservice is delivered through a combination of functional modules. Each core product module has a well-defined internal API that allows it to be seamlessly inserted into the orchestrated flow that comprises the microservice logic.

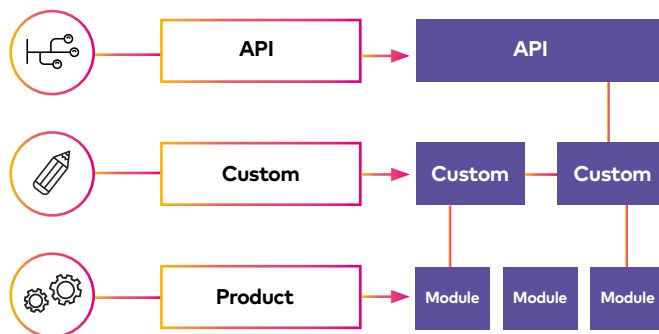


Figure 3: Amdocs approach to Microservices

Any Amdocs microservice can, in turn, be extended or customised by developing solution specific business capabilities built by service providers and/or by Amdocs, depending on the collaboration model employed. These capabilities can be used to augment an existing core product module, or replace it entirely, and rely heavily on the well-defined internal APIs noted above.

All microservices' external-facing APIs come with definition files following the OpenAPI (www.openapis.org) specification. The API is semantically versioned adhering to these main principles:

- Major version is updated only when incompatible API changes are made
- Minor version updates are done to expose new functionality in a backwards-compatible way
- Patch version is updated for backwards-compatible bug fixes

3. Stateful vs Stateless Considerations: Overview

The key difference between stateful and stateless applications is that stateless applications don't "store" data whereas stateful applications require backing storage. Stateful applications like the Cassandra, MongoDB and MySQL databases all require some type of persistent storage that will survive service restarts.

Keeping state is critical to running a stateful application whereas any data that flows via a stateless service is typically transitory and the state is stored only in a separate backend service like a database. Any associated storage is typically ephemeral. By definition, stateless services do not need to persist data from session to session. This means they can be replicated on demand and each replica does not need to be aware of or coordinate with other replicas.

As organisations adopt containers, they tend to begin with stateless containers as they are more easily adapted to this new type of architecture and better separated from their monolithic application codebase, thus they are more amenable to independent scaling. The efficiency impacts on the network of being able to rapidly scale up as well as down as required are enormous. It's worth emphasising that containers will work in combination with stateful as well as stateless microservices-style applications. i.e. you can also containerise stateful applications.



4. Amdocs Microservices

Amdocs next-generation development toolkit / ecosystem enables the development of telco-grade microservices and NFV solutions. Amdocs adopts the latest advances in software engineering to create a cloud-based BSS/OSS platform which delivers significant benefits to any service provider. It comprises of the microservices themselves as well as tools for their implementation and ongoing maintenance (Figure 4: Microservice Approach). Traditional monolithic BSS/OSS deployments are difficult to scale, and the lack of granular control means generic capability is deployed that may be irrelevant to specific use cases, markets and target customers at any given time. The Amdocs microservice toolkit is designed to deploy in the telco-cloud, dynamically scaling to meet demand and instantiating only those components that are needed to support the specific needs of the service at that time.

Microservices	Framework	Management
Catalog of microservices to allow for the flexible delivery of the Amdocs solution portfolio. Services enabled by Amdocs are enabled by Microservices.	Next generation framework for the development of telco grade microservices based solutions: • Modular Architecture • Cloud Native • Enhanced security and SSO • Microservices enabled	Operations, maintenance and toolset to allow for the efficient management of a solution: • Kubernetes and Docker support • Unified Monitoring

Figure 4: Amdocs Microservice Approach

The Amdocs Microservice Approach enables:

- Microservices-centric development focus
- A cluster architecture enabling management of distributed systems as a single entity
- A highly distributed in-memory database
- Modular software components (extending on the already modular approach taken in delivering solutions like Amdocs Charging and Policy, but focussed on distributed deployment and independently modular upgradability)
- Enhanced linear and elastic scalability
- Cloud-native deployment support
- Enhanced security and SSO
- CI/CD (deployment pipelines in conjunction with Kubernetes)
- Efficiencies based on Amdocs' own in-field experiences of mesh technology and Service Based Architecture (SBA) for deployed telco environments

The Amdocs microservice toolkit provides the continued solidification of the move to digital, embracing cloud technology and microservices for needed dynamism, flexibility, and agility. It enables service providers to position beyond their traditional core business and supports the development of an ecosystem of new capabilities and services aimed at supporting a service provider's desire to grow revenue and deliver long-term opportunity, rapidly linking service needs to business outcomes (Figure 5).

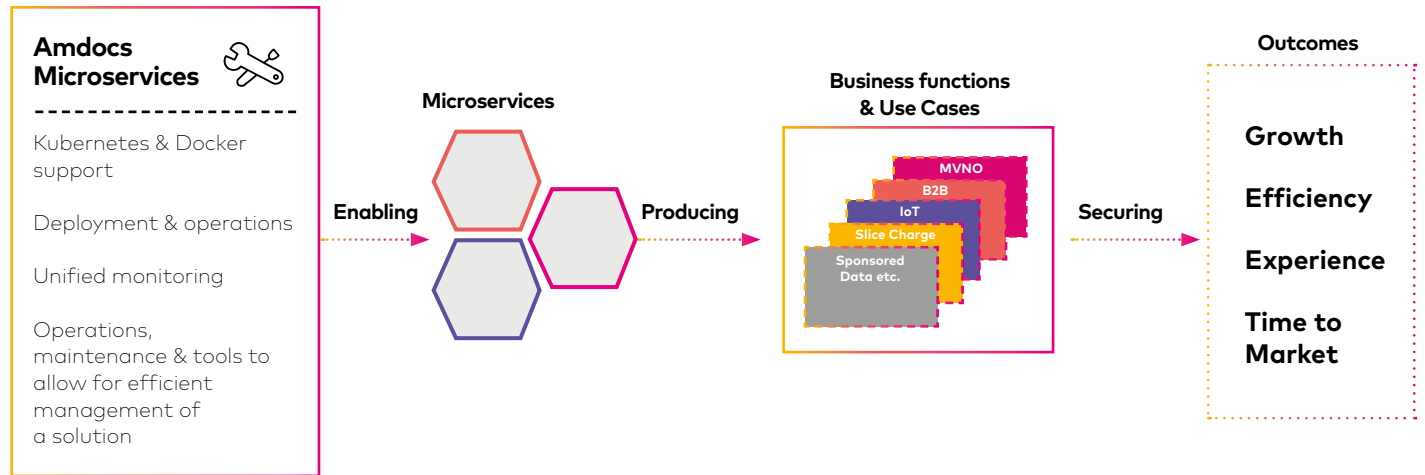


Figure 5: Microservice Toolkit & Efficient Business Outcomes





Why We're Different

Amdocs' experience and solutions can be used to provide a tailored, low risk, pre-integrated set of enablement to suit any service provider's requirements. As it is a modular approach, service providers only need to take the solutions they want and the API-driven approach means Amdocs can integrate with any existing systems that the service provider has in place.

Tier 1 service providers: for many large service providers who are undergoing a lengthy (and expensive BSS/OSS digital transformation) Amdocs PCC enablers can provide a plan B. They can be quickly implemented in parallel to the existing legacy stack in order to allow the service provider to realise and increase revenues from digital services and enable personalized customer engagement.

Tier 2 and 3 service providers: including Digital First Sub brands and MVNx: Amdocs Digital Platforms provide the low-risk solution to more radically get an end-to-end Digital stack up and running.

Furthermore, Amdocs service capsules (service-oriented microservice combinations) ensure rapid rollout at the scale fit for purpose and at a cost point that make a tailored offering affordable for specific consumer, enterprise and IoT audiences.

Offering complete flexibility, Amdocs PCC can be delivered on-premise or in the cloud and meticulously managed "as a service". This is all with the assurance that Amdocs is already the PCC vendor of choice for leading Tier 1 service providers.