

# BT's journey toward a 5G Core

A direct evolution  
to cloud native



**ERICSSON**

In partnership with

**BT Group**

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# Unrivaled network transformation

Ericsson worked with BT on a full cloud-native transformation, evolving toward a new commercial network powered by Ericsson's dual-mode 5G Core.

## Executive summary

Communications service providers worldwide are moving to virtualized and cloud-native platforms. BT's technology was based on bespoke legacy hardware and needed an upgrade to stay ahead, allow for increased capacity, refresh equipment in line with government targets and build a network that can cope with both 4G and 5G.

5G standalone (SA) requires a new core network based on cloud-native principles, so BT decided to leap directly from physical to cloud-native architecture. While the upgrade represented a great opportunity, the project also presented challenges in terms of scale and complexity, along with the need to preserve service quality during the upgrades.

Ericsson provided solutions, including Ericsson's dual-mode 5G Core with its Packet Core Gateway value-added functions such as traffic and video optimization, built-in software probes and integrated firewall and the container-as-a-service (CaaS) layer. The cloud-native dual-mode 5G Core solution combines Evolved Packet Core (EPC) and 5G Core network functions into a common platform, supporting both 4G and 5G. Ericsson needed to make certain that 10 years of invested functionality carried over to BT's new platform, ensuring BT could continue to deliver high-quality services.

BT's cloud-native EPC, which includes support for 5G non-standalone (NSA), was launched in 2022. As of December 2022, millions of subscribers had been migrated, while still fully preserving service parity and quality for customers. BT's new core network – the dual-mode 5G Core – is designed to support 5G SA and the new services BT aims to launch over the coming years, from new network capabilities to network slicing and network exposure APIs.

"As of December 2022, we had migrated millions of subscribers to our new network. Service quality is very important to us, so carrying out this migration without a single reported interruption to our customers' service was a huge achievement."

Reza Rahnama,  
MD Mobile Networks, BT





**The leap to cloud native**

BT's technology was based on bespoke legacy hardware (physical network functions, or PNFs), but all around the world, service providers are moving to virtualized and cloud-native platforms. To continue its reputation as a leading provider of reliable communications services, BT recognized that an upgrade was needed for many reasons, including allowing for increased capacity and building a network that could cope with both 4G (including 2G and 3G legacy equipment) and 5G. The need to introduce 5G SA meant deploying a new core network based on cloud-native principles.

There were also strategic gains from collapsing multiple network capabilities into a single network function, a process

that was enabled by the Packet Core Gateway. The legacy architecture had separate interoperating functions, such as the firewall, Gi-LAN and transmission control protocol (TCP) optimization, from several vendors. This restricted BT's agility and made scaling very difficult, as any increase in capacity could take several months to materialize.

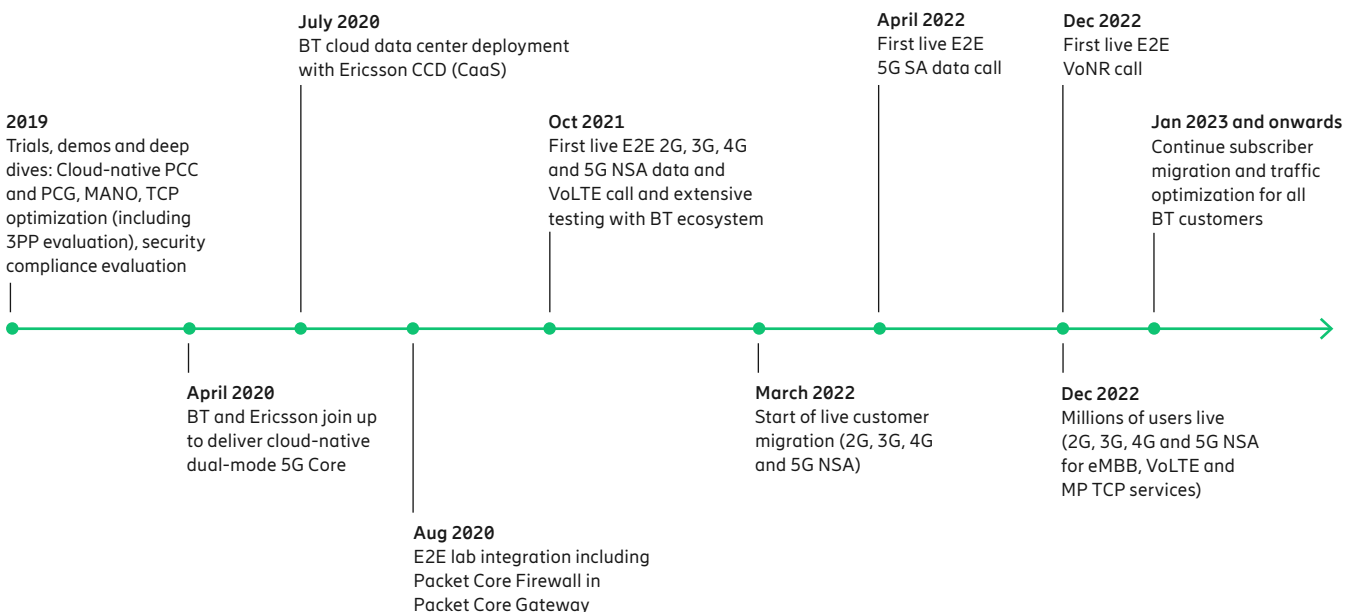
Against this backdrop, BT took the bold decision to transform its network, which included taking a leap directly from PNFs to a cloud-native architecture.

The timing was right for BT's full transformation. It was ready for virtualized network functions (VNFs), but recognized that if it failed to fully evolve to cloud native at this stage, another upgrade would be needed very shortly after.

**BT Group**

BT is the largest provider of fixed-line broadband and mobile services in the UK, as well as one of the world's leading communications service providers. It also offers subscription television and IT services. Its purpose is simple yet ambitious: To connect for good.

**Figure 1: BT's cloud-native dual-mode 5G Core deployment milestones**



# BT's transformation journey

Ericsson enabled BT's cloud-native transformation through the dual-mode 5G Core, a solution that includes the capability to integrate several key functions and enable advanced analytics and customer experience management tools.

### Building the best solution for BT

Delivering high-quality services is absolutely vital for BT – as Reza Rahnama, MD Mobile Networks at BT, says: "We are a very service-obsessed organization." BT had 10 years of invested functionality built into its platform, and it was necessary to ensure that this functionality carried over to the new platform. Delivering a solution that benefited both BT and its customers, while ensuring service parity, was therefore crucial, and Ericsson was committed to ensuring any functionality would be matched for a smooth transition. Ericsson had to create over 35 features to map from BT's existing systems to Ericsson's solution.

Implementing Ericsson's dual-mode 5G Core – a single-core solution – was critical during the transition period. The cloud-native technology combines

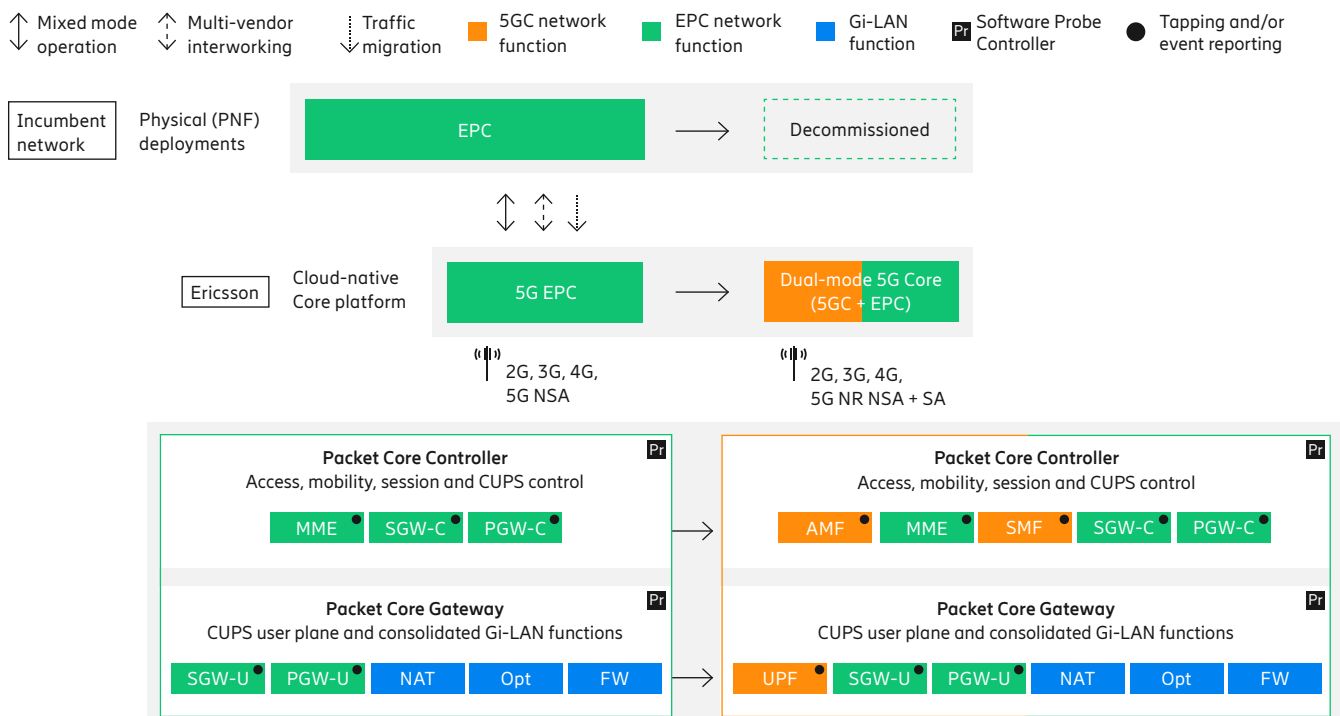
EPC and 5G Core network functions into a common platform, supporting both 4G and 5G. BT has millions of customers still using 4G, so having a single core that can cope with both was important. Within Ericsson's Packet Core Gateway, offered as part of the dual-mode 5G Core, BT was also able to consolidate a number of functions including firewall, software probes and network address translation (NAT), as well as utilize additional functions for TCP optimization. As Reza Rahnama says, the added and consolidated functionalities will "help us greatly with the operation of our network."

Reza Rahnama describes BT's proactive approach to security as always assuming that the bad actors could already be within the network, despite having a very strong perimeter. Previous investments had gone toward separate firewall solutions, but

now, he explains: "...with the firewall that we have from Ericsson, we are capable of segmenting the network where we need it to be segmented, and make it harder for the bad actors to get to the various parts of our network." The new solution offers an integrated Packet Core Firewall, powered by A10 Networks. This includes a unique all-in-one security offering which is integrated in the cloud-native user plane, allowing for significant total cost of ownership (TCO) savings as well as optimization for edge use cases.

Network visibility is also incredibly important to BT, having invested in analytics capabilities that allow issues to be pinpointed to a very granular level of detail. Previously, hardware probes had been utilized across the network, but BT often experienced major challenges during

Figure 2: BT's evolution to dual-mode 5G Core



"Monitoring this network is absolutely critical. We have to know what's happening so we can make the right decisions. Using Ericsson Expert Analytics, together with the built-in software probes in Ericsson dual-mode 5G Core, we have the capability to look at exactly what's happening to each subscriber and to the network."

Reza Rahnama,  
MD Mobile Networks, BT

deployment, finding them expensive and difficult to deploy. Also, as all traffic is encrypted in 5G Core, the hardware probes pose problems when it comes to capturing the desired data without breaching security. BT uses tools such as Ericsson Expert Analytics to monitor the network end-to-end. The built-in software probes in the dual-mode 5G Core solution feed into the analytics platform, while keeping content encrypted, providing customer-centric insights and ensuring customer experience.

BT required a system for resource orchestration of the cloud-native software and life cycle management (LCM) capabilities for automated software updates and upgrades. Ericsson Orchestrator, together with the continuous delivery and deployment approach, provided the tools that simplify these complicated processes.

### A complex journey

This was an extremely complex time for BT, because it was undergoing work across its entire platform with multiple vendors. With thousands of people involved, it needed to revolutionize its organization and ways of working, as well as evolving its operations – all against the backdrop of the COVID-19 pandemic.

BT decided it wanted its own continuous integration/continuous deployment (CI/CD) pipeline, given the multi-vendor nature of the network. Ericsson worked with BT to develop a generic blueprint for CI/CD and LCM, using tools that would be compatible with other vendors – a hybrid solution. This was an iterative process to provide the independent features of the overall software delivery – a commitment on both sides to test and learn. It was a huge challenge, technically and organizationally, to adapt from old ways of working (large upgrades once or twice a year) to the new cloud-native approach of smaller, more frequent upgrades so that software can be rolled out quicker in smaller, less risky packages.

The teams also had to contend with the technical challenge of introducing software probes. Setting up the software probes to develop a smooth solution was complex given the requirement to match the same data set as the hardware probes, but worth it for the long-term goal; a software solution that is efficient and scalable, with no additional equipment needed as the network grows.

### Reaping the benefits

Testing and reiterating was, and continues to be, a large part of the process. Starting with pilots and trials to demonstrate the ability of the new network, BT has now proven that the network can handle millions of subscribers on cloud-native 5G EPC, with more capacity to come. Another pilot tested 5G SA radio in the core to show that it was more than merely a proof of concept, proving that the 5G radio works with 5G Core for SA services.

Ericsson's Automated Acceptance Testing (AAT) tool has already had a positive effect on BT's software upgrade process by supporting an iterative and faster testing process. BT was previously undergoing large software upgrades once or twice a year; now, this happens more frequently with a view to launching new software releases nearly every month with automation. AAT is currently being rolled out in several hundred test cases, with the entire process now around 20 percent automated; given it covers thousands of cases, this is a high figure.

Outcomes such as TCP optimization have been measured against KPIs, with many exceeding the performance of BT's previous network. BT's new network is now live, offering simplicity, scalability and flexibility. These are largely due to the reduced complexity regarding third-party network functions, as well as analytics technology that gives the ability to accurately pinpoint issues in the network at the individual level, showing BT the entire customer journey. Ericsson's ability to probe the cloud environment to this degree, and to replicate and provide customer journey details to this extent, has helped designate BT as a cloud-native leader.

With Ericsson's cloud-native technology underpinning BT's commercial 5G NSA network, and the resultant automation pipeline, true value is being delivered to BT.

### Deployed Ericsson solution

- **Ericsson's dual-mode 5G Core:** Combining EPC and 5G Core network functions into a common cloud-native platform, for efficient TCO and service continuity while subscribers migrate from 4G to 5G, including products such as:
  - Ericsson Packet Core Gateway with value-added functions including traffic and video optimization, NAT and [built-in software probes](#), as well as [Packet Core Firewall](#), powered by A10 Networks, for integrated user plane and security functions in a single CNF
  - Ericsson Packet Core Controller with access, session, mobility and gateway control functions and built-in software probes to support the new 5G use cases
- **Ericsson Expert Analytics:** A cloud-native solution that performs customer-centric monitoring and identifies and troubleshoots issues
- **Ericsson Automated Acceptance Tests:** Performs automated testing during the software acceptance phase of the CI/CD pipeline
- **Ericsson Cloud Container Distribution:** Manages and orchestrates all containerized applications
- **Ericsson Orchestrator:** A product incorporating Cloud Manager and Evolved VNF Manager, providing end-to-end cloud orchestration capabilities
- **Ericsson Network Manager:** Provides a uniform operational environment on a cloud-ready software platform, and delivers close to zero downtime during software upgrades
- Ericsson network design and deployment services: Supporting BT to produce configuration files, initial testing and deployment so BT can further test features on an end-to-end basis

"We work with Ericsson for a number of reasons. Number one is the single core: 4G and 5G NSA as well as SA within the same core helps us massively operationally. Number two: The insights that we get from these tools to be able to operate and automate this network. And number three: The openness of APIs that allows us to program this network, as well as getting others to help us build new services on."

Reza Rahnama,  
MD Mobile Networks, BT

# The way forward

BT now has one core, the dual-mode 5G Core, covering legacy 2G and 3G, as well as 4G and 5G. This core network also supports 5G SA and is ready for the new services BT will look to launch over the coming years.

With the new network in place, BT will be able to tap into new network capabilities. By stabilizing and optimizing the cloud-native infrastructure, BT will be able to support 30 million subscribers. The move to a cloud-native core also means 5G SA and Voice over New Radio (VoNR) can be deployed, ensuring high quality and improved latency for users.

Network slicing is another area that can be deployed for further monetization of the network. The groundwork has been done with a view to implementing this; rolling out Ericsson Orchestrator was important not just to help BT simplify the way it managed the platform, but as a stepping stone to make it easier to begin trialing and then implementing network slicing. With Ericsson Orchestrator in place, the next move will be to harness the power of 5G that this platform brings. Together with the new core network, the Orchestrator

will enable the support of new market opportunities like consumer wearables, AR glasses and prioritized services through use cases including Fixed Wireless Access and private networks.

BT can also look to take advantage of network exposure. With 5G, service providers can easily activate new capabilities and expose them through APIs, boosting the programmability and adaptability of connectivity services to fit different needs. This will invite developers to further utilize the network to its full potential. As Reza Rahnama says, allowing the network to be used as a platform for invention by other parties benefits everyone: "Network exposure will be absolutely revolutionary for us, because we no longer have to decide ourselves what products to develop, but we can allow others to develop their products and utilize our network."

"We've successfully deployed our cloud-native dual-mode 5G Core for the 5G non-standalone network. The next stage is to bring the true promise of 5G alive – that is, bringing the standalone network. By doing so, that allows us to deploy a number of new enterprise services."

Reza Rahnama,  
MD Mobile Networks, BT



# A successful transformation

Ericsson was proud to support BT, a global telecoms industry leader, in its transformation journey. The technology leadership and innovation demonstrated by both parties in this partnership has revealed many learnings and insights.

BT's transformation journey, while not easy, has been deeply rewarding for both parties. BT required a solution that delivered on many fronts, including additional capacity, efficiency, security compliance and automation. Ericsson was able to integrate all these needs into one package of support.

## Key learnings

The project required close collaboration between all parties throughout to achieve the end goals. The solution was spread across many areas within BT, with its Network Cloud team looking after infrastructure, the Packet Core team looking after the application and Ericsson supporting the software delivery and deployment across multiple data centers. The CNF integration on BT's cloud infrastructure was challenging and required lots of skilled resources and "war room" type interactions with multiple vendors. Reza Rahnama's advice to service providers not having the scale of BT is to go with a more pre-verified stack.

With so many parties cooperating, engagement had to evolve along the way. This was never truer than early in the COVID-19 pandemic, when ways of working changed globally and affected how colleagues and collaborators everywhere connected. It's a source of great pride for Ericsson and BT that this transformation was performed during the pressure of the pandemic, while getting used to remote working. Becoming comfortable with change and the continuous learning of new products and infrastructure remotely was difficult initially, but – once achieved – greatly benefited the project outcome.

As well as the changes in ways of working, there were many lessons to be learned from the technical challenges presented on the journey. For example, with more regular software drops, BT and Ericsson found that settling early on software deployment processes and tools, as well as on the cloud operations approach, proved beneficial over the long term.

## Proudly preserving service quality

Decommissioning an incumbent system while maintaining, or even improving, the service experience for BT's customers presented a considerable challenge. It sometimes required multiple iterations and design reviews between Ericsson and BT's engineers. It needed a greater level of agility from both sides when documenting, approving and deploying changes. Through this joint collaboration, BT achieved their goal of completing the transformation without a single reported service interruption.

## Prepared for the future

Ericsson's achievements during this program include helping BT's transition to cloud-native deployment and operations by creating a blueprint that is repeatable and can be applied across the program. Additionally, multiple external systems, including hardware probes, firewalls and optimization tools, were consolidated into a single cloud-native function. With the solutions now in place, BT has taken a great technological leap forward and is in a fantastic position to use the groundwork already laid to continue embracing 5G and scaling up to meet future network challenges.

"I'm really excited about the future of this network, simply because it allows us to deploy and develop new services."

Reza Rahnama,  
MD Mobile Networks, BT

## About Ericsson

Ericsson enables communications service providers and enterprises to capture the full value of connectivity. The company's portfolio spans the following business areas: Networks, Cloud Software and Services, Enterprise Wireless Solutions, Global Communications Platform, and Technologies and New Businesses. It is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's innovation investments have delivered the benefits of mobility and mobile broadband to billions of people globally. Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York. [www.ericsson.com](http://www.ericsson.com)