Move as fast as you can to the 5GC

A TCO analysis of the transition to a converged 5G core

Monica Paolini, Senza Fili

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Moving to the 5G core (5GC) is a major shift that affects all subscribers and that requires effort and investment. Mobile network operators (MNOs) may understandably try to push the transition to the 5GC into the future. While this delays most of the capex investment, it does not eliminate the investment and it increases the opex because the MNO has to operate both the legacy core and the 5G standalone (SA) core.

Eventually MNOs will want to move to the 5GC because a 5G non-standalone (NSA) limits their ability to roll out new services – e.g., advanced and enterprise services that require network slicing – and fully leverage the capabilities of their 5G networks.

In this paper, we do not look at the revenue benefits of the 5GC. Added revenues from the 5GC may strengthen the case for an early move to the 5GC, but they are not included in our analysis.

Our total cost of ownership (TCO) model assesses the costs of the transition to the 5GC over a 5-year period – and specifically it estimates how the costs change as the MNO postpones the move to the 5GC.

When should an MNO with a 5G network upgrade the entire network to the 5GC and move to 5G SA? Our TCO model compares two scenarios for an LTE MNO that has deployed a new 5G network:

- Early adopter: The MNO does not waste any time, moves to the 5GC right away.
- Late adopter: The MNO does not want to rush into the 5GC, deploys 5G NSA, and moves to the 5GC in year 4.

Eventually, in both scenarios the MNO moves to the 5GC, but the saving in the early-adopter scenario is higher, with an overall 27% cost saving over 5 years, 32% capex saving and up to 39% opex saving (in year 3; in subsequent years the opex for both scenarios is the same because both the early adopter and the late adopter have switched to the 5GC) (Figure 1).

Our TCO model shows how MNOs can save by moving to the 5GC as soon as they deploy their 5G network. The longer the MNO delays the transition to the 5GC, the higher the transition costs.

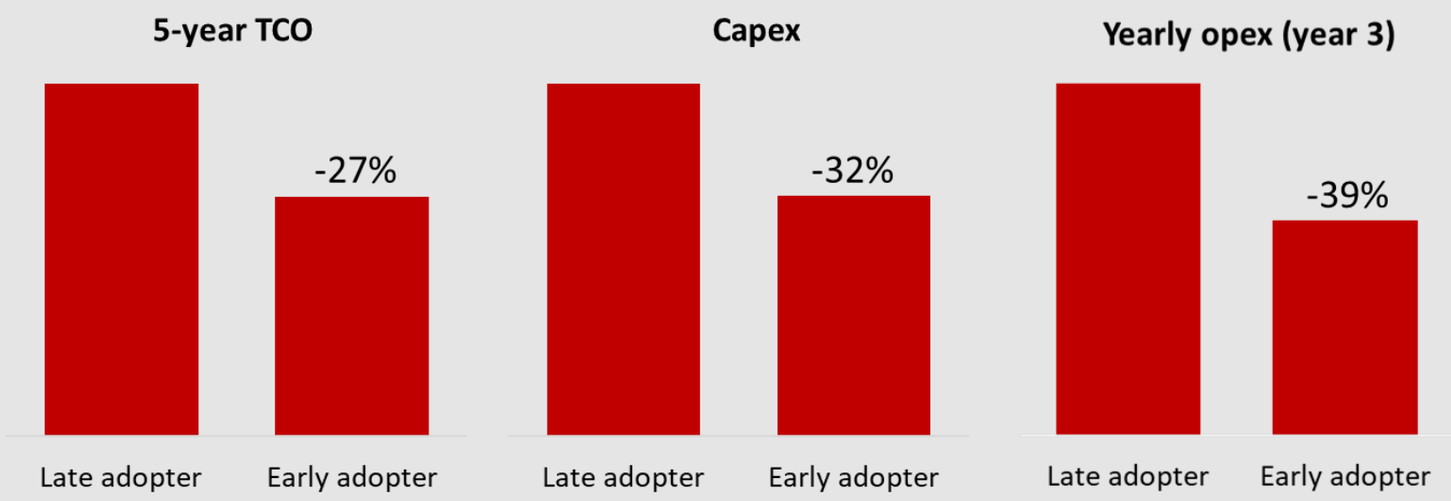


Figure 1. 5-year cumulative TCO, cumulative capex and year-3 opex

Why is an early shift to the 5GC cost-effective?

Results highlights. Our TCO model shows how the MNO can reduce both capex and opex over a five-year period by deploying the 5GC from the beginning, rather than waiting to do so until year 4. The overall TCO cost saving is 27% in the early-adopter scenario, and includes a 32% cost saving in capex. The cumulative TCO graph (Figure 2) shows the different cost dynamics in the two scenarios.

The opex of the early adopter is 39% lower than that of the late adopter in year 3. Because in both scenarios the MNO has the same core in years 4 and 5, the opex in those years is the same. As a result, in the early-adopter scenario, the cumulative opex reduction is 21% over five years, and the yearly opex reduction reaches 39% in year 3. The cumulative opex saving over the first three years is 34%.

A converged 5GC. The model assumes that the MNO moves to a state-of-the-art converged 5GC and SA solution that replaces a traditional, non-virtualized EPC. Key features of the converged 5GC solution include:

- Cloud-based, virtualized, containerized architecture, based on microservices
- UPF footprint
- COTS hardware
- AI-based automation tools

The move to a converged solution drives down the cost of equipment and installation over a

TCO model: Scenarios and assumptions

Scenarios

Our model compares two scenarios:

- Scenario 1: Early adopter – The MNO switches to a converged 5GC and 5G SA during the first year, supporting all subscribers (i.e., 5G, LTE and legacy) through the 5GC. Starting in year 1, the MNO has deployed the 5GC and no longer needs the EPC. It now benefits from a cloud-native microservice architecture and more advanced automation. The early adoption of the converged 5GC requires a high initial capex investment in year 1, but then capex in years 2–5 is low. The MNO sees a big decrease in opex, due to the higher cost-efficiency of the 5GC.
- Scenario 2: Late adopter – The MNO initially uses the EPC for its LTE and legacy subscribers, and 5G NSA for its 5G subscribers. The model does not include any capex for the EPC, because we assume it is already installed and paid for. The MNO incurs a higher opex because it has to support both the EPC and the 5G NSA, and, because it has not yet transitioned to a cloud-native core, automation is still limited. In year 4, when more than half of subscriber and IoT devices have 5G, the MNO transitions all devices to the converged 5GC and no longer needs the EPC. The MNO adopts the same converged 5GC solution used in the first scenario. This shift in year 4 causes a spike in capex, but then, during years 4 and 5, the MNO sees a big decrease in opex due to the higher cost-efficiency of the 5GC. In the last two years, both scenarios have the same opex because they use the same converged 5GC solution.

Network

The network assumptions are the same for both scenarios. The MNO's size grows from 10 million subscriber devices and 1 million IoT devices in year 1, to 12.1 million subscriber devices and 5.7 million IoT devices in year 5. 5G accounts for 5% of subscriber and 20% of IoT devices in year 1, growing to 70% of subscriber and 90% of IoT devices in year 5. By year 5, we expect that all new subscriber and IoT devices will support 5G.

Changing the number of subscriber and IoT devices would impact the TCO size (i.e., having fewer subscribers would reduce the TCO) but would not affect the drivers, and the relative difference between the two scenarios would be preserved.

However, changing the percentage of 5G subscriber and IoT devices affects the TCO for each scenario differently. A slow adoption of 5G reduces the urgency of moving to the converged 5GC, and lowers the relative TCO of the late adopter. A faster adoption of 5G increases the benefits of moving to the 5GC, and tilts the balance of the TCO in favor of the early adopter.

Cost, requirements, and traffic inputs are from Mavenir.

non-converged solution, but the cost saving over a non-converged solution is not included in the model because the transition to a converged 5GC occurs in both scenarios.

Capex saving. In both scenarios, the capex to upgrade to the converged 5GC is the same in both scenarios, because the solution adopted is the same (a cloud-native core based on a microservice architecture). In the late-adopter scenario, the interim adoption of a 5G NSA that operates alongside the EPC introduces an additional capex component, which accounts for the overall higher capex.

Opex saving. The opex saving in the early-adopter scenario comes from two sources.

The first source is that the adoption of the converged 5GC eliminates the need to support two core solutions (EPC and 5G NSA). 5G NSA relies on the EPC, so its opex is not as high as the opex for the 5GC SA or the EPC, but it still adds 50% to the EPC opex for 5G subscribers. As a result, the higher the adoption of 5G, the higher the added opex from the 5G NSA for the late adopter – and the larger the cost saving for the early adopter.

The second source of opex saving for the early adopter is the higher cost-effectiveness of the converged 5GC. The 5GC not only eliminates the need to support multiple cores, it also allows the MNO to move away from legacy equipment and implement a more flexible and technologically advanced solution. Our model assumes that the MNO selects this option, along with a virtualized, containerized solution that provides more flexibility, automation, and efficient operations – all factors that drive down the opex.

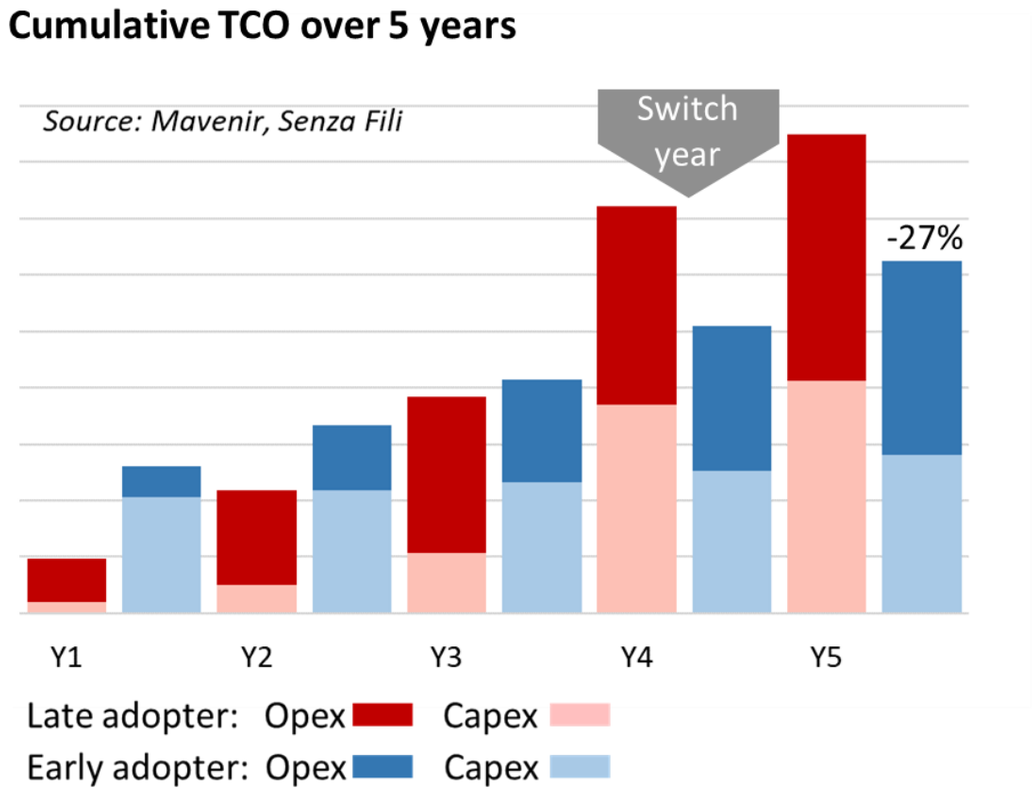


Figure 2. Cumulative TCO over 5 years

The opex in the late-adopter scenario is higher for lease, data center, and power costs, primarily because of the need to support two core solutions. However, the most significant opex reduction in the early-adopter scenario comes from operations and maintenance (O&M) (69%) and specifically from increased efficiency in network monitoring, troubleshooting, maintenance, upgrades, and technical and customer support.

Year 1. In year 1, the early adopter makes a higher investment to migrate all its subscribers to the converged 5GC. In the late-adopter scenario, the MNO keeps using the existing core infrastructure for LTE and legacy subscribers, so its capex for the core is exclusively due to the use of the 5G NSA for its 5G subscriber and IoT devices. As a result, in year 1, the late adopter is better off, even though its opex is higher.

Years 2–3. The balance changes starting in year 2. The early adopter continues to benefit from a lower opex and is no longer saddled with a high capex. The only required capex is to expand the converged 5GC to support new subscribers and IoT devices. The late adopter continues to have low capex, but its opex is higher than that of the early adopter, because it has to support multiple cores. During years 2 and 3, the late adopter faces a slightly higher capex and much higher opex than the early adopter. The higher capex is driven by the need to support each new subscriber and IoT device both with the EPC and the 5G NSA. As a result, during years 2 and 3, the late adopter's TCO is higher.

Year 4. In year 4, the late adopter's disadvantage over the early adopter grows, because it has to shoulder the transition costs that the early adopter faced in year 1.

Because the number of subscribers is higher, the capex is slightly higher than it was for the early adopter in year 1. The capex spent by the late adopter on the 5G NSA is mostly wasted, as 5G NSA subscribers need to be moved to 5G SA. Overall, the late adopter is still at a disadvantage over the early adopter, even though it now enjoys the same lower 5GC opex.

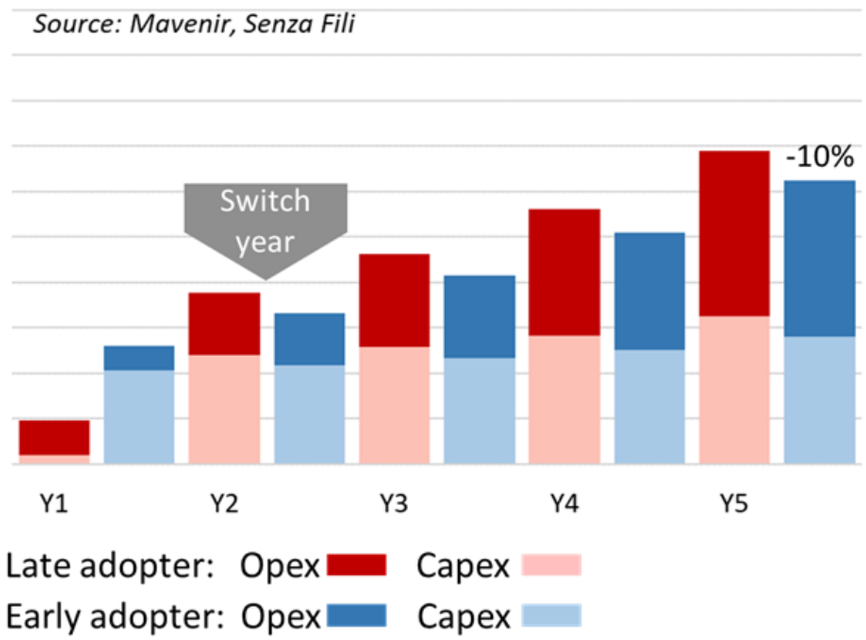
Year 5. Finally, in year 5, capex and opex are the same for the two scenarios, because the converged 5GC solution adopted is the same. It is a too-little, too-late benefit for the late adopter: the late adopter still has had to pay for delaying the adoption of the 5GC from year 1 to year 4.

Summary. Despite the financial benefits of an early switch to the converged 5GC, some MNOs may need to delay the move due to cash flow considerations. If they anticipate a slow uptake of 5G service, the cost saving from 5GC adoption is diminished. But for MNOs seeing a healthy growth in 5G and eager to use the 5GC's capabilities to launch new services and get new revenues, early adoption of the converged 5GC makes both strategic and financial sense.

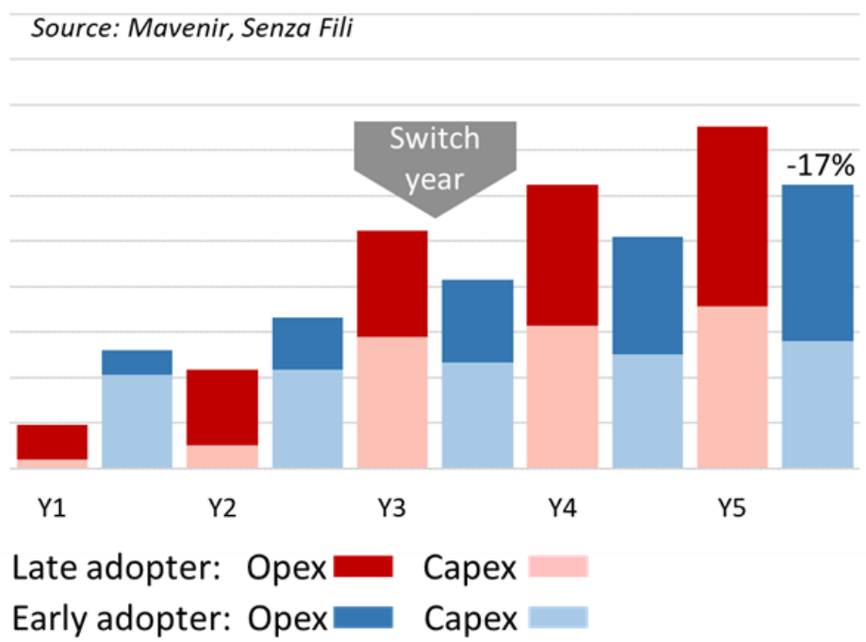
How long can the shift to the 5GC wait?

Our TCO base case compares an early adopter that adopts the converged 5GC in year 1 to a late adopter that shifts to the converged 5GC in year 4. What happens if the late adopter's shift occurs in a different year? The dynamics are the same – i.e., there is a capex spike and a reduction in opex with the 5GC in the shift year – but the penalty of late adoption increases with the delay. The cost saving for the early adopter is only 10% when the late adopter moves to the converged 5GC in year 2. If the shift happens in year 5, the cost saving grows to 36%. For reference, in the base case with the switch in year 4, the cost saving is 27%. The graphs in Figure 3 show the cumulative TCO for different switch years for the late adopter. The TCO for the early adopter, who has implemented the converged 5GC in year 1, stays the same on all the graphs, but we show it to allow easy comparison to the late-adopter TCO.

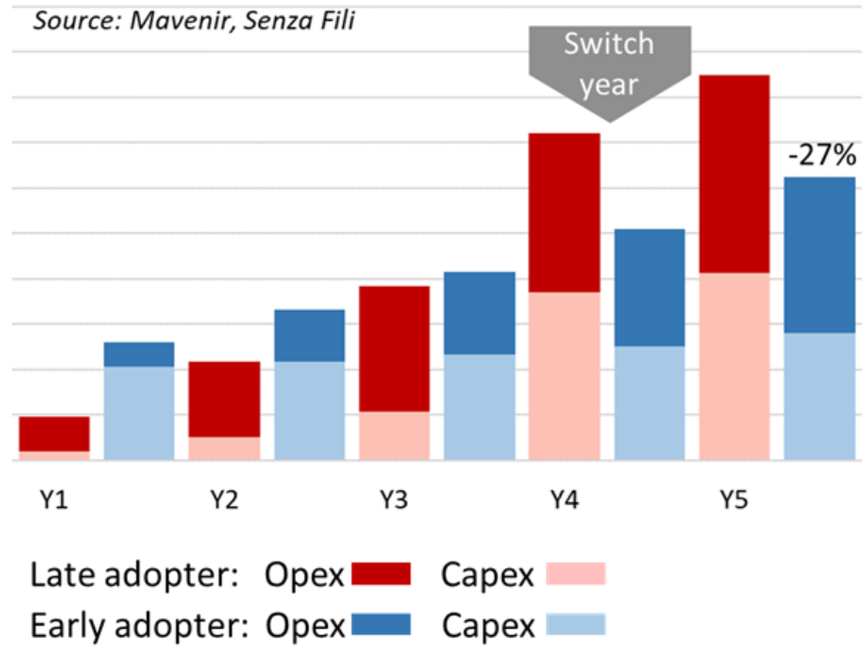
Cumulative TCO over 5 years: Switch in year 2



Cumulative TCO over 5 years: Switch in year 3



Cumulative TCO over 5 years: Base case, switch in year 4



Cumulative TCO over 5 years: Switch in year 5

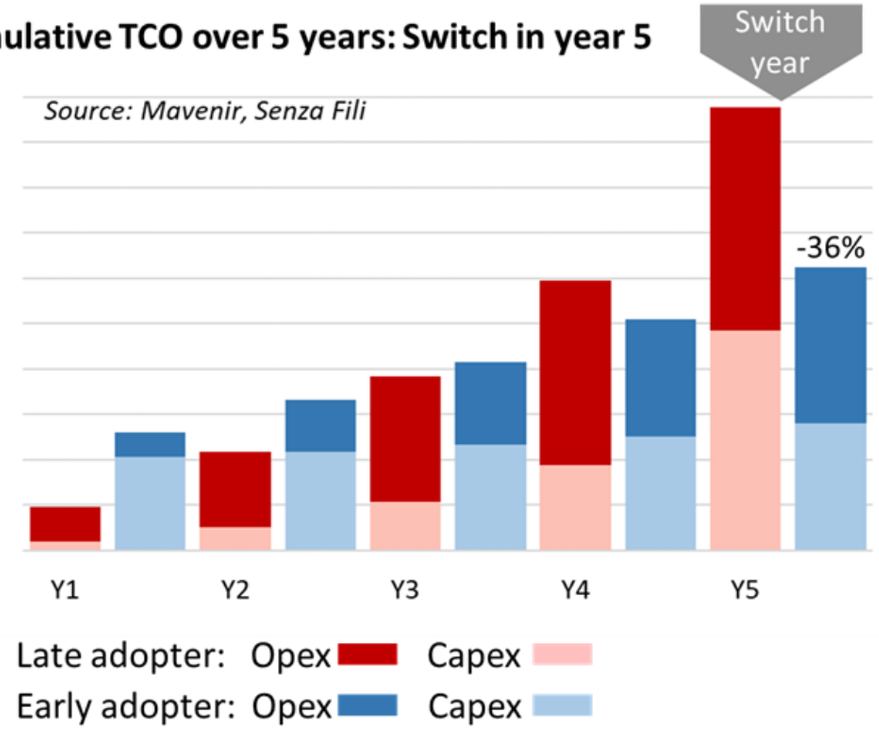


Figure 3. Cumulative TCO for different switch years

Takeaways

5G MNOs can postpone the adoption of the 5GC, but this increases the TCO over a 5-year period because they need to support both the EPC and the 5G NSA ahead of the switch. This delays the capex needed for the upgrade, but it also increases the opex.

The TCO saving is 27% over 5 years, including a 32% capex saving and up to a 39% opex saving (in year 3) for an MNO that chooses to adopt the converged 5GC in the first year versus the fourth year.

In the early-adopter scenario, the capex is higher in year 1, when the MNO moves all subscribers to the converged 5GC, but then the MNO benefits from a lower capex in subsequent years. In the late-adopter scenario, the main capex investment is delayed, but not eliminated – and the delay causes an increase of the overall capex needed to move to converged 5GC.

Opex cost saving for the early adopter comes from using a single core solution – the converged 5GC – for all subscribers and a more efficient architecture from year 1.

The cost impact of delaying the adoption of the converged 5GC grows with time. The early adopter cost saving over the late adopter grows from 10% from a first-year switch to the converged 5GC, to 36% for a fifth-year switch.

In addition to the cost saving demonstrated by our TCO analysis, an early adoption of the converged 5GC enables MNOs to benefit from the new 5G capabilities and launch new revenue-generating services.

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About Senza Fili

Senza Fili provides advisory support on wireless technologies and services. At Senza Fili we have in-depth expertise in financial modeling, market forecasts and research, strategy, business plan support, and due diligence. Our client base is international and spans the entire value chain: clients include wireline, fixed wireless, and mobile operators, enterprises and other vertical players, vendors, system integrators, investors, regulators, and industry associations. We provide a bridge between technologies and services, helping our clients assess established and emerging technologies, use these technologies to support new or existing services, and build solid, profitable business models. Independent advice, a strong quantitative orientation, and an international perspective are the hallmarks of our work. For additional information, visit www.senzafili.com

About Monica Paolini

Monica Paolini, PhD, founded Senza Fili in 2003. She is an expert in wireless technologies and has helped clients worldwide to understand technology and customer requirements, evaluate business plan opportunities, market their services and products, and estimate the market size and revenue opportunity of new and established wireless technologies. She frequently gives presentations at conferences, and she has written many reports and articles on wireless technologies and services. She has a PhD in cognitive science from the University of California, San Diego (US), an MBA from the University of Oxford (UK), and a BA/MA in philosophy from the University of Bologna (Italy).