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Automation is the Key to Realizing the Full Potential of 5G

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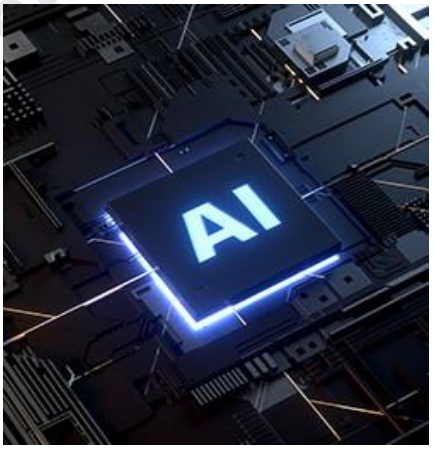

While the benefits of increased capacity, lower latency, and increased bandwidth are well known, the full spectrum of new 5G business opportunities for operators will only arrive with 5G standalone.

Non-standalone 5G allows operators to offer customers additional capacity and improved data rates by means of a 5G coverage overlay founded on the 4G network core. New B2C and B2B business cases such as gaming, V2X and IoT, network slicing and mobile edge computing, will unlock new revenue streams. But these advanced capabilities are dependent on a cloud-native core and service-based architecture of 5G SA.

In the 4G and 5G NSA world, a single network is shared among all the users. In the coming standalone world, each user will have the option of subscribing to their own dedicated and personalized network. Theoretically, there could be hundreds, thousands or even millions of simultaneous network slices, dynamically appearing and disappearing on the fly, each with its own customer-defined attributes. Each slice should have its own core network functions.

From an operations perspective, the network is about to become significantly more complex to manage.

Many operators are experimenting with the new 5G capabilities but, so far, most are limiting the number of slices. Even this is significantly increasing network complexity compared with 4G – because operators need to monitor and manage multiple core networks end-to-end.

For example, a stadium might have a regular requirement for network slices on match days tosupport e-ticketing, mobile payments, or in-stadium content services for spectators. However, a concert taking place at the same venue might benefit from a different slice offering additional support for the production for 12 or 24 hours around the event.

Healthcare is rightly seen as a massive opportunity for 5G. For many remote healthcare services high availability through guaranteed redundancy would be a key attribute. Ultra reliability rather than low latency would be key for remote supervision of surgery: as it will be some time before remote robotic surgery becomes an insurable reality, a human will continue to wield the scalpel.

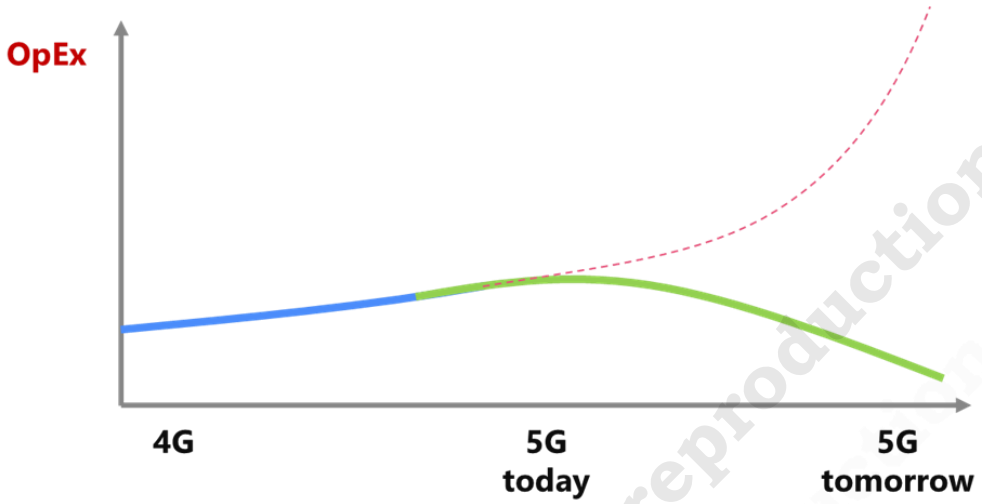

Figure 1 4G is setting the baseline for OpEx

Users of capital-intensive plants and machinery place massive importance on minimizing downtime and avoiding breakdowns. This type of equipment has traditionally been managed using very conservative physical monitoring. Embedded monitoring capabilities that connect over a highly reliable 5G slice that offers ultra-low latency could make a big difference by detecting issues even microseconds in advance. Until now, wireless connectivity has not been stable enough or latency reliably low enough to support such applications.

In the full 5G world, customers will be able to choose slice attributes that meet their specific needs, irrespective of whether they are primarily motivated by commercial or safety considerations. While there are thousands of potential use cases for 5G slices, few of them are mass market: 5G will create a mass market of niche applications.

So how are these new networks with infinite flexibility to be managed? The answer is zero-touch automation.

4G and physical network functions set the baseline for OpEx in the past. Costs were relatively stable but rose with inflation and in response to traffic growth (see figure 1 above). On today's 5G networks, slices are currently limited in number, mostly static, and managed in the same way as the legacy network. However, even this increase in complexity, and the gradual introduction of new technologies such as containers and public clouds, are adding to OpEX. If current management techniques and processes were to be maintained into the era of dynamic 5G slicing, OpEx would escalate exponentially and unsustainably. Reliability is also likely to suffer as it becomes more difficult to trouble-shoot impacts that a human operator cannot foresee in a reasonable time frame. But the good news is that the more automation there is, the greater the benefit that might accrue. Where automation processes can be applied to legacy technologies, the cost of managing 4G could go down, or at least remain stable.

Service Assurance

Service assurance is a key enabler for effective automation: It is only possible to control what is being actively monitored. To activate something on the network, it is necessary to know that something needs to be done – whether because of a fault, mistake, or a breach of a service level or some other defined threshold.

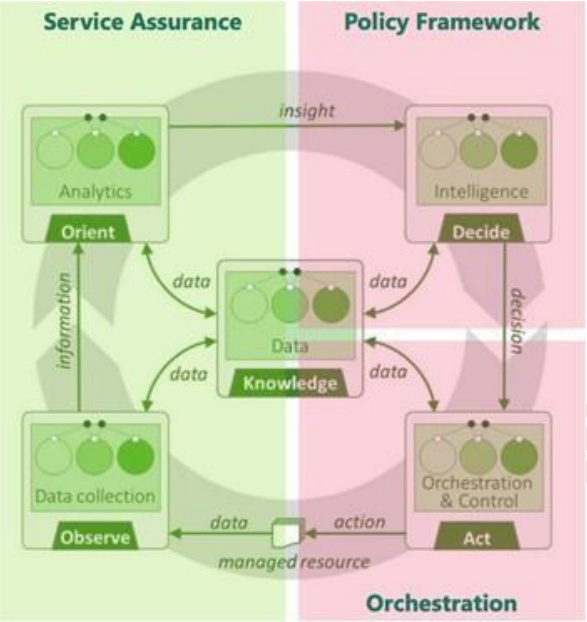

Figure 2 Assurance and Orchestration to Achieve service Automation
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Effective service assurance relies on the adoption of real-time monitoring rather than relying on aggregated KPIs that could, like traditional CDRs, arrive 15 minutes after an event. Even in a multi-vendor environment, real-time monitoring of the traffic exchanged between network functions allows service assurance to notify orchestration immediately that something is happening. Orchestration can then actuate on the core network. By creating a closed loop, service assurance can anticipate a potential issue when a particular metric is approaching a defined threshold. Orchestration can be alerted to take an appropriate preemptive measure.

ETSI Zero-touch Service Management

This philosophy is in line with the ETSI's Zero-touch Service Management (ETSI-ZSM) architecture which identifies the need for a close collaboration between assurance and orchestration to achieve end-to-end service automation. This is the way to manage thousands of concurrent slices in a 5G SA network (see Figure 2).

Service assurance starts with the definition of data collection points. Based on observed real-time data, analytics works out whether everything is operating correctly or whether there are traffic trends that could cause damage or a potential breach. The policy manager decides what actions need to be taken based, for example, on the relevant customer's contracted service status.

Currently, service assurance tends to be used as an operational tool aiding troubleshooting and monitoring. With strong support from the operators who see the benefits for operations and cost control, ZSM standards promise to make service assurance an integral and integrated part of the OSS landscape. It is an important stepping-stone towards the future automation of 5G networks.

This is still work in progress. ZSM has not yet specified some key interfaces and processes. This means that service assurance solutions currently need to be integrated separately with each orchestration vendor (see Figure 3 on next page).

To be compliant with ZSM, a service assurance partner needs to integrate with the top layer of the Management and Orchestration (MANO), which includes a policy manager, NFV Orchestrator (NFVO), and the knowledge base. The NFVO can talk to the virtual network functions manager for each virtualized function vendor deployed. Service assurance can suggest an action, but it is the policy manager that

makes the decision.

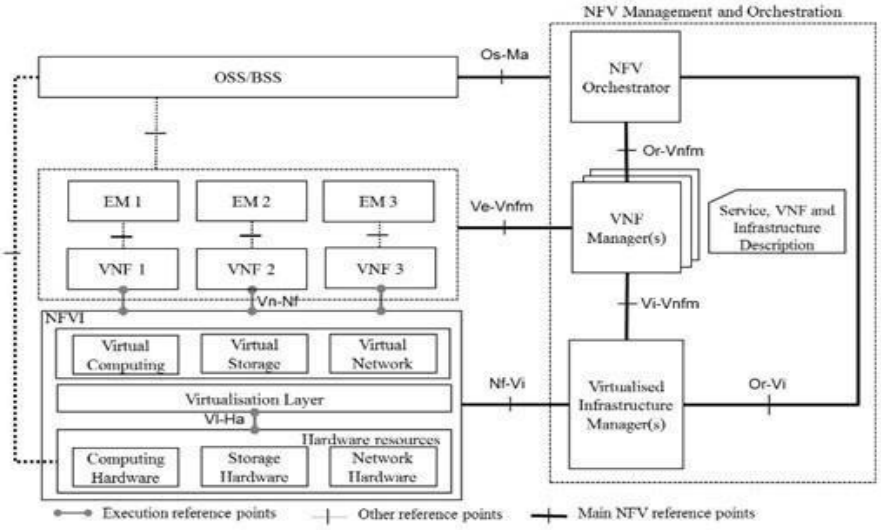
Action could be as complex as changing network function from one vendor to another in real-time. For example, in an industrial private network use case, the NFVO could switch from a high-capacity network function used during busy hours to a lower cost, smaller scale function for off-peak hours, reducing OpEx for the operator. By collecting data across all network elements and monitoring latency between data centers, Anritsu is also investigating the feasibility of enabling operators to move functions to the least cost data center on disaggregated networks offering multiple flavors of edge.

Organizational Culture

Automation requires a change of culture within operators. Operations teams are used to working on live networks: they deploy the network, test it, set it live, and deploy the fixes on the network while it is running.

Operators need to adopt a more developer-centric mindset. Actions needed to fix an issue need to be developed and then tested repeatedly until the operations team is 100 percent sure that that the solution can be reliably activated in the network without setting off a chain reaction of other issues. This is not the way most operators currently work.

Many 5G MANO solutions have been up and running in labs for six or seven years. Orchestration works well and can deliver tangible benefits to network management. However, there are currently few, if any, live dynamic network slice deployments "in the wild."



E2E Network Service Orchestration (ETSI MANO)

Figure 3 Management and Orchestration (MANO)

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Hesitancy about whether automation is ready to deliver x9s reliability has contributed to the slow commercial deployment to date. Limited supply of standalone-compatible devices has also held back R&D into new use cases.

AI & ML

Artificial Intelligence (AI) and Machine Learning (ML) are currently rarely out of the news. ML could become an incredibly powerful addition to automation by extracting extra insight from the multiple data streams collated by service assurance from across the network.

ML based on neural networks brings great potential to monitor networks: 90-97 percent reliability of predictions and anomaly detection is way above current capabilities.

This, paired with ML based on scripting with 100 percent reliability in execution, has immense potential and can enable faster and effective future network management while maintaining cost control.

Conclusion

There is no business case for making changes to a core network to serve a niche market. The full potential of 5G rests on the ability to support masses of niche use cases efficiently.

Service assurance combined with automation provide operators with the tools to manage network expansion and additional network complexity with the same resources they have today.

Better coordination between ETSI, 3GPP, and TMF could enable ZSM to realise massive benefits by standardizing integration and interactions between all NFV applications.

By the time ZSM releases mature enough, the OSS environment will be ready, and devices will beavailable to incorporate 5G SA into diverse consumer and industrial equipment, systems, and services. This is when the high bandwidth, ultra-low latency, and massive machine communications of 5G will unleash new business opportunities for operators.