Independent market research and competitive analysis of next-generation business and technology solutions for service providers and vendors

5G Performance Monitoring: Competitive Advantage at the Network Edge

A Heavy Reading white paper produced for Accedian

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COMMERCIALIZING 5G SERVICES AT SCALE

Operators worldwide are investing in 5G to drive down cost-per-bit and to enter new markets with an array of services, from low-power IoT, to industrial control applications, high-speed mobility, ultra-broadband, and more. These service types place diverse demands on the network and radically impact how infrastructure and services should be monitored.

High-value services that transform a customer's business processes require committed SLAs with accurate and timely reporting, as well as the ability to anticipate and respond to changing network conditions. Importantly, the 5G framework now provides operators with an opportunity to define service level monitoring in addition to network health monitoring. Service assurance is fundamental to the 5G architecture and to new commercial offers.

This white paper discusses how performance monitoring can help operators meet customer expectations for services in the 5G-era, drawing on the results of a new survey with more than 100 mobile operator respondents conducted by Heavy Reading in the third quarter of 2018. The paper discusses the "edge network" and why control of access networks and distributed cloud assets can give operators a sustainable competitive advantage versus public cloud platforms, if they can assure performance of end-user services.

5G Timeline: From Deployment to Operation at Scale

Operators in all the major geographies have committed to launch 5G services within the next 12 months. Figure 1 shows a generic timeline for initial deployment and network expansion in later years.

Figure 1: 5G Timeline

<table>
<thead>
<tr>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>5G PoCs &amp; Field Trials</td>
<td>5G Trials End-to-End (with 5G Core)</td>
<td>City-Level 5G (Selected Markets)</td>
<td>Commercial @Scale</td>
<td>Densification &amp; National Coverage</td>
<td></td>
</tr>
</tbody>
</table>

Source: Heavy Reading

With the first standards and network equipment now available, and with more than 15 smartphone models expected in 2019 (albeit in limited quantities), operators can plan, with some confidence, for service introduction. We expect to see launches from the big four U.S. operators, from Korean and Japanese operators, and from a large number of European operators in 2019. In China, large-scale commercial networks are expected in 2020.

Excepting a few fixed wireless applications, most of the first commercial 5G launches will focus on mobile broadband. Mobile services are worth a trillion dollars to operators annually...
and it is critical that 5G helps to sustain and develop the market for broadband access. In the second phase, the opportunity to enter new markets with new service capabilities will become the driving force behind 5G.

**Network Slicing: Toward a 5G Services Platform**

One important way 5G services will be created and operated is through the use of "network slicing." For the purposes of this paper, we can think of network slicing as the ability to provide a cohesive view of what a service needs in terms of network capability, and of the SLAs and KPIs associated with the delivery of that service. How the network slice is composed and instantiated is also important, but generally less material to the customer. By supporting multiple slices on common infrastructure, the 5G network can become a platform for third-party value creation in a way similar to cloud platforms today. There are degrees of sophistication in network slicing and we expect operators to introduce the capability in a coarse-grained model initially, perhaps limited to the core and transport network, before moving progressively to more dynamic, fine-grained, end-to-end slices over time.

The phased introduction of slicing is covered in the Heavy Reading survey. **Figure 2** shows a majority of operators (56 percent) expect to have introduced network slicing in a limited fashion within two years of commercial 5G launch and that a healthy 38 percent will offer a more advanced form of slicing tailored to important customers and verticals within the same timeframe. Over a longer timeframe (i.e., the period two to four years from commercial launch), 61 percent of operators will have "extensively deployed network slicing." This indicates that, despite complexity and challenges, operators remain committed to a vision of 5G as a service platform on which customers can innovate and generate value.

**Figure 2: What is your company’s timetable for deploying network slicing in its 5G core network at the following stages? (n=127)**

<table>
<thead>
<tr>
<th></th>
<th>Within 2 years of initial commercial deployment</th>
<th>Within 2-4 years</th>
<th>Not yet determined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited deployment</td>
<td>55.9%</td>
<td>23.6%</td>
<td>20.5%</td>
</tr>
<tr>
<td>Deployment for important customers &amp; industry verticals</td>
<td>38.1%</td>
<td>41.3%</td>
<td>20.6%</td>
</tr>
<tr>
<td>Extensive deployment</td>
<td>20.5%</td>
<td>40.2%</td>
<td>39.4%</td>
</tr>
</tbody>
</table>

Source: **Heavy Reading 5G Operator Survey on Performance Monitoring, 3Q18**

**THE 5G EDGE ADVANTAGE**

To meet demanding performance requirements, particularly as it relates to latency and deterministic performance, and to scale networks to control traffic bursts at the edge, operators will need to distribute network and cloud functions. The ability to deploy network functions at the edge, and run applications closer to the user, is inherent to the 5G architecture.
Figure 3 identifies key edge locations from on-premises deployment, such as in factories or warehouses, to access network locations, such as central office or transport aggregation points, to cloud on-ramp locations deployed in larger cities or regional data centers.

Figure 3: Service Provider Edge Network Taxonomy

The "on-premises edge" is a clear target for near-term deployment because it is associated with local-area use cases. Examples of locations include industrial facilities, public venues, enterprise campuses, etc. Closer to the core, cloud on-ramp locations – typically in a regional data center close to an Internet PoP – are also good candidates, because operators generally already have content delivery networks (CDNs) deployed in this part of the network.

The access network is harder to call and is subject to greater variability, according to geography, service mix, existing facilities, etc. In a 5G context, a phased approach is most likely. In the first phase, functions will move from central data centers to city-level or regional deployments, hosted within the operator network. As a rule of thumb, in a mid-sized European country, this could mean going from, say, three data center locations nationally to perhaps 10-20 regional data centers over time. In a larger country, it could mean going from 10 central locations today to 100 over time. Typically, these locations would be larger central offices and exchanges that have been redesigned as edge data centers. In a second phase, there is potential to extend further to the edge and deploy in smaller central offices, transport aggregation sites, and perhaps cell sites. Many factors will determine the rate at which the 5G edge is deployed. The question is, how real will this conceptual advantage be in practice?

Edge Network Advantage

Operators themselves believe ownership of access networks and edge cloud assets give them an advantage over off-network cloud providers. Figure 4 shows how their opinion falls across four different scenarios in the Heavy Reading survey. A sizeable 40 percent of
operators believe the ability to host applications in their edge data center would give them a competitive advantage over cloud players without access or edge network assets. A further 22 percent expect advantages even where the service provider "hosts the application in its central data center."

Thus, 62 percent of respondents think the combination of access and cloud assets enables operators to offer superior end-to-end performance guarantees with 5G, compared with public cloud providers. A smaller 11 percent say this applies even when only access ownership is considered, and the application is hosted in the public cloud. This makes a total of 73 percent of respondents that believe network ownership offers advantages in the ability to offer end-to-end performance guarantees, relative to public cloud service providers. This intuitively sounds correct; the challenge is to use performance monitoring to prove it.

Figure 4: Does ownership of access networks and edge cloud infrastructure enable mobile service providers to offer superior end-to-end performance guarantees for 5G compared with public cloud providers? (n=127)

A significant 27 percent are not entirely convinced saying that while ownership of access networks and edge cloud possibly gives them an advantage, "it's not clear to what extent" This is also a reasonable view given the uncertainty around future service offers.

One of the challenges of edge applications is that you also need to distribute monitoring of the access and edge cloud assets; because networks are no longer static, monitoring must be implemented in a more dynamic way. The challenge is that to distribute monitoring under the old model of probes and taps on network equipment interfaces is simply too expensive. Moreover, the classic models restrict the rate at which networks functions, and the applications they support, can be moved around the network or be adapted to changing demand or new opportunities. This issue of static monitoring and service assurance is one of the reasons why telecom operators have been unable to address market opportunities.

Automate & Orchestrate Service Assurance

Distributed and dynamic cloud networks will also require automation to support orchestrated monitoring and assurance. One of the challenges with this is that network monitoring tools today are, like network operation systems in general, reliant on manual scripting. **Figure 5**
shows that only 1 percent of respondents to the Heavy Reading survey say their performance monitoring is "not reliant on manual scripting at all," and only 9 percent say they are "less than 10 percent reliant." By the same token, only 10 percent are "more than 90 percent reliant." The bulk of operators are either "50-90 percent reliant" or "10-50 percent reliant." Automating this large number of manually-operated network performance processes and tools is therefore important to realizing the performance advantage of edge applications.

Figure 5: To what extent is your company's network performance management still reliant on manual scripting? (n=127)

![Pie chart showing reliance on manual scripting](image)

Source: Heavy Reading 5G Operator Survey on Performance Monitoring, 3Q18

Figure 6 shows operator timeframes for automating various monitoring and service processes. The most notable feature is that a very large majority of processes will be automated within five years of 5G launch and about half within the first two years. Network configuration (green) and network management and fault management (yellow) are the lead candidates for automation, outscoring service creation (blue) by a small distance. This difference possibly reflects the "order of work" in developing 5G; before you can offer a service, you need to build a network, therefore, you need to focus on those tasks first.

Given the relatively small differences in the scores, this ranking suggests that in all cases, there is now a focus on automating network operations in order to maximize revenues from new services and drive cost-per-bit efficiency with 5G.

Figure 6: When is your company likely to automate the following processes in its network following commercial launch of 5G? (n=127)

<table>
<thead>
<tr>
<th>Process</th>
<th>&lt; 2 years</th>
<th>2-5 years</th>
<th>&gt; 5 years</th>
<th>Unlikely to automate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network management</td>
<td>52%</td>
<td>37%</td>
<td>10%</td>
<td>1%</td>
</tr>
<tr>
<td>Network configuration</td>
<td>56%</td>
<td>37%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>Service creation</td>
<td>44%</td>
<td>45%</td>
<td>9%</td>
<td>2%</td>
</tr>
<tr>
<td>Performance management</td>
<td>48%</td>
<td>38%</td>
<td>11%</td>
<td>3%</td>
</tr>
<tr>
<td>Fault management</td>
<td>52%</td>
<td>30%</td>
<td>13%</td>
<td>5%</td>
</tr>
<tr>
<td>SLA management</td>
<td>46%</td>
<td>41%</td>
<td>10%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: Heavy Reading 5G Operator Survey on Performance Monitoring, 3Q18
END-TO-END APPLICATION MONITORING

To monitor a 5G network, operators can deploy physical and software agents at strategic locations, such as transport aggregation points, central offices, or regional/local data centers, or at the hand-off to external networks. These multiple monitoring points can be combined to produce a comprehensive view of application performance.

In other cases – for example, low-latency services that bypass the core network – it will be necessary to monitor interfaces at the edge and derive a performance view directly, without correlation from regional or centralized monitoring. This is shown in Figure 7.

Figure 7: Multiple Application Monitoring Points

In a 5G scenario, it is important to also extend monitoring to the NFV infrastructure (NFVI) platforms at the edge locations, and to orchestrate the monitoring functions using the same tools used to deploy and manage the virtual network. From these strategic NFVI locations, an operator can deduce end-to-end network performance, which can be combined with service-layer monitoring tools and analytics in a Service Operation Center (SOC), to build a reliable picture of how well end-user services are performing relative to expectations and SLA commitments.

Because this approach is focused on the services customers actually pay for, and how they experience them, it delivers stronger, more actionable information than standalone network element monitoring.
CONCLUSION: A NEW ERA FOR SERVICE PERFORMANCE MONITORING & ASSURANCE

The increasing importance of virtualization for key network functions in 4G, 4.5G and 5G networks, along with the adoption of distributed cloud network architectures, calls for a radical change to service performance monitoring and assurance.

During 2019, operators will continue to deal with more data, diverse traffic types, and a growing number of apps with stringent throughput requirements at the edge. As they begin deploying 5G, this will generate incredible amounts of network performance data from active testing, passive testing and telemetry. The ability to understand performance on a per-slice basis will have a transformative effect on what is needed for network and service performance monitoring. Handling all of this data will require a big data solution that leverages machine learning and artificial intelligence in order to determine how services are truly performing.

To do so effectively, operators need complete, real-time visibility of every link in the service delivery chain – at both a network and an application level – as well as better visibility into connectivity with application and cloud-hosting companies and CDNs.

With this end-to-end visibility, operators can monitor the network and the services running on it to identify and resolve potential issues and problems before they occur, and before they impact the customer experience.

Mission-critical 5G services can benefit from edge cloud deployment. For these and other 5G services, customers will demand guaranteed service performance levels. To meet this demand, accurate, reliable and proactive network, application and service monitoring will become essential for operators.
ABOUT ACCEDIAN

Accedian (www.accedian.com) delivers exceptional end-to-end network and application performance visibility for control over the best possible user experience.

Full visibility across network services and application chains – spanning virtualized, cloud, software-defined and physical infrastructure – empowers service providers and enterprises engaged with digital transformation to realize business goals and strengthen their competitive position.

Since 2005, Accedian has partnered with its customers to deliver solutions across the globe, helping them and their users to experience performance excellence.