
Executive Briefing

MobiNEX: The Mobile Network Customer Experience Index, Q4 2015

For the first time, STL Partners quantifies the customer ‘app experience’ on twenty-seven mobile networks in seven countries. Congratulations to the top three performers – Bouygues, Free and Orange (all in France)



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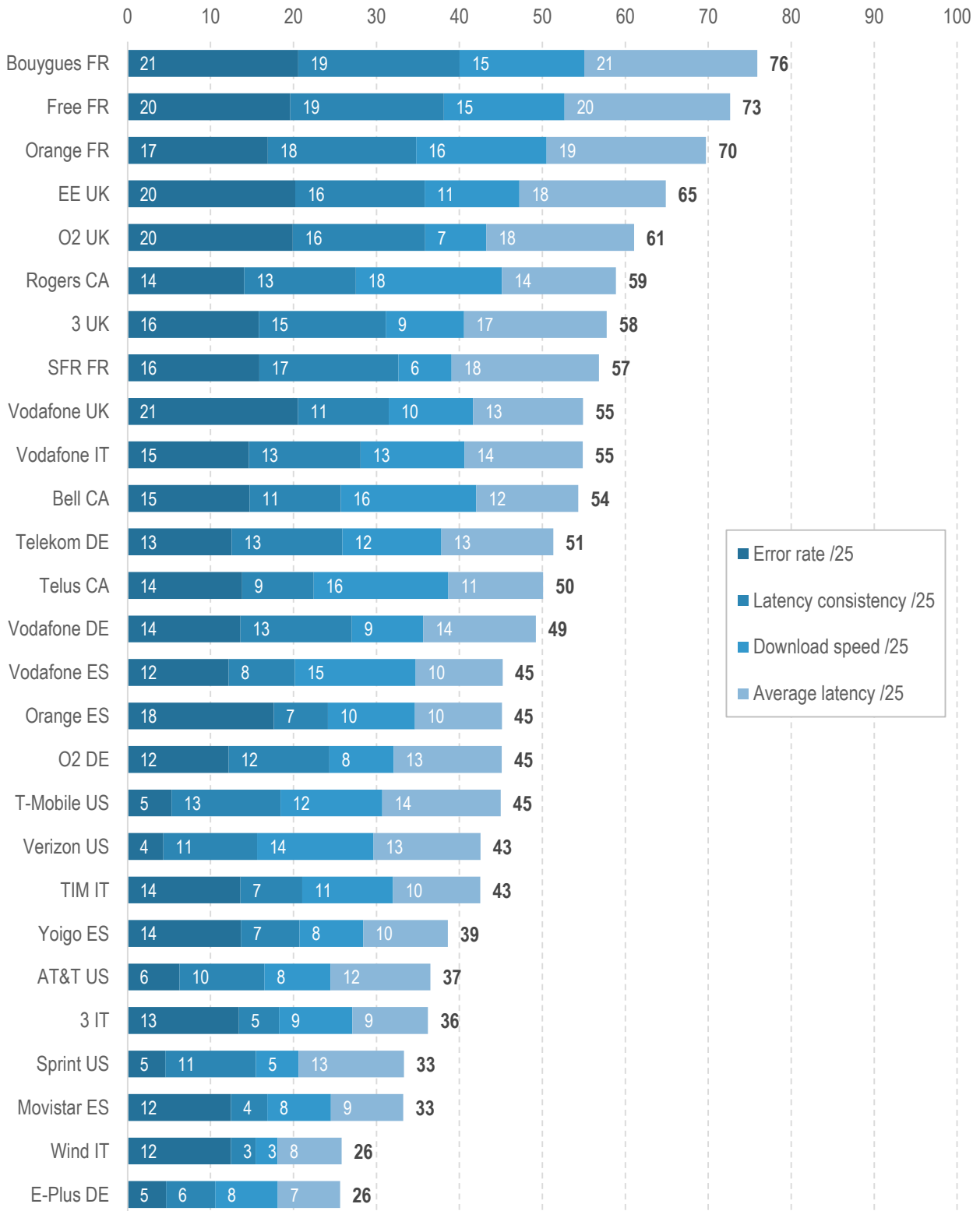
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Executive Summary

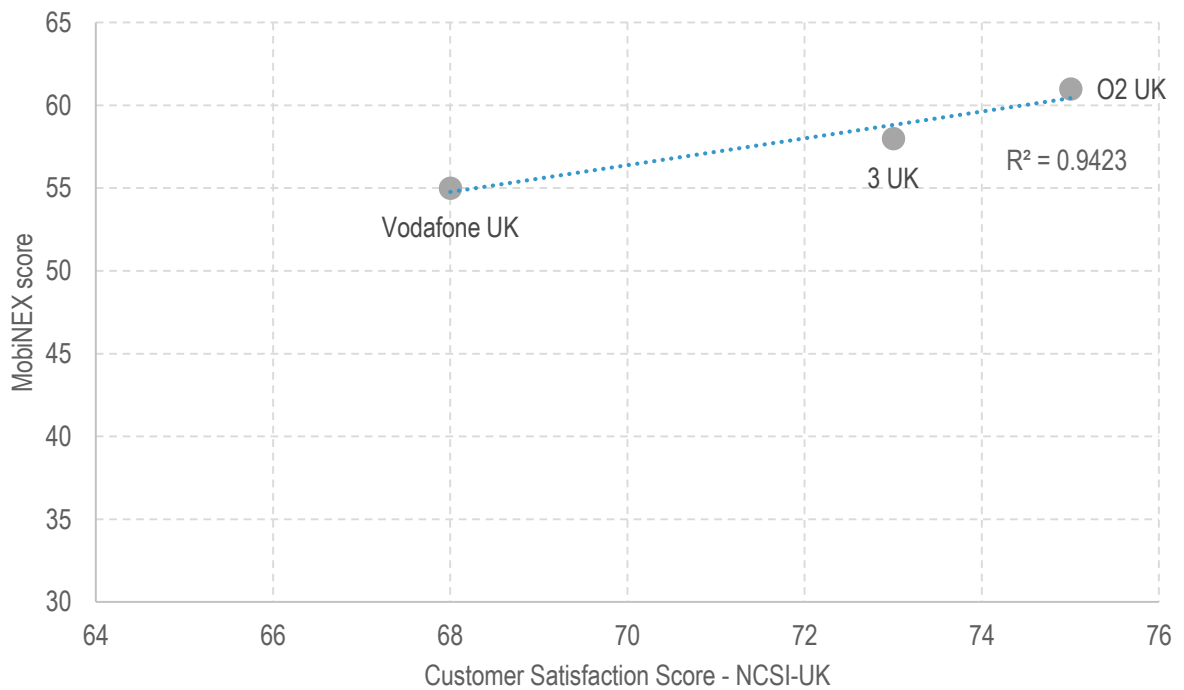
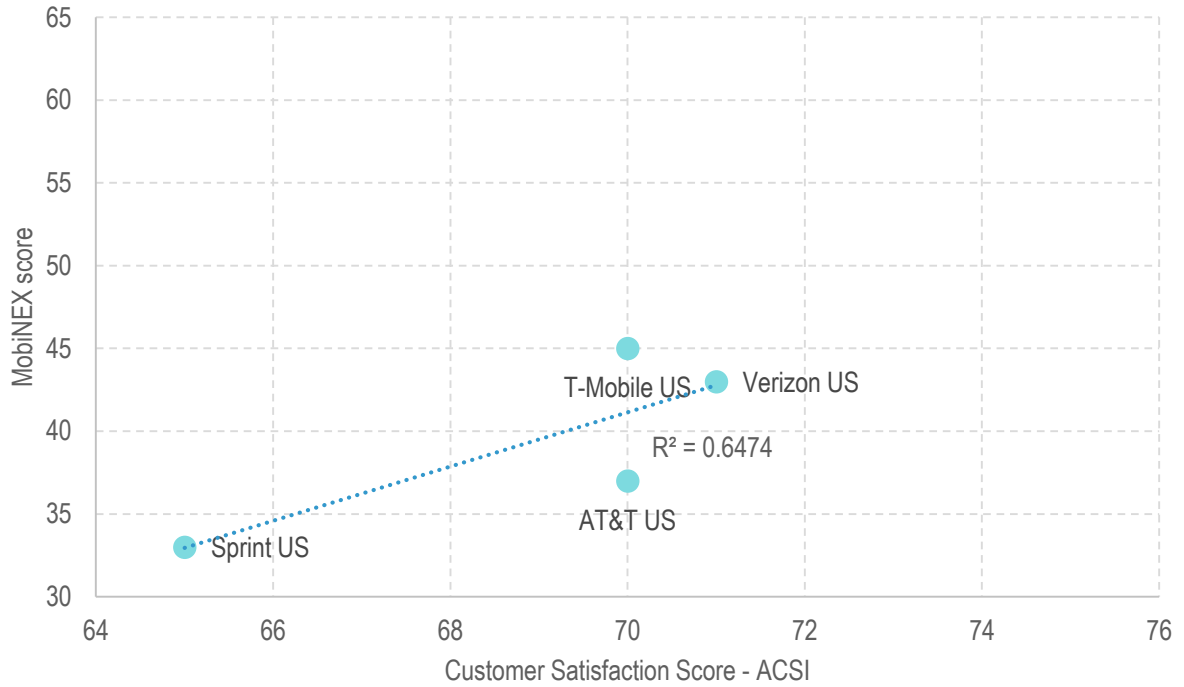
- In response to customers' growing usage of mobile data and applications, STL Partners has developed MobiNEX: The Mobile Network Experience Index, which benchmarks mobile operators' network speed and reliability by measuring the consumer app experience, and allows individual operators to see how they are performing in relation to the competition in an objective and quantitative manner.
- We assign operators an individual MobiNEX score based on their performance across four measures that are core drivers of customer app experience: download speed; average latency; error rate; latency consistency (the percentage of app requests that take longer than 500ms to fulfil). Aptelligent has provided us with the raw data for three out of four of the measures based on billions of requests made from tens of thousands of applications used by hundreds of millions of users in Q4 2015. We plan to expand the index to cover other operators and to track performance over time with twice-yearly updates.
- Encouragingly, MobiNEX scores correlate positively with customer satisfaction in the UK and the US suggesting that a better mobile app experience contributes to customer satisfaction.
- The top five performers across twenty-seven operators in seven countries in Europe and North America (Canada, France, Germany, Italy, Spain, UK, US) were all from France and the UK:
 - **Bouygues Telecom** in France scores highest on the MobiNEX for Q4 2015 with consistently high scores across all four measures and a total score of 76 out of 100.
 - It is closely followed by two other French operators:
 - **Free**, the late entrant to the market, which started operations in 2012, scores 73. **Orange**, the former national incumbent, is slightly let down by the number of app errors experienced by users but achieves a healthy overall score of 70.
 - The top five is completed by two UK operators: **EE** (65) and **O2** (61) with similar scores to the three French operators for everything except download speed which was substantially worse.
- The bottom five operators have scores suggesting a materially worse customer app experience and we suggest that management focuses on improvements across all four measures to strengthen their customer relationships and competitive position. This applies particularly to:
 - **E-Plus** in Germany (now part of Telefónica's O2 network but identified separately by Aptelligent).
 - **Wind** in Italy, which is particularly let down by latency consistency and download speed.
 - Telefónica's **Movistar**, the Spanish market share leader.
 - **Sprint** in the US with middle-ranking average latency and latency consistency but like other US operators, poor scores on error rate and download speed.
 - **3 Italy**, principally a result of its low latency consistency score.
- Surprisingly, given the extensive deployment of 4G networks there, the US operators perform poorly and are providing an underwhelming customer app experience:
 - The best-performing US operator, **T-Mobile**, scores only 45 – a full 31 points below Bouygues Telecom and 4 points below the median operator.
 - All the US operators perform very poorly on error rate and, although 74% of app requests in the US were made on LTE in Q4 2015, no US player scores highly on download speed.

MobiNEX scores – Q4 2015



Source: Aptelligent, OpenSignal, STL Partners analysis

MobiNEX vs Customer Satisfaction



Source: ACSI, NCSI-UK, STL Partners

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Introduction

Mobile app performance is dependent on more than network speed

Download speed has often been seen as the most important factor in network performance. However, for a website or application to load quickly, users are dependent on two factors: download speed and latency (the time taken for a packet of data to travel from one point to another). Which factor predominates largely depends on the design of a given website or app. If the network requests making up a webpage are few, but large, download speed will have a greater effect on load time. If the requests are many, but small, latency will be the determining factor.

Owing to the way developers use 'microservices' to construct websites and apps, latency has become increasingly important. In our previous reports, *Mobile App Latency in Europe: French Operators Lead; Italian & Spanish Lag* and *Lag Kills! How App Latency Wrecks Customer Experience*, STL Partners investigated the impact of latency on customer experience when using mobile networks. Using a very large data-set provided by mobile app intelligence specialist Aptelligent, we benchmarked major European mobile network operators on three counts: average network latency, the rate of unacceptably high-latency events, and application error rate.

We concluded that:

- There are wide differences between operators and countries in total roundtrip latency, but average latency is heavily dependent on the local market or geographic location. This may be owing to national or regional characteristics (e.g. peering arrangements), or because operators compete against each other nationally, so that operators in a given national market tend to have similar latency characteristics.
- There is a strong positive correlation between a network's average latency and the rate of application errors users experience on the network – when latency goes up, more errors occur. High network latency therefore has a double whammy impact on customer experience – customers have to wait longer and applications error-out more often.

This suggests that mobile operators have a significant impact on how well an app runs and how likely it is to experience an error. Network performance, therefore, is a key driver of mobile customer experience.

App performance as a measure of customer experience

It is clear that mobile customer experience varies widely between networks: in our last report, users of the worst performing mobile network in Europe experienced an app error rate over twice that of the top performer. As customers' understanding of the operators' role in app performance grows, they may begin to consider this as a factor when choosing a mobile service provider. It is therefore important for mobile network operators to know how well they are doing in terms of network performance and diagnose what they can do to improve the experience for their customers.

MobiNEX: The Mobile Network Experience Index

Methodology and key terms

Building on our previous research, STL Partners has developed MobiNEX: The Mobile Network Experience Index, which benchmarks mobile operators' network speed and network reliability by measuring customer app experience. This allows individual operators to see how they are performing in relation to the competition in a quantitative manner. Operators are assigned an individual NEX score based on their performance across four measures that STL believes are core drivers of customer app experience.

The four measures comprising MobiNEX are:

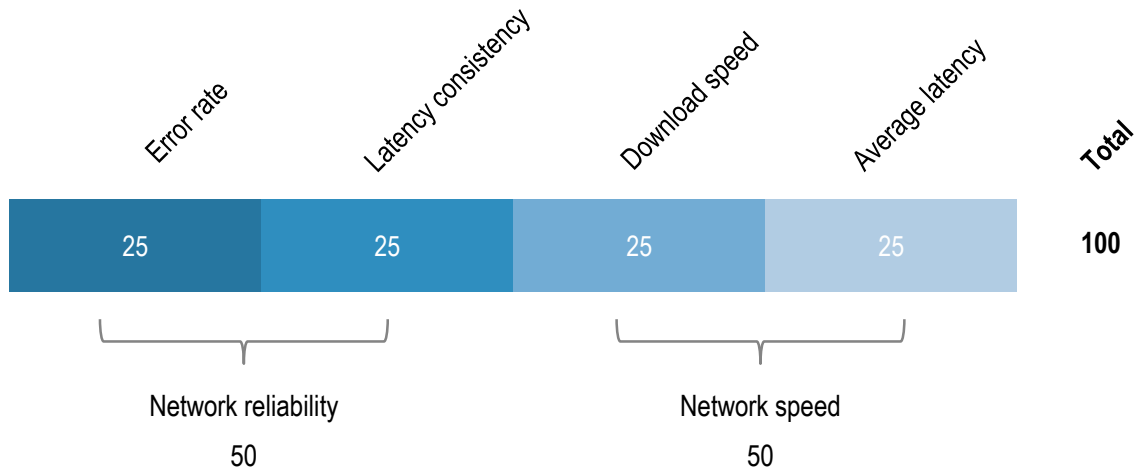
1. **Error rate:** The proportion of requests made by a customer using an application that experience an error. We assign scores based on the operator's error rate per 10,000 requests.
2. **Latency consistency:** The proportion of requests made by the customer using an application that experience unacceptably high-latency events. We assign scores based on the percentage of requests made that experience latency of greater than 500 milliseconds.
3. **Download speed:** The average speed actually experienced by users downloading data from the internet, in the form of application instructions and content. We assign scores based on the operator's average speed, measured in megabits per second (Mbps).
4. **Average latency:** The average amount of time taken from the customer taking an action on a device until they receive a response back from the application. Scores are assigned based on an operator's average 'total roundtrip latency' in milliseconds (ms) – the time it takes from the moment the user takes an action, such as pressing a button on a mobile device, to receiving a response – in effect, a packet arriving back and being processed by the application at the device.

The raw data for each measure, which is analysed in later sections of the report, is converted into an indexed score out of 25 points and, as shown in Figure 1, can be combined to give a total score out of 100.

To assign the scores, STL Partners has identified a 'top performance' and 'low performance' benchmark, to which we award 25 and 0 points respectively. The benchmarks have been chosen based on our assessment of 'best' and 'worst practise', taking into account data on current 'world best' performance for each measure (usually an operator in South Korea or Japan). We then calculate operator scores relative to the high and low benchmarks in a linear fashion.

An in-depth explanation of the source data and methodology is available in the Appendix.

Figure 1: MobiNEX – scoring methodology



Measure	Raw data used	Global leader	'Top performance' benchmark (scores 25/25)	'Low performance' benchmark (scores 0/25)
Error rate	Error rate per 10,000 requests	36 errors (Korea Telecom, South Korea)	25 errors	100 errors
Latency consistency	Requests with total roundtrip latency over 500ms, %	1.70% (NTT Docomo, Japan)	1.70%	30%
Download speed	Weighted average download speed, Mbps	38Mbps (Starhub, Singapore)	15.0 Mbps	2.0 Mbps
Average latency	Average Latency, ms	142ms (NTT Docomo, Japan)	142 ms	500 ms

Source: STL Partners

MobiNEX Q4 2015 Results: Top 5, bottom 5, surprises

The top five operators

- **Bouygues Telecom** in France scores highest on the MobiNEX for Q4 2015 with consistently high scores across all four measures and a total score of 76 out of 100.
- It is closely followed by two other French operators:
 - **Free**, the late entrant to the market, which started operations in 2012 and had already reached nearly 17% market share by the end of 2015, scores 73.
 - **Orange**, the former national incumbent which is currently exploring an acquisition of Bouygues, is slightly let down by the number of app errors experienced by users but achieves a healthy overall score of 70.
- The top five is completed by two UK operators: **EE** (65) and **O₂** (61). Both achieve similar error rate scores to their French counterparts and are only marginally worse for average latency and latency consistency, but score substantially worse for download speed (especially O₂).

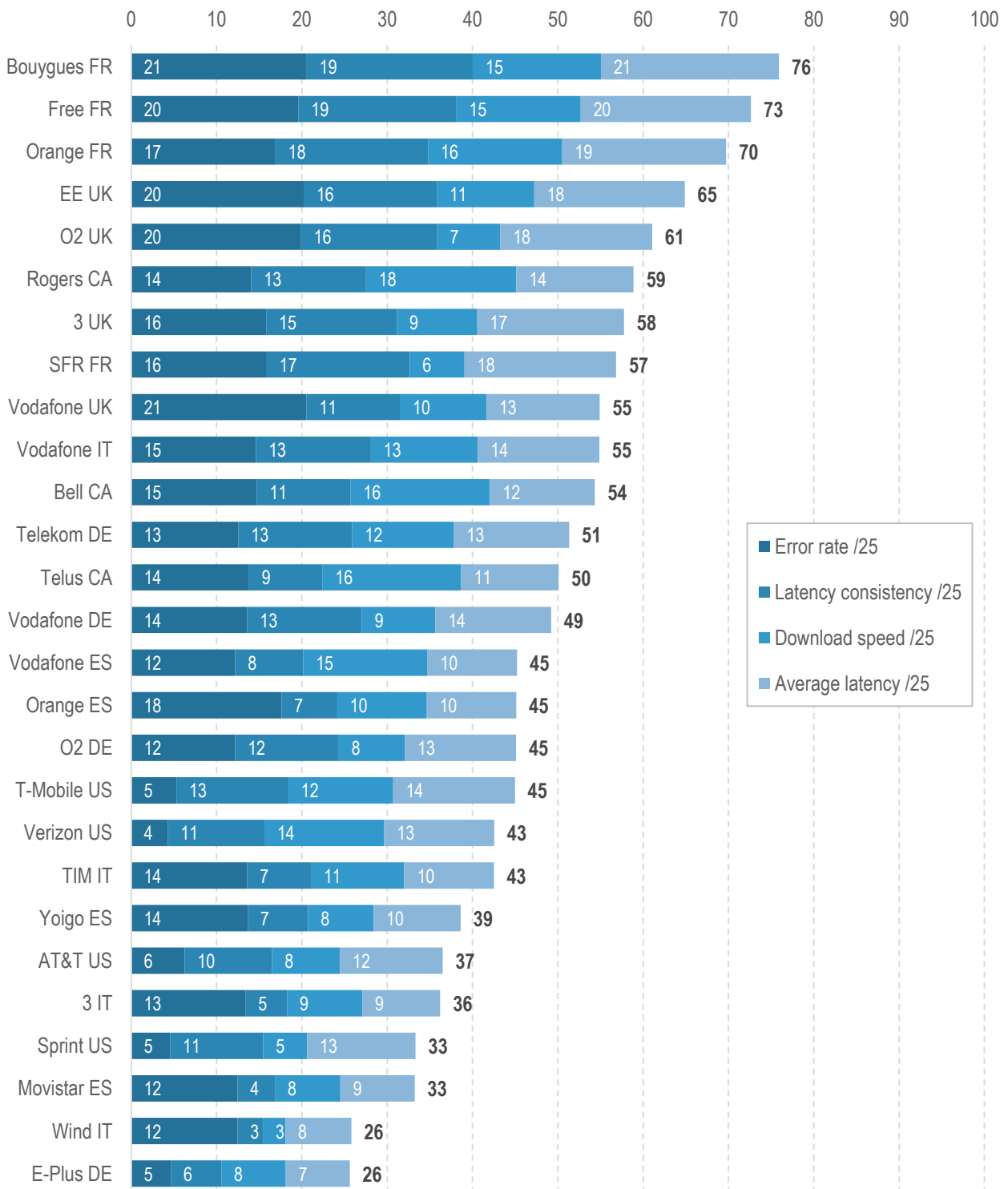
The dominance of French and UK operators clearly indicates that network performance is closely linked to local rather than inter-country competition. This is not surprising: operators invest in response to their local market, seeking to gain an advantage over or neutralise a disadvantage against players competing for the same customers. This point explains the wide range of performance of multi-operator groups such as **Vodafone** and **Telefónica**, whose operating companies are spread across the pack (see Figure 2 below).

The bottom five operators

- In joint last place, with scores that suggest a materially worse customer experience, are:
 - **E-Plus** in Germany (now part of Telefónica's O₂ network but identified separately by Aptelligent) which scores only 26 out of 100 and which suffers from problems on all four measures: a high app error rate, poor average latency and latency consistency, and slow download speed.
 - **Wind** in Italy, which also scores 26 and which is particularly let down by its latency consistency and its download speed (with scores of 3 out of 25 on each).
- **Telefónica** has the dubious distinction of having a second operating company in the bottom five. Spanish market share leader **Movistar** scores only 33, with particularly poor latency consistency meaning its customers are likely to suffer a 'laggy' experience when using apps.
- **Sprint** in the US also scores 33. Average latency and latency consistency is middle-ranking but, like other US operators, Sprint scores poorly on error rate and download speed.
- The bottom five is completed by **3 Italy** (36), principally a result of its low latency consistency score.

The wide range of countries represented at the bottom of the table contradicts the notion of local competition causing operators to cluster together set out above. However, it is important to note that nearly all of the Italian, Spanish and US operators are in the bottom half of the table such that the gap between **Wind**, **Movistar**, **Sprint**, **3** and their local peers is not that pronounced. **E-Plus** is an exception in that the rest of the German operators cluster in the middle of the ranking table. In other words, **E-Plus** is at a material disadvantage to its rivals and Telefónica will need to work hard to address these operational issues as it integrates the network with **O₂**.

Figure 2: MobiNEX scores – Q4 2015



Source: STL Partners

The surprises: operators found where you wouldn't expect them

Analysts and market observers often cite the US as a mobile market that has achieved higher broadband prices owing to its operators' network investment. And, as we show later in this report, it has the highest proportion of customers on 4G networks of the seven markets examined.

It is something of a bombshell, then, to find that US operators score so poorly on the MobiNEX and US customers appear to be getting a raw deal (especially given the relatively high prices they pay for mobile broadband):

- All four major US mobile operators are in the bottom half of the ranking.
- The best-performing US operator, **T-Mobile**, scores only 45 – a full 31 points below Bouygues Telecom and 4 points below the median operator.
- **Verizon** and **AT&T**, the US market leaders, score only 43 and 37 respectively and **Sprint**, as already noted, is in the bottom 5 with 33.
- All the US operators perform poorly on error rate. This is a real surprise given that many applications have been developed in the US-based start-ups and established companies and the vast majority are hosted in the data centres of US internet giants – Amazon and Google being particularly important.
- Although 74% of requests in the US are made on LTE, no US player scores highly on download speed. **Sprint**, and **AT&T** perform particularly poorly with 5 and 8 points respectively out of a possible 25.

STL Partners has argued that the price premium enjoyed by US operators has nothing to do with network quality¹ but is a function of the market structure (the dominance of AT&T and Verizon), coupled with strong growth and relatively benign regulation. Similarly, the French operators – collectively the best-performing players in the MobiNEX – have suffered substantive price erosion in the recent past in spite of network investment. STL Partners believes this is a strong argument against the notion of 'repremiumisation' – the ability for operators to extract a price premium through network-based differentiation.

¹ In our June 2015 report, *Repremiumization: The dangerous self-deception at work in European Telcos*.

MobiNEX is correlated with customer satisfaction

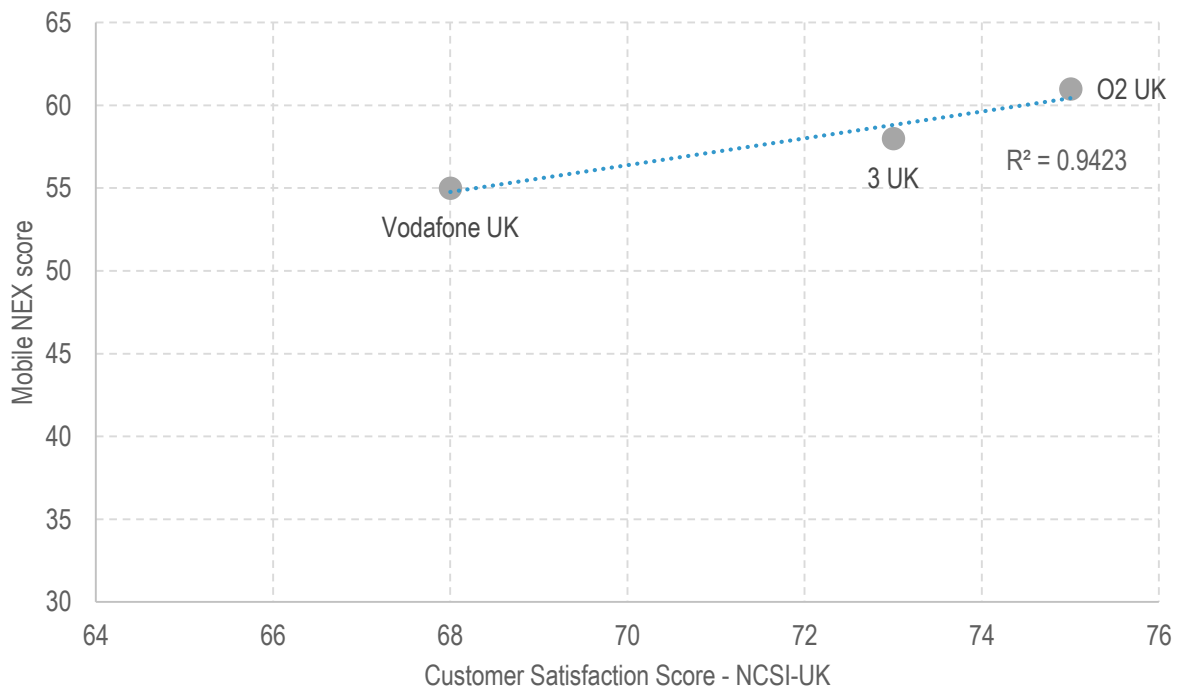
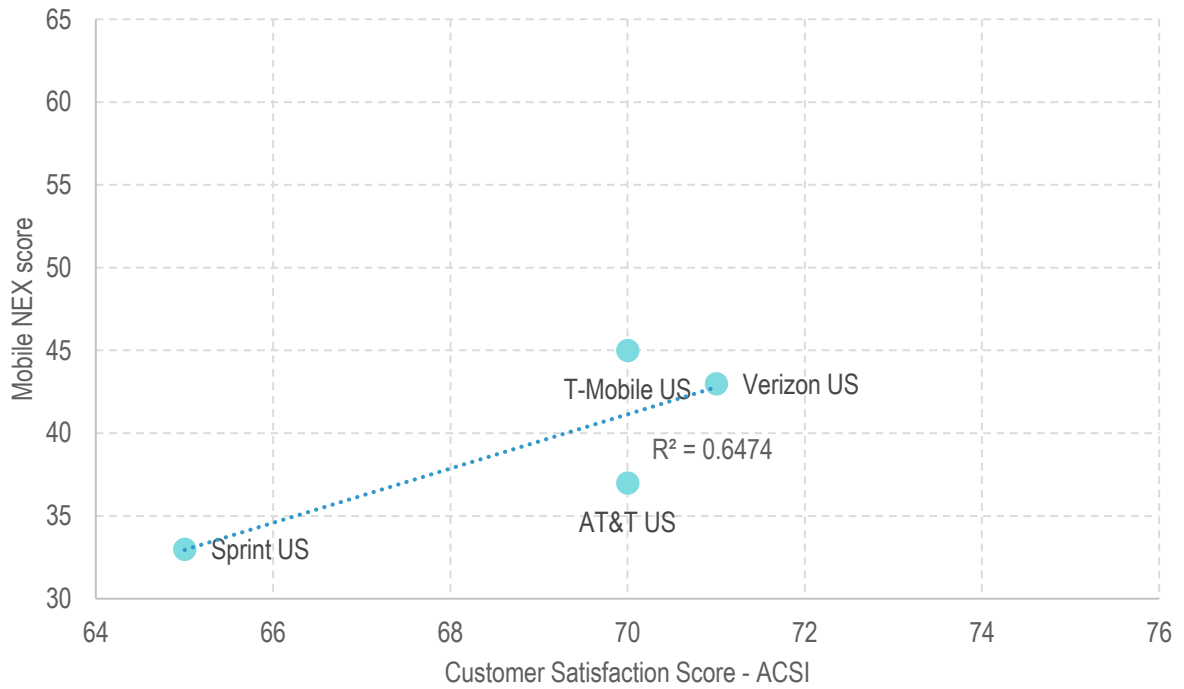
The MobiNEX produces a broad range of results and STL Partners is confident that it reflects differences in actual customer experience when using applications on different mobile networks. However, it is only valuable if it is shown to be linked to customer satisfaction that, in turn, should influence core financial and operational metrics such as ARPU, churn and net adds.

The difficulty is that there is no universal customer satisfaction metric. Customer satisfaction tends to be examined within a single national market or industry, and methodologies vary widely. This makes global comparison tricky. However, because the American Customer Satisfaction Index shares its methodology with the UK National Customer Satisfaction Index, we have been able to test the strength of relationship between the MobiNEX and customer satisfaction scores for British and American operators.

The absolute level of satisfaction with operators may vary between the US and UK (as indeed it does) owing to other factors – cultural differences, relative price levels, and so forth – but our confidence in the validity of the MobiNEX is increased by its strong positive correlation it has with the ACSI and NCSI-UK data – see Figure 3 below. While correlation does not imply causation, the strong relationship between our measure of customer app experience and a standard measure of customer satisfaction in two separate markets is encouraging.

In Figure 3 we have plotted US and UK operators on charts with the same scale to show the relationship between MobiNEX and customer satisfaction in the two countries. Overall, the UK operators perform better for both Mobile Network Customer Experience and customer satisfaction but the nature of the linear trend-line is different. Both markets show an encouraging positive correlation as measured by R^2 (the squared correlation) – the UK with 0.94 and the US with 0.65 (a score of 1.0 denoting a perfect relationship). It is worth noting that the number of data points in each market is low. The UK only has three pairs owing to the fact that the NCSI-UK did not capture data for EE in 2015; the US has four data pairs. Nevertheless, this suggests that MobiNEX is a good predictor of customer satisfaction – in other words the combination of factors we have chosen – speed + latency + errors – do affect customer experience.

Figure 3: Customer Satisfaction vs MobiNEX, 2015



Source: ACSI, NCSI-UK, STL Partners

Segmenting operators by network customer experience

Two segmentation dimensions...

As explained in **the Methodology and key terms** section above, STL Partners grouped the four measures of the MobiNEX into two dimensions, each worth 50 points:

1. **Network performance:** comprising Download Speed and Average Latency.
2. **Network reliability:** comprising Error Rate and Latency Consistency.

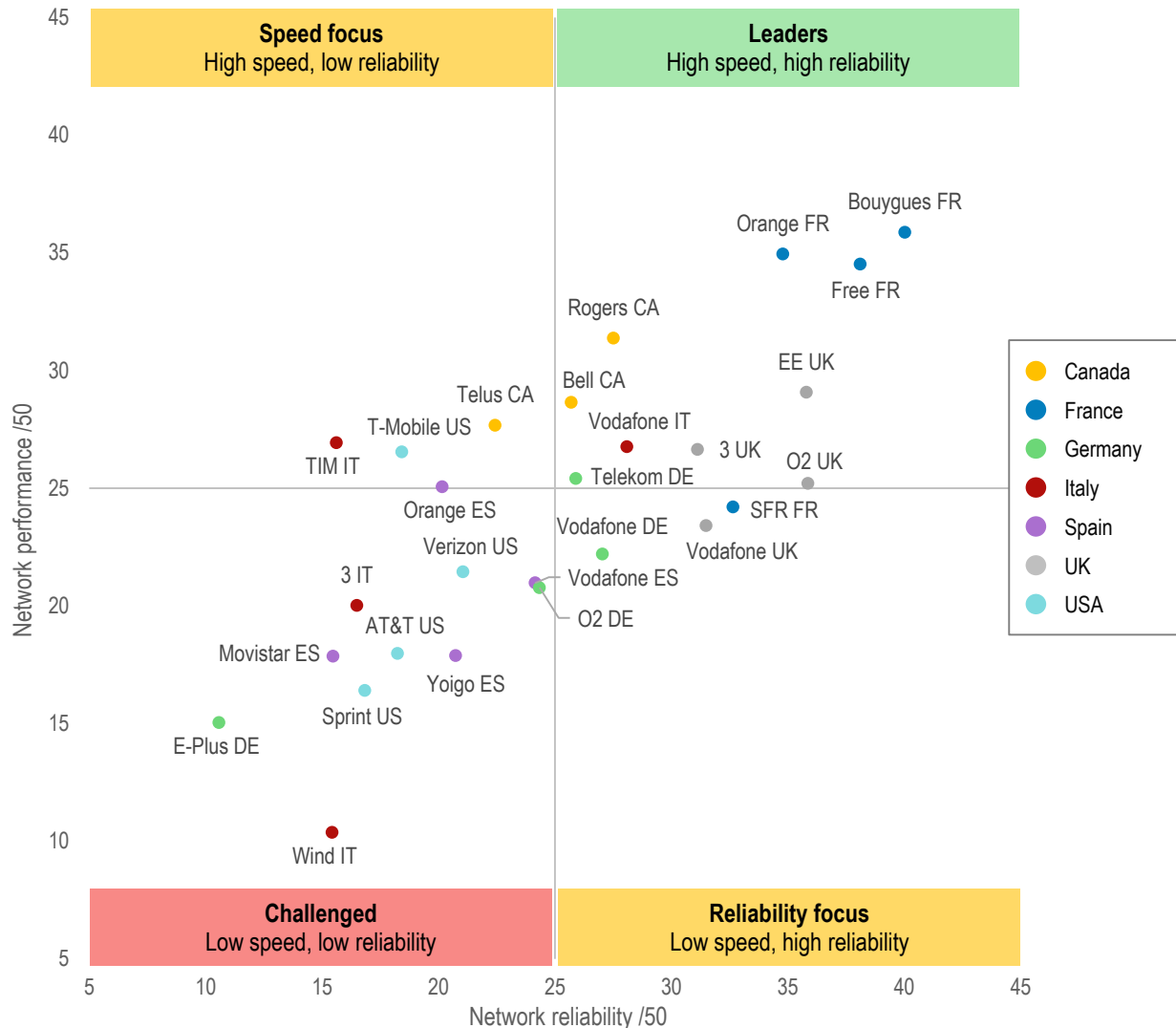
...produce four operator segments

We show the distribution of operators along the two dimensions in Figures 4 and 5. This shows that there is a positive correlation between network performance and network reliability – in other words, as network speed increases and latency decreases so the proportion of application errors and requests experiencing latency above 500ms reduces. Intuitively, of course, this makes sense.

Nevertheless, there is a good deal of variation within the overall trend as some operators perform particularly well on one dimension, compared to the other. For example, Telus (Canada), T-Mobile (US), TIM (Italy), and Orange (Spain) score well on network performance (high speed, low latency) at the expense of network reliability (error rate and latency consistency) – we have placed these players into the ‘Speed focus’ segment. Conversely, Vodafone (in both Germany and the UK) and SFR (France) form the ‘Reliability focus’ – those that score proportionally higher on network reliability than network performance.

The remaining twenty operators split evenly between ‘Leaders’ and ‘Challenged’ – with three out of four US operators found within the latter quadrant.

Figure 4: MobiNEX operator segmentation – network speed vs network reliability



Source: STL Partners

Operators in the same country tend to have similar MobiNEX characteristics

The clustering of operators by country observed in the overall MobiNEX scores is even more evident in Figure 4 above. We have given operators in each country the same colour and it is easy to see that most operators within each country tend to have the same underlying network characteristics.

- The **UK** operators score higher on network reliability than network performance and so cluster at the border of the Leaders’ and Reliability focus quadrants.
- For **Canadian** operators, the reverse is true: they score higher on network performance and so cluster at the border of the Speed focus and Leaders’ quadrants.
- The **French** players score well on both dimensions and so are all (or close to being) Leaders.

- The **German** mobile operators cluster in the middle – mid-table on both dimensions – with the exception of **E-Plus**, which performs poorly on both.
- The **Spanish** and **US** operators tend to be weaker on both network performance and reliability so that three out of the four operators in both markets are Challenged.
- **Italian** operators are by far the most diverse bunch. They range from the worst performing overall network (**Wind**) which is poor on both dimensions (and particularly so on network performance) to **Vodafone Italy** which is a Leader. **3 Italy's** scores place it towards the top of the Challenged whereas **TIM** is in the Speed focus group – scoring well on network performance and poorly on network reliability.

Figure 5: MobiNEX operator segmentation – with total scores

Speed focus High speed, low reliability		Leaders High speed, high reliability	
Telus (Canada)	50	Bouygues (France)	76
T-Mobile (US)	45	Free (France)	73
Orange (Spain)	45	Orange (France)	70
TIM (Italy)	43	EE (UK)	65
		O2 (UK)	61
		Rogers (Canada)	59
		Three (UK)	58
		Vodafone (Italy)	55
		Bell (Canada)	54
		Telekom (Germany)	51
Challenged Low speed, low reliability		Reliability focus Low speed, high reliability	
Vodafone (Spain)	45	SFR (France)	57
O2 (Germany)	45	Vodafone (UK)	55
Verizon (US)	43	Vodafone (Germany)	49
Yoigo (Spain)	39		
AT&T (US)	37		
3 (Italy)	36		
Movistar (Spain)	33		
Sprint (US)	33		
Wind (Italy)	26		
E-Plus (Germany)	26		

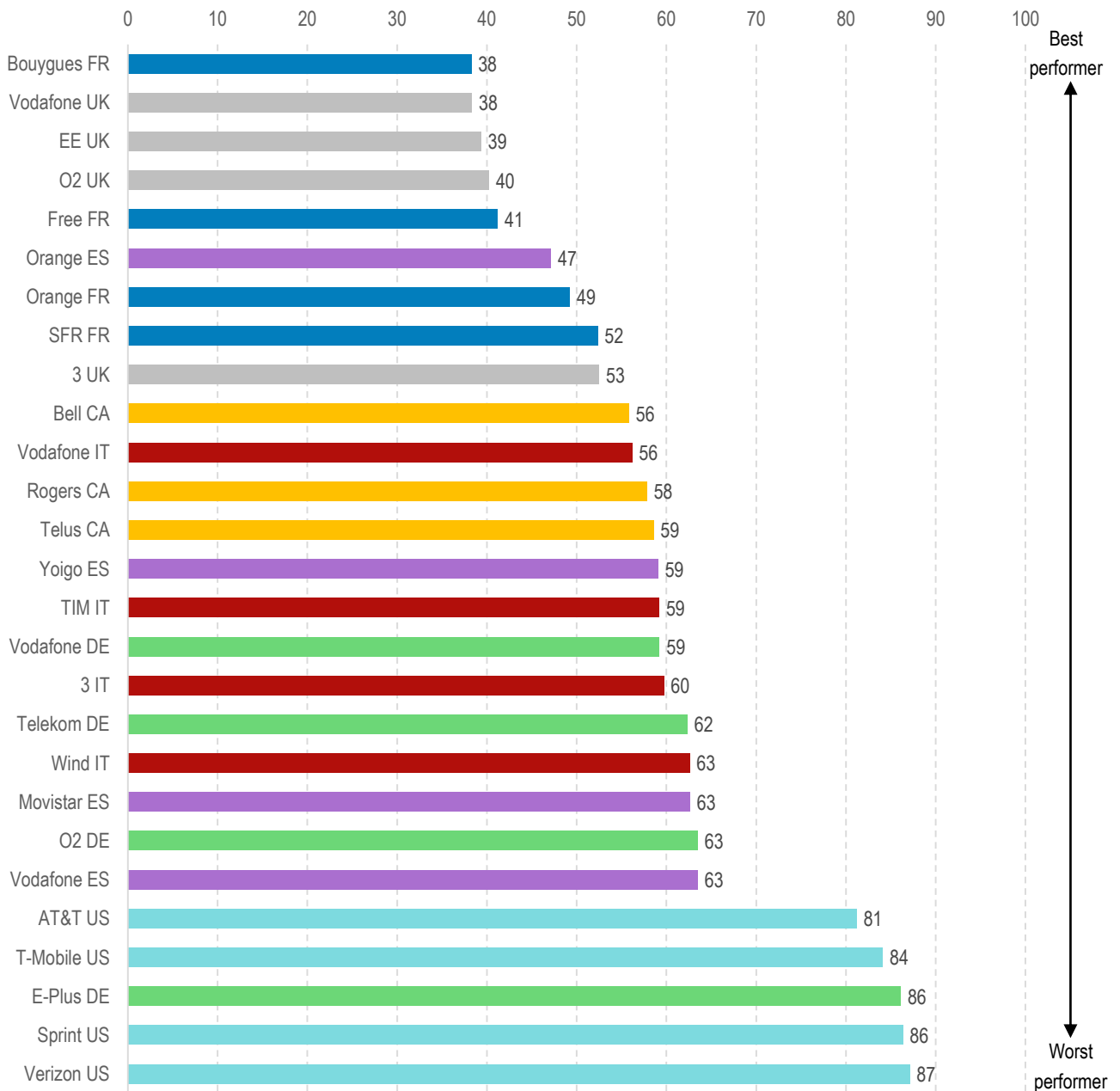
Source: STL Partners

Competition (and technology improvements) should push all the operators towards the 'Leaders' quadrant over time. A key thing to watch, therefore, is whether any operator in the other quadrants can, like Vodafone Italy, break away from their peers in the near future as this should create a material advantage in terms of customer app experience and customer satisfaction that *may* translate into a stronger market performance.

Error rate²

Quantitative analysis

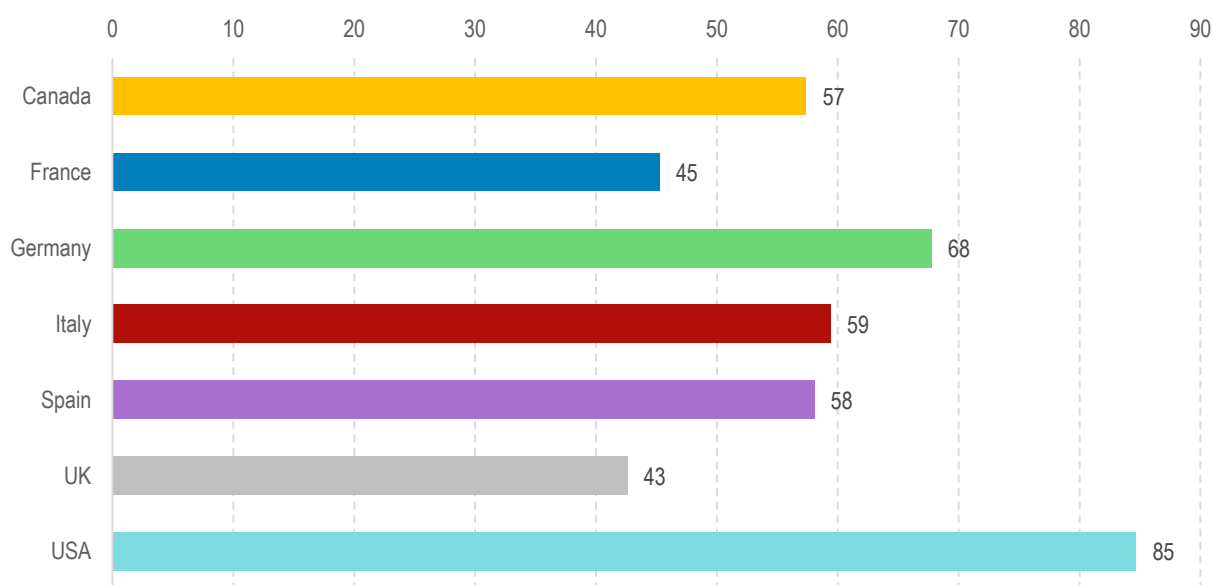
Figure 6: Major Western markets – error rate per 10,000 requests



Source: Aptelligent, STL Partners

² A network reliability measure. The proportion of requests made by a customer using an application that experience an error. We assign scores based on the operator's error rate per 10,000 requests.

Figure 7: Major Western markets – average error rate per 10,000 requests



Source: Aptelligent, STL Partners

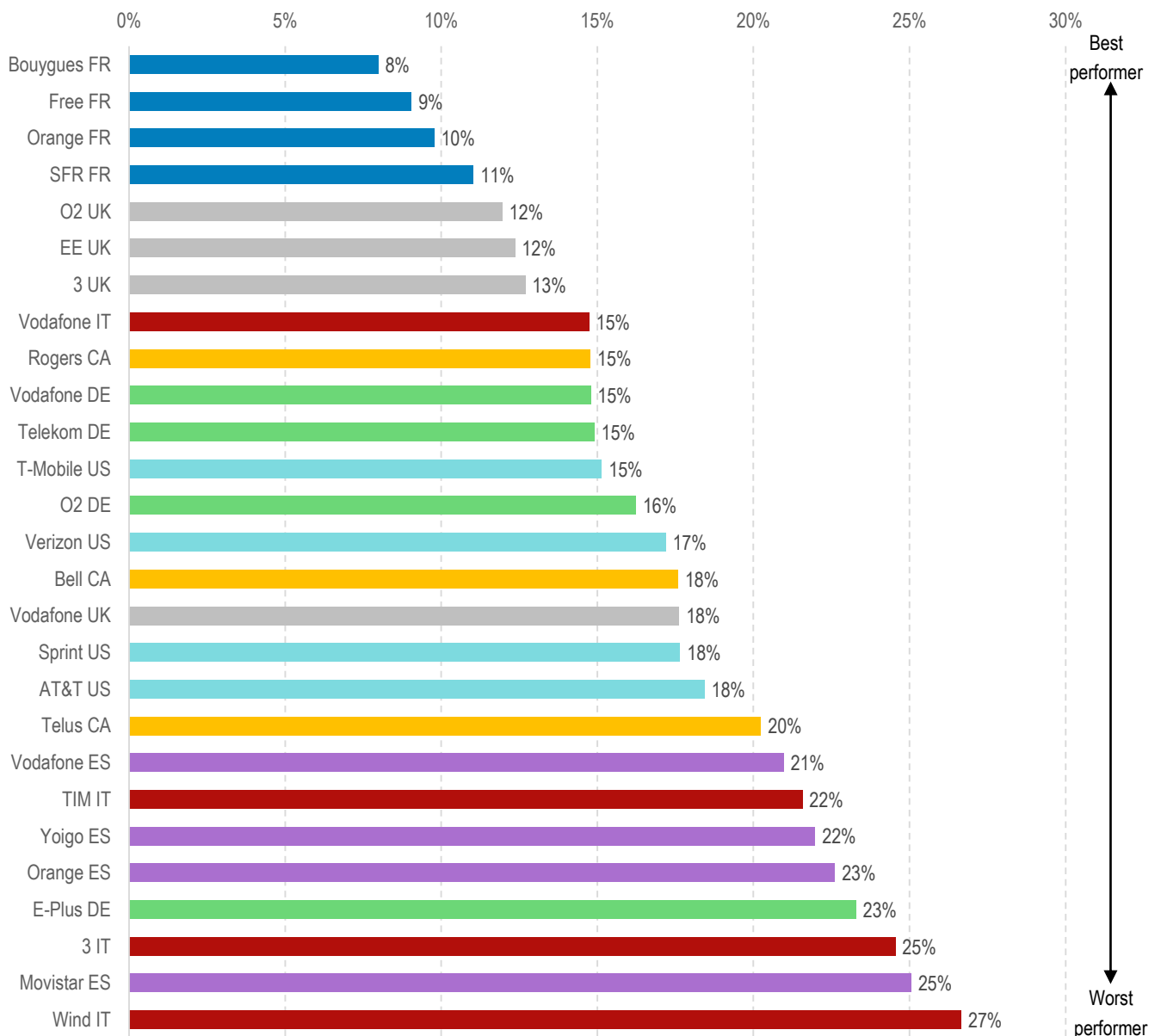
Key findings

- Error rate is indisputably a driver of customer experience: fewer errors make happier customers. And although an error is not always the fault of the network operator - it could be an app coding issue for example - different error rates between operators does indeed point to differences in network performance.
- On error rates, the twenty seven operators fall into four distinct tiers:
 - **Bouygues and Free in France, and Vodafone, EE, and O2 in the UK**, are far above the other operators with 41 app errors or fewer per 10,000 requests.
 - Next comes **Orange in Spain** and the remaining **French and UK players (Orange France, SFR, and 3UK)** all with between 47 and 53 errors per 10,000 requests.
 - Nearly half of all operators experience between 56 and 63 errors per 10,000 requests:
 - **All the operators in Canada and Italy**
 - **All Spanish operators except Orange Spain (better than this)**
 - **All German operators except E-Plus (worse than this)**
 - Finally, there is a big gap to the five worst performing players with error rates between 81 and 87: **E-Plus and the US players**. As we already noted, the performance of the latter group is surprising given the prevalence of LTE and the presence of Amazon and Google data centres, which host many apps, in the US. This suggests there may be a common network-related issue with the US operators – one that is independent of basic network technology since network errors are high on both GSM and CDMA networks.

Latency consistency³: Requests with latency over 500ms

Quantitative analysis

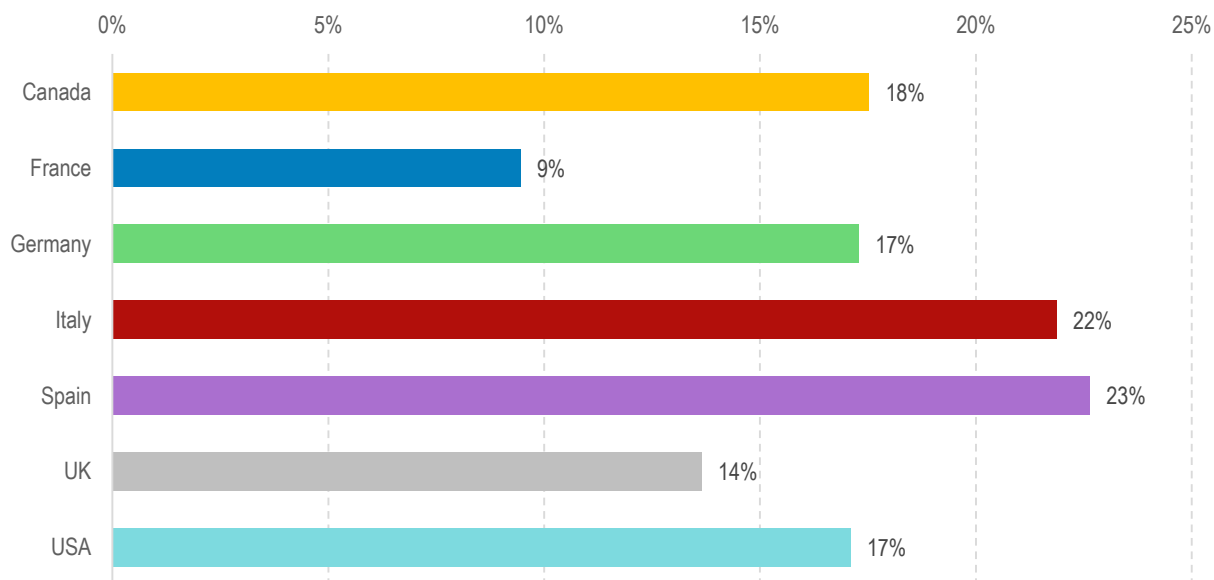
Figure 8: Major Western operators – percentage of requests with total roundtrip latency greater than 500ms



Source: Aptelligent, STL Partners

³ A network reliability measure. The proportion of requests made by the customer using an application that experience unacceptably high-latency events. We assign scores based on the percentage of requests made that experience latency of greater than 500ms.

Figure 9: Major Western markets – average percentage of requests with total roundtrip latency greater than 500ms



Source: Aptelligent, STL Partners

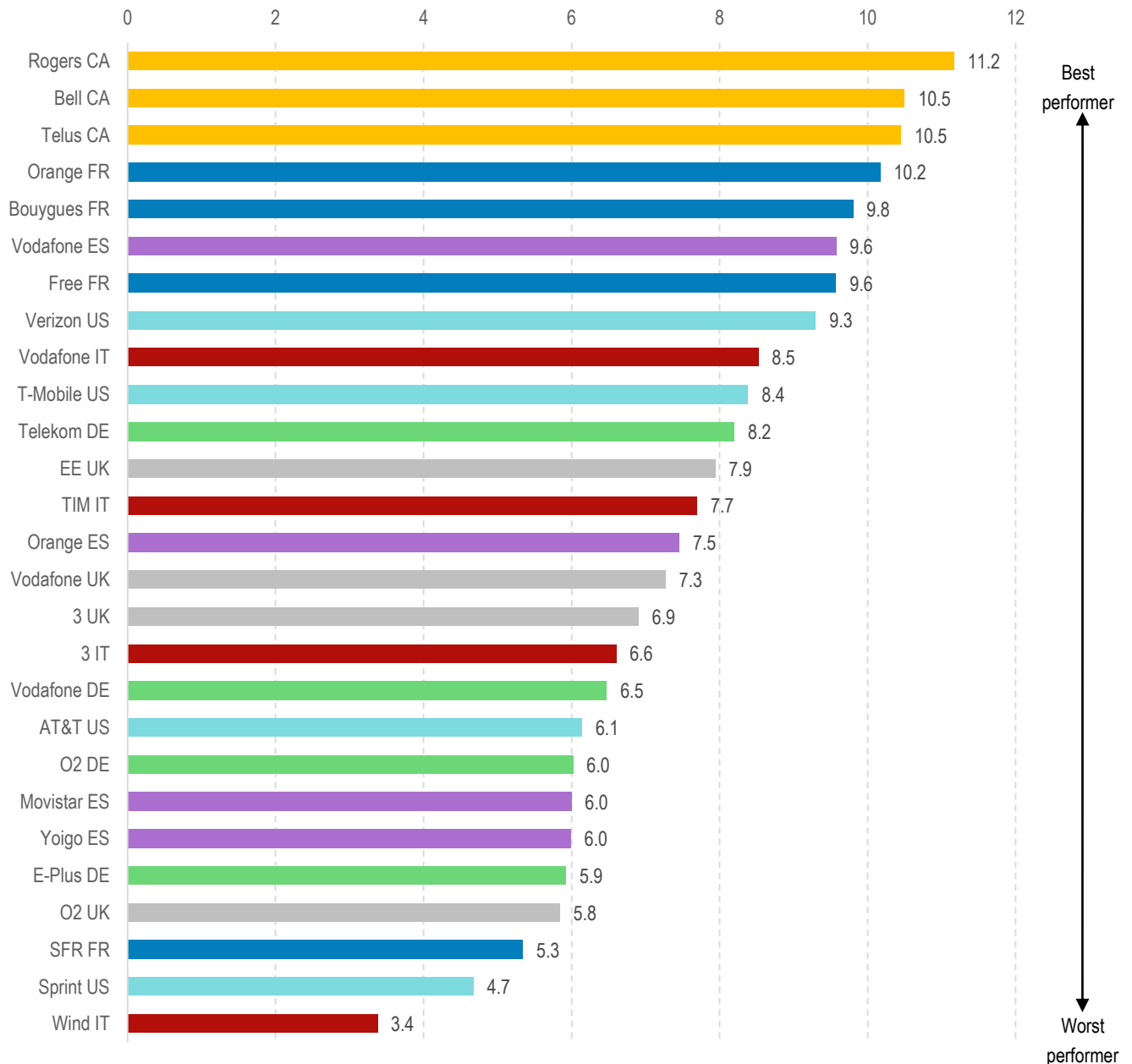
Key findings

- As we argued in previous reports, the percentage of requests with a total roundtrip latency over 500ms is likely to have a more significant impact on customer experience than average latency.
- It is sobering, then, to see the huge range in performance here, from **Bouygues with 8%** to **Wind with nearly 27%**.
- The **French and UK operators, again, stand out as leaders** – all with less than 13% of requests with total roundtrip latency below 500ms (except **Vodafone UK at 17.6%**).
- Nine operators – **seven of which are in Spain and Italy** - had more than one in five requests above the 500ms threshold suggesting a poor experience for users, namely:
 - **Wind – Italy**
 - **Movistar – Spain**
 - **3 – Italy**
 - **E-Plus – Germany**
 - **Orange – Spain**
 - **Yoigo – Spain**
 - **TIM – Italy**
 - **Vodafone – Spain**
 - **Telus – Canada**

Download speed⁴

Quantitative analysis

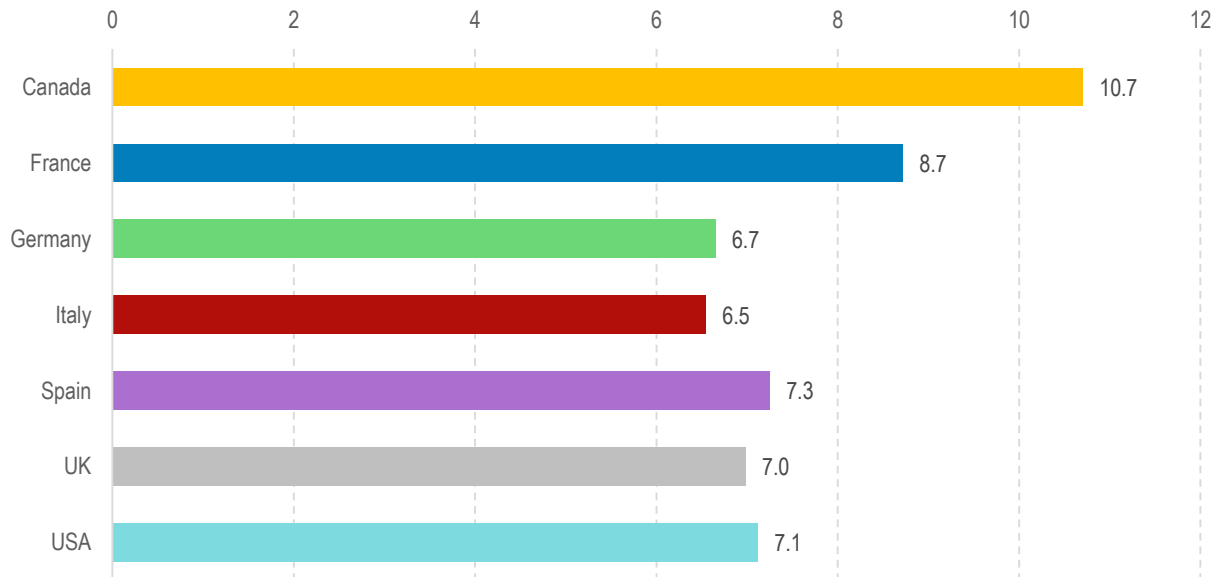
Figure 10: Major Western operators – average weighted download speed across 3G and 4G networks (Mbps)



Source: OpenSignal, STL Partners

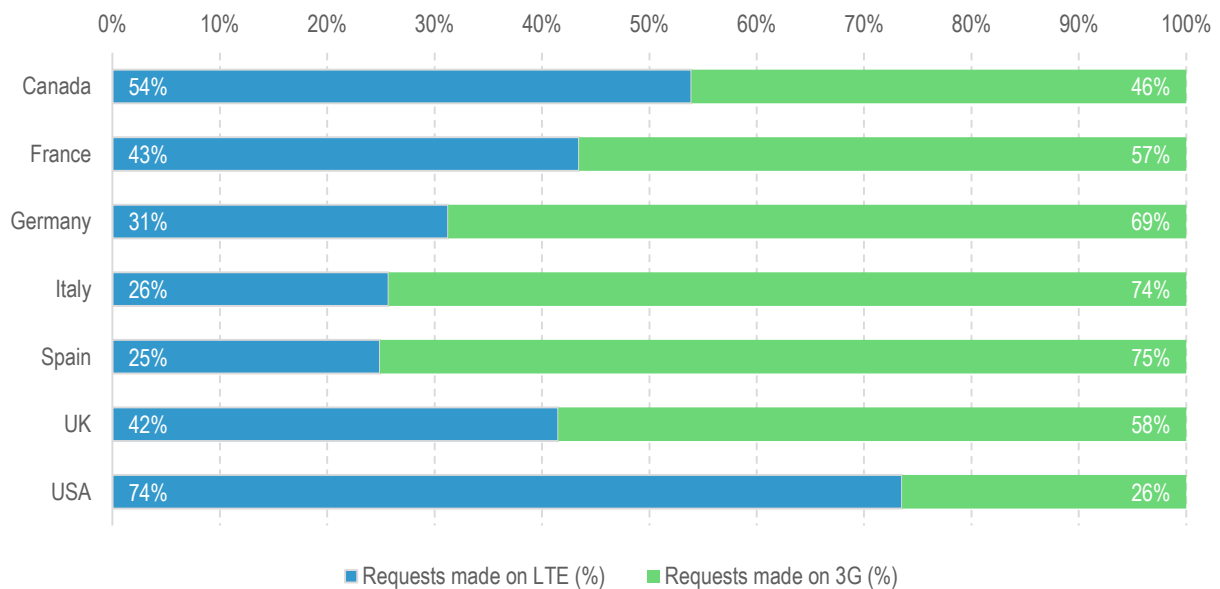
⁴ A network performance measure. The average speed actually experienced by users downloading data from the internet, in the form of application instructions and content. We assign scores based on the operator's average speed, measured in megabits per second.

Figure 11: Major European markets – average weighted download speed (Mbps)



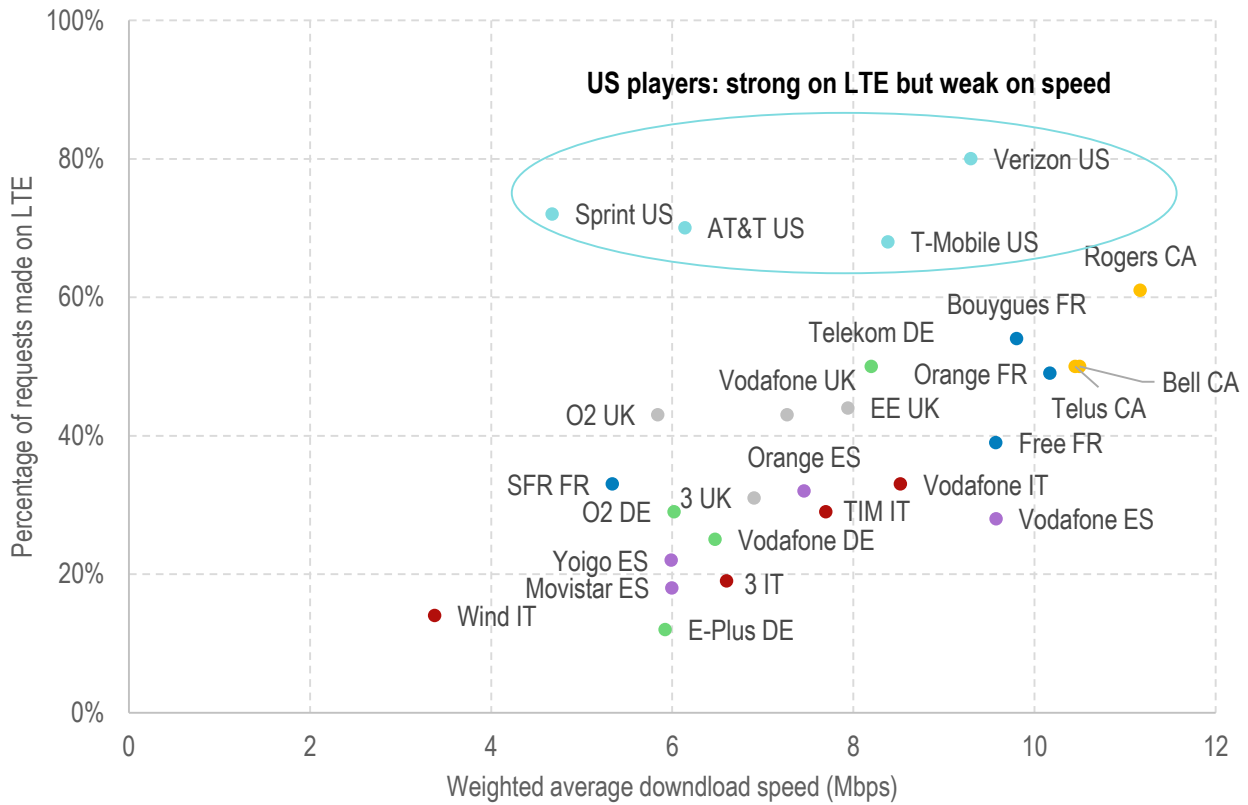
Source: OpenSignal, STL Partners

Figure 12: Major Western markets – percentage of requests made on 3G and LTE



Source: Aptelligent, OpenSignal, STL Partners

Figure 13: Download speed vs Percentage of LTE requests



Source: OpenSignal, STL Partners analysis

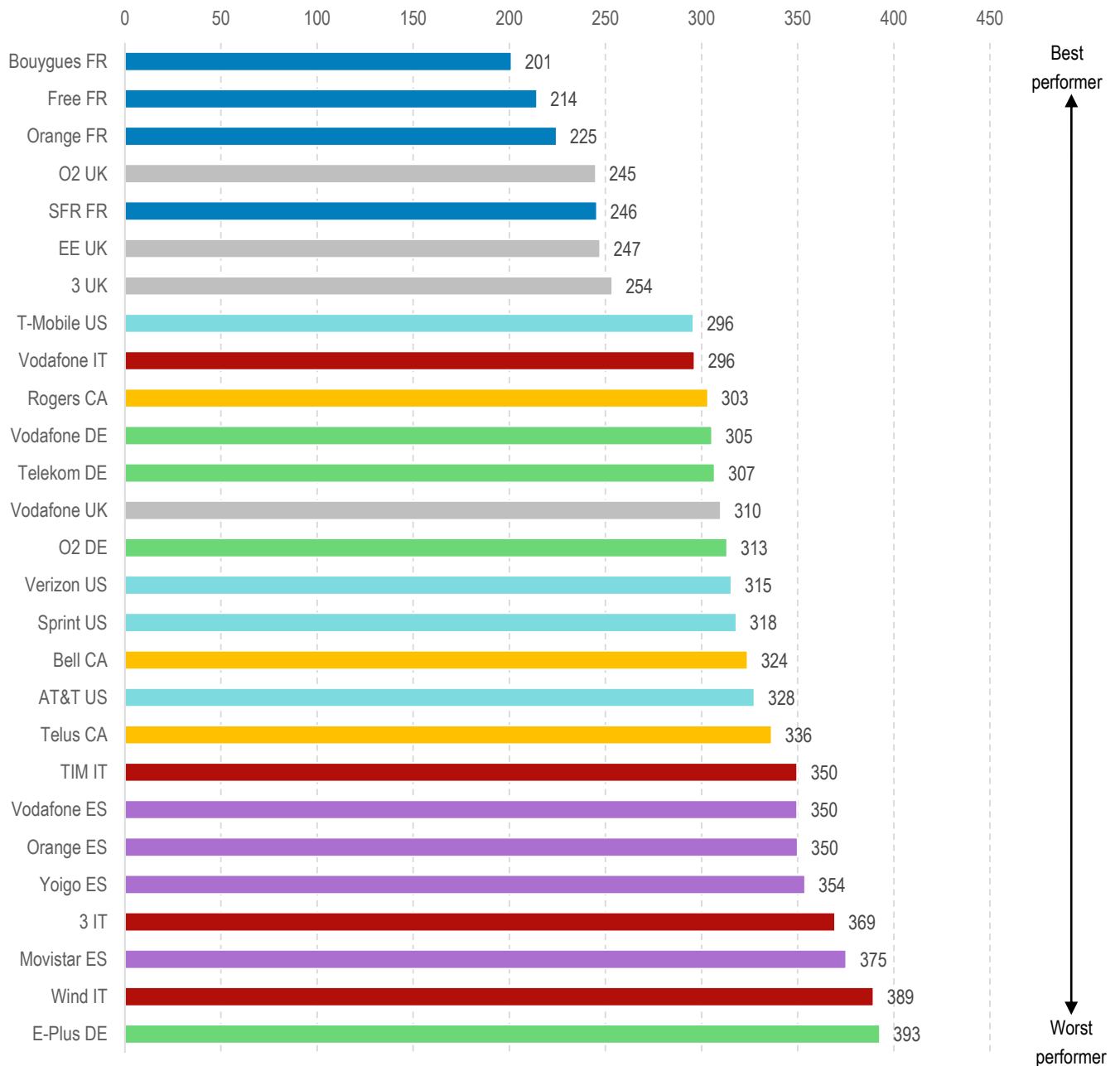
Key findings

- Canadian operators are the top three for download speed. French operators also perform well, with the exception of **SFR**, the third worst player with an average download speed of 5.3 Mbps, which is around half that of its local competitors.
- Wind** (Italy) and **Sprint** (US) performed very poorly in Q4 2015, with average speeds of 3.4 Mbps and 4.7 Mbps respectively, which were well below their peers and dragged the countries' weighted average down. **Italy** averaged 6.5 Mbps, but if Wind is excluded this rises to 7.6 Mbps. Likewise, the **US** averages 7.1 Mbps, or 7.9 Mbps if Sprint is excluded.
- Figure 13 shows that download speed positively correlates with the percentage of app requests made on LTE networks: more requests on a faster network (with lower latency, too) produces greater average speed.
 - The **US** players are clear outliers in this respect. Far more requests are made on LTE in the US than anywhere else (74% vs the next highest country, **Canada**, on 54%) but the average download speed is comparable with countries in which the percentage of requests made on LTE was in the 25%-40% range.

Average latency⁵

Quantitative analysis

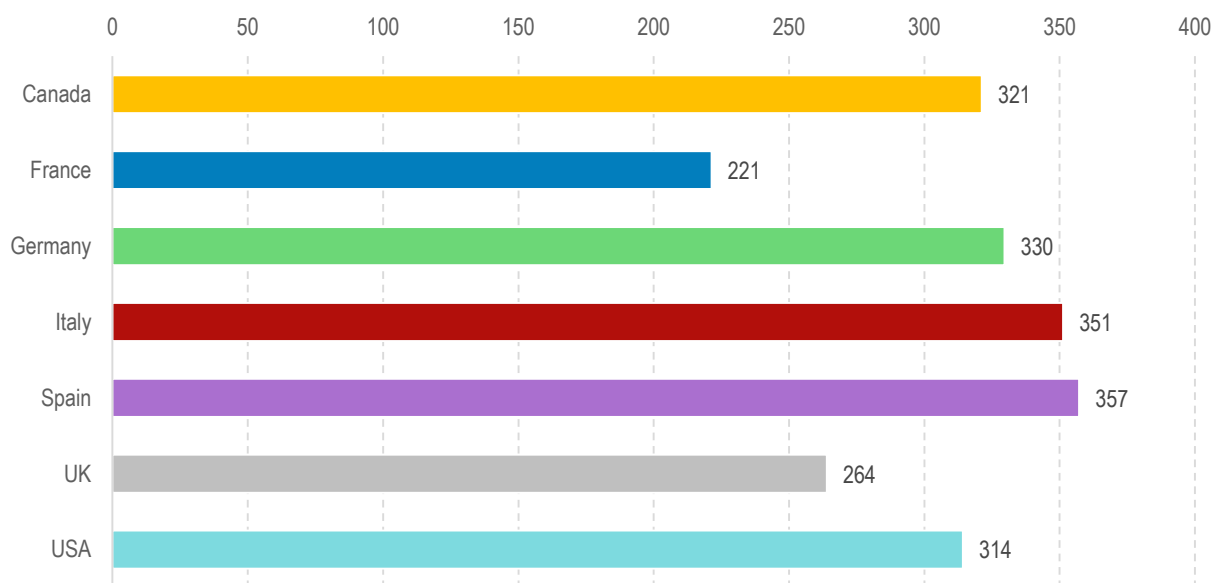
Figure 14: Major Western operators – average total roundtrip latency (ms)



Source: Aptelligent, STL Partners

⁵ A network performance measure. The average amount of time taken from the customer taking an action on a device until they receive a response back from the application. Scores are assigned based on an operator's average 'total roundtrip latency' in milliseconds

Figure 15: Major Western markets – average total roundtrip latency (ms)



Source: Aptelligent, STL Partners

Key findings

- For average latency, operators within each country tend to group closely together, with all four French operators at the top. The UK players are close behind, with the exception of Vodafone UK, which performed substantially worse than its three competitors. There is a significant gap between the best three UK players and the rest (headed by T-Mobile US)
- Operators in Spain and Italy performed particularly poorly, with only Vodafone Italy outside the bottom eight places.
- The top performer (Bouygues in France) had average latency that was nearly half that of the worst performer (E-Plus in Germany), suggesting a very material customer experience difference.
- Again, the US operators, given their high percentage of requests over LTE, performed surprisingly poorly.

Appendix: Source data and methodology

Our partner Aptelligent (formerly Crittercism) collects a wide variety of analytics data through code embedded in thousands of mobile apps used by hundreds of millions of people around the world in their every-day lives and work. To date, the primary purpose of the data has been to help app developers make better apps. In our two previous reports, we worked with Aptelligent to produce further insights from the data to serve the global community of mobile operators.

For this report Aptelligent has provided a data-set containing information on the performance of twenty-seven major operators (the top three or four by market share) in seven major Western markets (Canada, France, Germany, Italy, the United Kingdom, and the United States) over a fourteen-week period beginning on 28th September 2015. The data-set includes:

1. Average total roundtrip network latency experienced at the application layer⁶, in milliseconds (ms). which we use to calculate our “latency” score
2. The percentage of network requests with a roundtrip time of over 500ms⁷, which we use to calculate our “latency consistency” score
3. The percentage of requests made over which resulted in application errors, which we use to calculate our “error rate” score.

In a similar vein, the British company [OpenSignal](#) crowdsources data on mobile carrier signal quality from users of its consumer app. In return for sharing data on signal strength, data upload/download speed and reliability, app users are pointed towards better signal and WiFi hotspots, and provided with colour-coded coverage maps. In addition, [OpenSignal's NetworkRank](#) service provides data on the comparative performance of different carriers in specific regions.

From OpenSignal's public information, we have compiled a data-set which includes the following information for each of the twenty-seven operators:

4. Average download speed experienced on different network types, in megabits per second (Mbps)
5. Time spent on 2G/3G/4G networks.

This allows us to calculate a weighted average of the download speed experienced by customers on specific carriers, which we use to calculate our “download speed” score.

For each of the four measures, STL Partners has identified a “top performance” and “low performance” benchmark, which is used to assign each operator an indexed score out of twenty-five. Combined, these add up to a theoretical total score out of 100.

⁶ A detailed explanation of the value of using actual application latency data is available in [Mobile App Latency in Europe: French Operators Lead; Italian & Spanish Lag](#), p. 7.

⁷ 500ms was chosen as the cut-off point based on our belief that a delay of more than this is likely to impact mobile users negatively. For more information see [Mobile App Latency in Europe: French Operators Lead; Italian & Spanish Lag](#), p. 8.

Figure 16: MobiNEX benchmarks

Measure	Raw data used	Global leader	'Top performance' benchmark (scores 25/25)	'Low performance' benchmark (scores 0/25)
Error rate	Error rate per 10,000 requests	36 (Korea Telecom, South Korea)	25	100
Latency consistency	Requests with total roundtrip latency over 500ms, %	1.70% (NTT Docomo, Japan)	1.70%	30%
Download speed	Weighted average download speed, Mbps	38Mbps (Starhub, Singapore)	15.0 Mbps	2.0 Mbps
Average latency	Average Latency, ms	142ms (NTT Docomo, Japan)	142 ms	500 ms

When assigning the benchmarks, we looked at the performance of the best (usually in South Korea or Japan) and worst operators across the globe as well as identifying a theoretical 'best practise' in which all but the most demanding customers would be satisfied. For example, for "download speed", we chose 15 Mbps as warranting a top score of 25 rather than the 38 Mbps achieved by Starhub in Singapore:

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About Aptelligent

Founded in 2011, Aptelligent helps organizations improve, optimize, and monetize their mobile apps – by delivering real Mobile App Intelligence. Delivering real-time insights from both operational and end-user behavioral data, Aptelligent is incorporated into >23,000 apps with over 100 billion monthly app launches across 120 countries, spanning industries and use cases. Trusted by 3 of the top 5 credit card issuers, 3 of the top 5 media companies, 3 of the top 5 retailers, and 2 of the top 3 hotel chains with the success of their strategic mobile app initiatives, Aptelligent fully supports iOS, Android, Windows 10, and Hybrid app platforms across all popular devices.

Aptelligent has become one of the primary sources for impartial, real-time statistical data on the mobile ecosystem including device performance, carrier network performance, OS/App crash and error rates and a wealth of additional data. Working with some of the leading analyst and media firms, Aptelligent data has been cited in reports by Business Insider, CNN, Fox News, Le Figaro, and Yahoo News, among other notable news organizations. With Network Operations Centers in both the US and Germany (for EU subscribers), Aptelligent fully adheres to the strict EU privacy standards – all user data is kept fully anonymous and is never sold for advertising or other commercial use.

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