








## SINGLE WHOLESale NETWORK: GLOBAL EXPERIENCE


The following table presents a compilation of global experience with network rollout via the Single Wholesale Network model based on publicly available sources such as official websites of the respective SWN operators, public media, scientific journal articles and global indices and data points.


Country	Network generation	Aims / Expectations / Rationale given	SWN implementation details	Outcomes
Belarus 	4G	<ul style="list-style-type: none"> <li>To reduce costs,</li> <li>to significantly stimulate the market of cloud and ICT services,</li> <li>to create the backbone for the digital economy,</li> <li>to remove industry entry barriers for new services and projects.</li> </ul>	<p>The government has elected a <b>single infrastructure provider</b> Belarussian Cloud Technologies (beCloud), to construct the physical LTE-A radio access network over 1800 MHz and 2600 MHz bands, which it leases to the mobile carriers. SWN is a joint limited liability company with the <b>51% government stake</b>.</p> <p>It was launched in December 2015 in partnership with <b>Bel Huawei Technologies</b> as the contractor for the first stage and Ericsson Nikola Tesla Corporation as the contractor for the second stage.</p> <p>The rollout was very slow until in December 2019, <b>A1</b> (largest private telecom, ICT &amp; content service provider in Belarus) announced a 3-year strategic partnership with SWN beCloud to develop 4G in Belarus by <b>providing part of its infrastructure for base stations, as well as a transport network based on hybrid, radio relay and fibre optic communication lines</b> so that a 4G network in the 800 MHz frequency band became available in rural areas. As a result of this partnership, from August 2020 to September 2021, the 4G network coverage significantly expanded.</p>	<ul style="list-style-type: none"> <li>According to GSMA's Mobile Connectivity Index, by the year-end of 2019, countrywide coverage for 4G in Belarus was around 82%, while market penetration was at 35%. As of 2021, Belarus' countrywide 4G market penetration was at 48%, according to SpeedChecker.</li> <li>According to GSMA Mobile Connectivity Index, Belarus' <b>mobile tariff score has been dropping lower and lower below the region average beginning the year 2019</b>.</li> <li>As of May 2020, 4G availability in Belarus was 66% of the time, according to the OpenSignal report.</li> <li>As of January 2022, Belarus stood at the bottom of the list regarding mobile median connection speed, ranked 126<sup>th</sup> among 140 countries (source: Speedtest Global Index).</li> <li>The position has not changed much — <b>as of January 2023, Belarus ranks 128<sup>th</sup> in mobile performance</b> (source: Speedtest Global Index).</li> </ul>
	5G		<p>On November 12, 2019, in Vienna, in the presence of the A1 company, <b>Belarus signed an agreement with Austria for assistance in information and communication technologies to accelerate the development of broadband and digital technologies, including 5G</b>.</p> <p>A1 in partnership with ZTE, launched the 5G SA (Standalone) network in test mode on May 22, 2020. <b>Commercial rollout delayed indefinitely</b> — still at "laboratory" stage with very limited coverage.</p> <p>Two years later, Mid-April 2022, the Belarusian Communications and Informatization Minister reportedly announced that the country is still only 'ready' to deploy 5G technology. <b>The delay was caused by government indecisiveness over the rollout mode – the traditional network competition model was among the considerations</b>.</p>	<ul style="list-style-type: none"> <li>According to GSMA Mobile Connectivity Index historical data, since 2014, Belarus' mobile network performance dimension score has consistently remained below its regional peers, with the gap beginning to increase steadily since 2017.</li> <li>The <b>end-2022 report by Ookla reported Belarus among the top 10 countries that still heavily rely on 2G and 3G connections (39.7% of the sample)</b>.</li> </ul>

<p><b>Brunei</b></p> 	<p>4G and lower and 5G future-proofing</p>	<ul style="list-style-type: none"> <li>to consolidate and modernise all the transferred networks to deliver highly resilient and quality services to the whole nation;</li> <li>to create a level playing field for all MNOs on the retail end;</li> <li>to create an economy of scale <b>while taking advantage of the country's geography (size) and small population size (less than 500,000 people).</b></li> </ul>	<p>SWN is <b>led by a 100% state-owned entity</b>, Unified National Networks (UNN).</p> <p>On September 1, 2019, UNN reportedly <b>took over all network infrastructure operated by the existing MNOs (which are already state-owned), modernised 54% of all base stations (including fibre backhaul) within a year</b> and in September 2020, started the physical rollout of a truly unified Single RAN network.</p> <p><b>The primary consideration for UNN was</b> not only to identify the base case for a 5G return on investment [in the future] but, more importantly, that the investments have targeted <b>to create an excellent national 4G / 3G network</b> with leading capacity or in other words <b>remain focussed on the real customer demand</b>.</p> <p>UNN also <b>expanded the passive network infrastructure on top of what it has inherited from MNOs</b>.</p> <p>The Single RAN network was reportedly 5G-ready in early 2021 without any additional deployment. Some sites were planned to start implementing 5G frequencies in phases beginning in April 2021 but will not be accessible to the public <b>until the market is ready</b>. Some radio frequencies used for 4G will be freed up for 5G closer to the launch date.</p> <p>Meanwhile, the 5G Innovation Lab at Universiti Teknologi Brunei (UTB) has been reported to <b>facilitate the creation of 5G applications</b> (to prepare the market).</p> <p>On September 17, the Authority for Info-communications Technology Industry of Brunei Darussalam (AITI) announced that the country is <b>officially beginning 5G trials</b> to be run for eight months.</p>	<ul style="list-style-type: none"> <li>It has been reported that according to UNN CEO Dr Steffen Oehler, by the end of August 2021, 54% of all base stations (including fibre backhaul) covering 65% of the population.</li> <li>According to GSMA Mobile Connectivity Index historical data, Brunei's network performance dimension score has significantly increased; in 2021 it read well above the East Asia and Pacific regional average.</li> <li>As of January 2022, Brunei ranked 17th (out of 140 countries) in terms of mobile median connection speed (source: Speedtest Global Index).</li> <li>As of January 2023, Brunei ranks 12<sup>th</sup> among 137 other countries in terms of its mobile performance (source: Speedtest Global Index).</li> </ul>
<p><b>Kazakhstan</b></p> 	<p>4G</p>	<ul style="list-style-type: none"> <li>To speed up the rollout of the 4G/LTE network throughout the country and achieve cost efficiency while facing the challenge of low population density.</li> </ul>	<p>The structure of the telecom industry in Kazakhstan is equivalent to the dual wholesale network (DWN).</p> <p>In 2015 Tele2 and Altel (Kazakhtelecom) announced plans to combine their mobile operations in the country by creating a joint venture and merging their two networks in 2016/7 to spearhead efforts for developing a 4G/LTE network.</p> <p>In August 2016, Beeline Kazakhstan signed an agreement with Kcell to jointly develop a 4G network in Kazakhstan. The initiative is based on both operators sharing the 4G/LTE Radio Access Network (RAN) by a geographical split, with each operator investing 50 per cent of the overall costs. The MNOs were jointly</p>	<ul style="list-style-type: none"> <li>By the end of 2016, the joint network was planned to cover at least 30% of the country's population and 97% by the year-end of 2022.</li> <li>According to GSMA, in 2017, 4G penetration in Kazakhstan reached only 12%. And even in 2021, 4G coverage still stood at 75.7% of the population and ranked 76th worldwide according to Inclusive Internet Index 2021.</li> <li>As of January 2022, Kazakhstan ranked 91<sup>st</sup> among 140 countries in terms of its mobile median</li> </ul>


			<p>responsible for developing the network in seven regions of Kazakhstan each.</p> <p>In 2018 Kazakhtelecom bought 75% of Kcell shares, and in 2019 also acquired a controlling stake in Tele2. Thus, two consortiums currently operate in Kazakhstan to provide mobile communication and Internet services: the Kazakhtelecom group (Tele2, Altel and Kcell) and KaR-Tel (Beeline). Kazakhtelecom is owned by the government, making Beeline the only private company providing mobile services in Kazakhstan.</p>	<p>connection speed (source: Speedtest Global Index). The position did not change even as of January 2023.</p> <ul style="list-style-type: none"> <li>• According to Worldwide broadband speed league 2022 (derived from over 1.1 billion speed tests taken in the 12 months up to June 30 2022, spanning 220 countries), Kazakhstan ranks 154th with a mean download speed of 9.89 Mbps and 1 hour 9 minutes to download a 5GB movie.</li> </ul>
	5G		<p>On December 22 and 23, 2022, 5G spectrum was auctioned among two consortiums with both frequency blocks on offer won by Kazakhtelecom's two subsidiaries.</p>	<ul style="list-style-type: none"> <li>• According to GSMA Mobile Connectivity Index historical data, since 2014, Kazakhstan's mobile network performance dimension score has consistently remained below its regional peers, with the gap steadily increasing over the years (accelerating since 2019).</li> <li>• Uneven coverage of the mobile network and poor cell signal in rural areas persists until today.</li> </ul>
<p><b>Kenya</b></p> 	4G	<ul style="list-style-type: none"> <li>• high-quality, affordable telecoms services,</li> <li>• a comprehensive spectrum plan, and</li> <li>• increased market penetration.</li> </ul>	<p>In 2013 the Kenyan national broadband policy proposed to develop a single wireless network functioning as a national open-access LTE network. It was to be funded, used and owned by a <b>single public-private consortium comprising major telecom operators and the Kenyan government.</b></p> <p><b>The 700 MHz and 800 MHz spectrum bands were to be exclusively reserved for using the consortium-owned open-access network.</b></p> <p>The Kenyan government did not plan to allocate or auction excess LTE spectrum (or award mobile licences) to individual operators.</p> <p>The consultative process took too long, and negotiations were too complicated, holding major stakeholders back. In 2013 Safaricom – Kenya's largest telecommunications provider – pulled out of the deal, resulting in the project dying before it took off.</p>	<ul style="list-style-type: none"> <li>• According to <a href="#">Mobile Connectivity Index 2018 by GSMA</a>, <b>mobile internet penetration in Kenya increased only from 16% to 24% from 2014 to 2017.</b></li> <li>• According to Worldwide broadband speed league 2022 (derived from over 1.1 billion speed tests taken in the 12 months up to June 30 2022, and spanning 220 countries), Kenya ranks 137th with a mean download speed of 12.42 Mbps and 55 minutes to download a 5GB movie.</li> <li>• As of January 2023, Kenya ranked 95th among 138 countries in terms of its mobile median connection speed (source: Speedtest Global Index).</li> </ul>
<p><b>Mexico</b></p> 	4G	<ul style="list-style-type: none"> <li>• To foster competition in the telecommunications and broadcasting markets,</li> <li>• to increase investment in innovation (the</li> </ul>	<p>The intended <b>SWN would operate alongside private networks.</b> The public competition was to be held for a license for 90 MHz in the 700 MHz band (in which the Mexican wholesale network was to be deployed) open to <b>100% foreign ownership</b>, requiring a domestic Mexican company to be established. The <b>winner of a spectrum licence in an auction would have access to the Government-owned fibre backbone network and any other Government-owned utilities required to install and operate the SWN.</b> Regarding spectrum, the winner would pay an initial fee</p>	<ul style="list-style-type: none"> <li>• As of May 2020, 4G availability in Mexico was 86.4% of the time, according to the OpenSignal report.</li> <li>• As of 2021, Mexico's countrywide 4G market penetration was at 73%, according to SpeedChecker.</li> <li>• As of January 2022, Mexico is ranked 80th among 140 countries in terms of its mobile median</li> </ul>

		<p>expectation was for the number of VMNOs to grow and lead to higher competition and lower prices for consumers) and</p> <ul style="list-style-type: none"> <li>• more efficient access to rural areas.</li> </ul>	<p>(the winning bid amount). However, it is then also required to pay annual fees (determined as a function of the frequency band involved and the zones covered by the licence, but independently of the winning bid amount) for the licence period (20 years).</p> <p>The <b>remainder of the high-spectrum band was auctioned to private MNOs through a competitive process.</b></p> <p>In November 2016, it was announced that <b>the successful bidder was the Altán Redes multinational consortium.</b> The Red Compartida, SWN built by Altán Redes, was authorised to begin commercial operation in mid-March 2018 upon reaching 30% coverage of the total population. The goal for the SWN was to provide coverage to 50% of the total population by 2020 and 92% by 2024.</p> <p>In the mid of 2021, Altán Redes <b>filed for bankruptcy</b>, asking to restructure its debt. By the end-2022 the telecommunication company exited bankruptcy through a government bailout (the government became the majority stakeholder in Altan Redes).</p>	<p>connection speed (source: Speedtest Global Index).</p> <ul style="list-style-type: none"> <li>• As of January 2023, Mexico slightly improved its position to 77<sup>th</sup> among 137 other countries in terms of its mobile median connection speed (source: Speedtest Global Index).</li> </ul>
	5G		5G service is currently provided in a few cities by AT&T Mexico.	
<p><b>New Zealand</b></p> 	4G	<ul style="list-style-type: none"> <li>• To close the gap in rural-urban internet access</li> </ul>	<p>According to the <b>Rural Connectivity Group (RCG) <a href="#">official website</a></b>, "in August 2017, the [RCG] was appointed by the government to be the infrastructure provider to bring 4G wireless broadband, 4G voice calling (VoLTE) and 3G mobile service to rural New Zealand under the Rural Broadband Initiative 2 (RBI2) and the Mobile Black Spot fund (MBSF)."</p> <p>The RCG network uses 4G <b>Multi-Operator Core Network (MOCN) technology — all the MNOs (Spark, Vodafone, and 2degrees) share one piece of infrastructure, including the pole, antenna, base station equipment, power, and backhaul.</b></p> <p>RCG will mainly use 700 MHz frequency because it is the spectrum best suited for rural users. This will be supported with 1800 MHz and 2100 MHz frequencies if additional capacity is required.</p>	<ul style="list-style-type: none"> <li>• According to the early 2021 OpenSignal report, there has been clear evidence of a shrinking rural-urban mobile divide in New Zealand, even though the appearance of 5G could mask the progress. For example, there has been a noticeably increasing proportion of time New Zealand rural users spend connected to 4G. Also, according to the same report, rural and urban New Zealand users had comparable video experiences and even gaming experiences. Although, users in rural New Zealand experience significantly lower download and upload speeds than in urban areas (likely, due to the accelerating 5G rollout in urban areas).</li> </ul>
<p><b>Russia</b></p> 	5G	<ul style="list-style-type: none"> <li>• To solve 5G spectrum scarcity (5G applicable spectrum was occupied for military operations).</li> </ul>	<p>There was a proposition to follow the SWN model by a <b>consortium of four leading mobile operators (MTS, MegaFon, Beeline, Tele2)</b> due to the scarcity of the 5G spectrum.</p> <p>However, <b>the contention has started as many policy-makers and industry analysts express their grave concern regarding the impact of SWN on innovation and competition in the telecom</b></p>	—

			<p><b>industry</b> (and, as a result, quality and prices to end-users) and all other related industries in a domino fashion.</p> <p>Therefore, <b>other alternatives have been actively discussed</b>, including spectrum conversion and geographic spectrum sharing among a few MNOs to preserve an element of competition.</p> <p>Eventually, the decision was made to keep popular 5G bands (3.5GHz) reserved for the military but <b>use other spectrum bands for 5G and make them available for auction</b>. Russian MNOs must also use Russian equipment and software to build their 5G networks. Therefore the <b>government is prepared to incentivise sharing agreements among the MNOs, including spectrum pooling which the smaller players in the Russian telecom industry do not welcome</b>.</p> <p>However, the decision on releasing specific bands appears yet to be finalised. In addition, the absence of national radio equipment for 5G further complicates the situation. However, <b>the government and regulators are determined to balance rollout costs and competition even in this challenging situation</b>.</p> <p>Russian MNOs have expressed keen interest in obtaining 700 MHz bands released after the transition of on-air television broadcasting from analogue to digital format. This would allow them to roll out LTE services nationwide quickly.</p> <p>The pilot 5G networks built on Russian equipment have been launched in a few major cities.</p>	
<p>Rwanda</p> 	<p>4G</p>	<ul style="list-style-type: none"> <li>• To <b>enhance broadband coverage (including rural and remote areas)</b> and speed,</li> <li>• reduce costs and</li> <li>• Increase innovation that would drive increased usage through better content and applications.</li> </ul>	<p>KT Rwanda Networks is SWN (4G LTE), implemented in 2014 as a <b>joint public-private venture between the government and South Korean operator Korea Telecom (KT)</b>.</p> <p><b>The government provided KT access to its national fibre-optic networks and spectrum</b> in the 800 MHz and 1800 MHz. <b>The development and operation of 4G infrastructure in Rwanda were reserved for KT only by law</b>. Also, <b>no 4G spectrum was allocated to retail operators</b>. As a result, KT assumed the role of a single network operator to resell capacity to individual MNOs.</p> <p>The network was launched in 2014, and the goal was to reach 95% of the population (with a broadband penetration rate of at least 40%) by 2017 and universal access by 2020. <b>However, the rate of adoption of 4G services was extremely slow</b>.</p> <p>Eventually, KT was forced to <b>look for business ventures outside of Rwanda to compensate for its losses over recent years</b>.</p>	<ul style="list-style-type: none"> <li>• According to Mobile Connectivity Index, Rwanda's "network coverage" score increased from 59.5 to 88.8 in 2015 – 2021, while the network performance dimension score increased only from 28.3 to 50.2.</li> <li>• According to <a href="#">Mobile Connectivity Index 2018</a> report by GSMA, Rwanda's <b>mobile internet penetration increased only from 13% to 22% over the years 2014 – 2017</b>. GSMA specifically stated <b>"prohibitive prices" to consumers driven by high spectrum prices</b>. Sub-Saharan Africa region, Rwanda included, was noted as being affected the most. For example, <b>on the affordability sub-dimension of the Mobile Connectivity Index 2018 (which includes tariff prices), Rwanda received a very low score (significantly lower than the regional</b></li> </ul>

			<p>As of the beginning of 2023, reportedly, the Rwanda Utilities Regulatory Authority (RURA) expressed their intention to modify KT's licence to allow other companies to deploy 4G networks as part of the country's National Broadband Policy and Strategy, adopted by the government in October 2022 (<b>effectively ending SWN monopoly for 4G and future generations of network</b>). Also, the licences held by individual MNOs in Rwanda are to become technology neutral.</p>	<p><a href="#">score</a>), pointing towards highly prohibitive consumer prices.</p> <ul style="list-style-type: none"> <li>• According to Inclusive Internet Index 2021, Rwanda ranked 106<sup>th</sup> among 120 countries.</li> <li>• Also, according to the Worldwide broadband speed league 2021, Rwanda ranked 169<sup>th</sup> out of 224 countries with a mean download speed of 6.28 Mbps.</li> <li>• According to the <b>end-2022 report by Ookla, Rwanda was among the top 10 countries that still heavily rely on 2G and 3G connections (41.1% of the sample)</b>.</li> </ul>
<p>South Africa</p> 	5G	<ul style="list-style-type: none"> <li>• To solve spectrum scarcity,</li> <li>• reduce infrastructure duplications in the sector,</li> <li>• increase telecommunications coverage,</li> <li>• reduce data costs,</li> <li>• promote competitive pricing,</li> <li>• enhance the quality of services, and</li> <li>• reduce barriers to entry for smaller telecom players.</li> </ul>	<p>The model was supposed to be <b>MNO-led SWN</b> by MTN, Vodacom, Liquid Telecom and Rain South Africa for both standalone and non-standalone 5G. <b>The government planned to force private sector operators to buy a specific portion of SWN's capacity before they become eligible to be allocated excess high-value spectrum</b> by the Independent Communications Authority of South Africa (ICASA) via auction.</p> <p>However, <b>the plan has been put on hold by the ICASA</b>. Nationwide there is still a low level of sites, but wherever available, most sites are in urban areas, which is noted by ICASA as follows: <b>"..It is evident that this could exacerbate the digital divide, as the initial deployments are in urban areas"</b>.. and <b>"despite the policy and regulatory framework, network rollout remains skewed towards urban areas</b> – and the prospects of providers rolling out modern broadband services in rural and less affluent areas without government intervention are minimal" (Sources: SMS, ICASA).</p>	—



<p><b>United Kingdom</b></p> 	<p>4G</p>	<ul style="list-style-type: none"> <li>• to solve poor mobile coverage</li> <li>• to cement plans to give high-quality 4G coverage to 95 per cent of the UK by 2025</li> </ul>	<p>In October 2019, the Department of Digital, Culture, Media, and Sport (DCMS) and four MNOs (EE, O2 UK, Three, and Vodafone) <a href="#">have set a deal</a> on a new scheme <b>to improve mobile coverage in rural areas</b> and signed a £1 billion <b>Shared Rural Network (SRN)</b> deal in March 2020. Under the proposal, the four operators were to invest £530 million to open up and share existing masts and infrastructure to close almost all partial not-spots. In addition, government-owned mobile infrastructure built as part of the Emergency Services Network was also to be made available to all four operators, taking full advantage of government assets. The proposal from MNOs was to be matched by a £500 million investment from the government to cover hard-to-reach areas where there is currently no coverage from any operator.</p> <p>In March 2020, the <a href="#">£1 billion deal between MNOs and the government</a> was signed. The government has also pledged £5 billion to subsidise the rollout of gigabit-capable broadband in the harder-to-reach areas of the country.</p> <p>Reportedly, UK operators have chosen <b>not to adopt a neutral hosting approach (which involves sharing base station equipment)</b>, limiting the sharing to towers and sites. There is also no pooling of spectrum.</p>	<ul style="list-style-type: none"> <li>• Progress to date remains modest. The most recent Connected Nations report from regulator Ofcom indicated 92% coverage in May 2022, up one percentage point compared to January 2021.</li> <li>• The critique (see, for example, <a href="#">“Neutral Hosting as a Rural Mobile Network Solution”</a>) has stated <b>the lack of neutral hosting, which involves the sharing of base station equipment, and not working with local communities to reduce costs of backhaul through direct-buried fibre as main contributors to the lack of progress.</b></li> </ul>
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