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smaller than the large antennas used in previous mobile networks. Some are only a few inches (several centimeters) long. The massive MIMO (multiple input) was deployed in 4G as early as 2016 and typically uses 32 to 128 small antennas in each cell. At the right frequencies and configuration, it can increase performance from 4 to 10 times. [10] Multiple bitstreams of data are transferred at the same time. With a technique called beamforming, the base station computer continuously calculates the best route for radio waves to reach each wireless device and will arrange multiple antennas to work together to create beam millimeter waves to reach the device. [9] [2] Application areas ITU-R has identified three main application areas for 5G capability capabilities. These are Improved Mobile Broadband (eMBB), Ultra Reliable Low Latency Communications (URLLC), and Massive Machine Type Communications (mMTC). [11] In 2020, one eMBB is deployed; URLLC and mMTC are several years away in most places. [12] Improved mobile broadband (eMBB) uses 5G as a way forward for 4G LTE mobile broadband services with faster connections, higher throughput and more power. This will benefit areas of more traffic, such as stadiums, cities, and concert venues. [13] Highly Trusted Low Latency (URLLC) refers to the use of the network for critical applications that require continuous and robust data exchange. Massive Machine-Type Communications (mMTC) will be used to connect to a large number of devices. 5G technology will connect some of the 50 billion connected IoT devices. [14] Most will use cheaper Wi-Fi. Unmanned aerial vehicles, which will transmit using 4G or 5G, will assist in disaster relief efforts by providing real-time data to emergency responders. [14] Most cars will have 4G or 5G mobile connection for many services. Autonomous cars do not require 5G, as they must be able to operate if they do not have a network connection. [15] Although remote operations have been performed more than 5G, most remote operations will be performed on equipment with a fibre connection, usually faster and more reliable than any wireless connection. The performance speed of 5G will range from ~50 Mbit/s to more than gigabits.[16] The fastest 5G is known as mmWave. As of July 3, 2019, mmWave had a maximum speed of 1.8 Gbit/s[17] on the AT&Tp.75G network. Sub-6 GHz 5G (mid-band 5G), by far the most common, usually delivers between 100 and 400 Mbit/s, but will be much further afield than mmWave, especially outdoors. [17] The spectrum of the low frequency band offers the greatest range, thus providing a larger coverage area in a specific location, but slower than other bands. 5G NR (New Radio) speed below 6 GHz bands may be slightly higher than 4G with similar spectrum and antenna although some 3GPP 5G networks will be slower than some advanced 4G 4G networks for example, the T-Mobile LTE/LAA network, which in Manhattan [20] and Chicago reaches 500+ Mbit/s. [21] The 5G specification allows LAA (License Assisted Access) as well, but the LAA 5G has not yet been proven. Adding a LAA to an existing 4G configuration can add hundreds of megabits per second speed, but it's an extension of 4G, not a new part of the 5G standard. [20] The similarity in the throughput between 4G and 5G in existing bands is due to 4G already approaching Shannon's data rate. 5G speeds in a less common millimeter wave spectrum with a much richer bandwidth and shorter range, and thus greater frequency reuse may be significantly higher. [22] In 2019, the latency 5G in the shipping of air latency[23] is 8-12 milliseconds. [24] The latency server must be added to the air latency for most comparisons. Verizon reports that its 5G early deployment of 30 ms[25] Edge Servers close to the towers can reduce latency to 10-20 ms; 4- ms will be very rare years outside the lab. Standards The original term was associated with the International Telecommunications Union IMT-2020 standard, which required a theoretical maximum download speed of 20 gigabits per second and 10 gigabits per second upload speed, as well as other requirements. [26] Industry Standards Group 3GPP then selected the 5G NR (New Radio) standard together with LTE as a proposal for submitting the IMT-2020 standard. [27] [28] The first phase of the 3GPP 5G specifications is scheduled to be completed in release 15 in 2019. The second phase of release 16 should be completed in 2020. [29] 5G NR may include lower frequencies (FR1), below 6 GHz and higher frequencies (FR2) above 24 GHz. However, speed and latency at the beginning of fr1 deployment using 5G NR rare for 4G hardware (non-stand-alone) aren't slightly better than the new 4G systems, which are estimated to be 15 to 50% better. [30] [31] [32] IEEE covers several 5G zones with the main focus in the wiring sections between the remote radio head (RRH) and the base band unit (BBU). 1914.1 Standards focus on the network architecture and divide the connection between the RRU and the BBU into two main sections. Radio unit (RU) per distributor unit (DU), which is NGFI-H (next generation fronthaul interface) and DU to central unit (CU), which is NGFI-I interface providing a more diverse and cost-effective network. NGFI-H and NGFI-I have defined the operational values to be pooled to ensure that different traffic modes defined by the ITU can be transported. The 1914.3 standard creates a new Ethernet frame format that is able to perform IQ data more efficiently depending on the functional distribution used. It is based on the definition of functional breakdowns 3GPP. Several network synchronization standards are updated in IEEE groups to ensure that the accuracy of the RU network time is maintained to the level required for traffic over it. 5G NR Main Article: 5G NR NR (New Radio) is a new air interface developed for the 5G network. [33] This should be a global standard for air interface of 3GPP 5G networks. [34] Standard implements of 5GTF: The 5G network introduced by American carrier Verizon fixed wireless access at the end of 2010 uses the above standard specification, known as the 5GTF (Verizon 5G Technical Forum). The 5G service provided to customers in this standard is incompatible with 5G NR. There are plans to upgrade 5GTF to 5G NR when [it meets our strict specifications for our customers, according to Verizon. [35] 5G-5G: Specification of 5G standards developed by KT Corporation. Hosted at Pyeongchang 2018 Winter Olympics. [36] Internet of Things Internet of Things (IoT) 3GPP is about to submit the development of NB-IoT and mMTC (LTE-M) as a 5G technology for the use of LPWA (Low Power Wide Area). [37] Deployment See also: List of 5G NR networks 5G 3.5 GHz Cell Site Deutsche Telekom in Darmstadt, Germany 5G 3.5 GHz Cell Site Vodafone Karlsruhe, Germany Beyond mobile network, 5G is also designed for private networks with applications of industrial IoT, corporate network and critical communications. The initial launch of 5G NR depended on pairing with the existing LTE (4G) infrastructure in non-stand-alone (NSA) mode (5G NR radio with 4G core) before maturing the standalone (SA) mode with the 5G core network. Since April 2019, the Global Mobile Suppliers Association has identified 224 operators in 88 countries that have proven, tested or tested, or have been licensed to test 5G technologies in the field, deploy 5G networks, or have announced the launch of services. [38] In November 2018, the equivalent figures were 192 operators in 81 countries. [39] The first country to be a large-scale 5G was South Korea in April 2019. Swedish telecom giant Ericsson predicted that by the end of 2025 5G network will cover up to 65% of the world's population. [40] Also plans to invest 1 billion rials (\$238.30 million) in Brazil to add a new assembly line dedicated to fifth generation technology (5G) in its Latin American operations. [41] When South Korea launched its 5G network, all carriers used Samsung, Ericsson and Nokia base stations and equipment, with the exception of LG U Plus, which also used Huawei equipment. [42] [43] Samsung was the largest supplier of 5G base stations in South Korea at launch, which at the time had shipped 53,000 base stations, out of the 86,000 base stations installed nationwide at the time. [44] The first rather significant disposition was in April 2019. In South Korea, SK Telecom requested 38,000 base stations, KT Corporation 30,000 and LG U Plus 18,000, of which 89% are in the six largest cities. [45] They use the 3.5 GHz (sub-6) spectrum in unsecured (NSA) mode, and the tested speeds ranged from 193 to 430 Mbit/s down. [46] 260,000 signed up in the first month and 4.7 million by 2019. Nine companies sell 5G radio hardware and 5G systems to carriers: Altiostar, Cisco Systems, Datang Telecomm/Fiberhome, Ericsson, Huawei, Nokia, Qualcomm, Samsung and ZTE. [48] [49] [50] [51] [52] [53] [54] Radio spectrum A large number of new radio spectrum (5G NR bands) have been allocated 5G.[55] For example, in July 2016, the U.S. Federal Communications Commission (FCC) released a large bandwidth in the under-high band spectrum 5G. Spectrum Frontiers Proposal (SFP) doubled the amount of millimeters of unlicensed spectrum to 14 GHz and created flexible, mobile-use spectrum the FCC had licensed to date. [56] In March 2018, the European Union's co-legislators agreed to open the 3.6 and 26 GHz bands by 2020. [57] As of March 2019, 52 countries, territories, special administrative regions, disputed territories and dependencies formally considering the introduction of certain spectrum bands for 5G services, holding consultations on appropriate radio frequency allocations for 5G, have announced auction frequency plans or have already assigned spectrum for 5G. [58] Unlicensed spectrum MNO increasingly uses unlicensed spectrum in the 2.4 and 5 GHznet (5G) frequency bands. 4G and 5G networks also use these lanes to unload traffic in heavily congested areas and provide connectivity for billions of IoT devices. Advances in Wi-Fi, LTE unlicensed spectrum (LTE-U), license-powered access (LAA) and MultiFire use 4G and 5G technologies in these bands. [unreferred quote] 5G device Samsung Galaxy S10 5G, the first smartphone capable of connecting to 5G networks[59] In March 2019, the Global Mobile Suppliers Association released the industry's first database tracking 5G device launch worldwide. [60] In it, the GSA identified 23 vendors who had confirmed the availability of upcoming 5G devices with 33 different devices, including regional variants. There were seven announced 5G device-shaper factors: phones (x12 devices), hotspots (x4), indoor and outdoor customer space equipment (x8), modules (x5), Snap-on dongles and adapters (x2), and USB terminals (x1). [61] By October 2019, the number of notified 5G vendors had increased to 129, with 15 types of sales from 56 sellers. [62] In April 2019, 5G IoT chip areas had four commercial 5G modem chipsets and one commercial processor/platform, and more launches are expected in the near future. [63] The first all-5G Samsung Galaxy S20 was released on March 6, 2020. According to Business insider, the 5G feature was shown to be more expensive compared to 4G; the line starts at \$1,000 compared to the Samsung Galaxy S10e, which started at \$750. [64] On June 19, HMD Global, the current maker of Nokia branded phones, announced Nokia 8.3 5G, which it claimed to have a wider range of 5G compatibility than any other phone released at this time. Commission 201 support for all 5G bands from 600 MHz to 3.8 GHz is required.[65] Availability by country Technology New radio frequencies See also: 5G NR frequency bands 5GPP is known as New radio (NR), and the specification is divided into two frequency bands, FR1 (below 6 GHz) and FR2 (mmWave).[66] each with different capabilities. [67] Frequency range 1 (R1; 6 GHz) The maximum channel bandwidth specified in FR1 is 100 MHz because this overflowing frequency band has continuous spectrum. The frequency band most widely used in 5G frequency is 3.3-4.2 GHz. The frequency range 2 (R2; 24 GHz) The minimum channel bandwidth specified in FR2 shall be 50 MHz and the maximum is 400 MHz, with dual channel aggregation supported by 3GPP in release 15. In the United States, Verizon uses the n258 band 28 GHz and AT&T uses 39 GHz.[68] The higher the frequency, the greater the ability to support high data transfer speeds. The FR2 coating in the 5G 24 GHz range or above uses higher frequencies than 4G, and as a result some 5G signals are unable to travel over long distances (a few hundred meters), unlike 4G or lower frequency 5G signals (sub 6 GHz). It requires placing 5G base stations every few hundred meters to use higher frequency bands. Also, these higher frequency 5G signals cannot penetrate solid objects easily, such as cars, trees, and walls because of the nature of these higher frequency electromagnetic waves. 5G cells can be deliberately developed to be as inconspicuous as possible, which finds applications in places such as restaurants and shopping centers. [69] Cell Types Telecommunications Environment Maximum Number of Users Output Power (mW) Max. distance from the base station 5G NR FR2 Femtocell towers, companies Start: 4–8Users: 16-32 premises: 10-100Outdoors: 200-1000 dozens of Pico cells in public places such as shopping centres, airports, railway stations, skyscrapers 64-128 indoors: 1000-5000 tens of meters of Microcellular Urban Areas to fill coverage gaps 128 to 256 outdoors: 5000-10000 a few hundred Metro cells in urban areas to provide additional capacity More than 250 outdoors: 10 0000 2000000–20000 hundred meters wi-fi (for comparison) Hoesu, companies less than 50 indoors: 20-100Outdoors: 200-1000 a few tens of meters Massive MIMO See also: Multi-user MIMO Massive MIMO (multiple input and multiple output) antennas Femtocell towers and power density using a large number of antennas and multi-user MIMO (MU-MIMO). Each antenna is individually controlled and can embed the radio receiver components. Nokia requested a five-fold power increase for the 64 TxDx-Rx antenna system. The term massive MIMO was coined by Nokia Bell Labs researcher Dr. Thomas L. Marzetta in 2010, and has been launched on 4G networks, as SoftBank in Japan. [70] Of the more than 562 individual 5G demonstrations, tests or trials worldwide, at least 94 of 5G technologies are involved in Massive MIMO testing in the 5G context. [39] Edge computing Main article: Mobile edge computing Edge computing delivers the computing server closer to the end user. This reduces latency and traffic jams. [71] [72] Small cell master article: Small elements Small elements Small cell radio access nodes operating in a licensed and unlicensed spectrum ranged from 10 metres to a few kilometres. Small cells are critical to 5G networks, as 5G radio waves cannot travel long distances because of 5G higher frequencies. Beamforming Main Article: Beamforming Beamforming, as the name suggests, is used to guide radio waves to the target. This is achieved by creating radio waves to indicate in a specific direction. The technique combines the power of the array of elements of the antenna in such a way that the signals at certain angles experience constructive disturbances, while other signals indicating other angles experience destructive interference. This improves the signal quality in a specific direction, as well as the speed of data transfer. 5G uses beamforming to improve the signal quality it provides. Beamforming can be accomplished using a progressive array of antennas. The convergence of Wi-Fi and cell one expected benefit from the transition to 5G is the convergence of multi-network functions to achieve cost, capacity and complexity reduction. LTE is focused on convergence with Wi-Fi band/technology through various efforts such as License Assisted Access (LAA), 5G signals in unlicensed frequency bands, also used in Wi-Fi) and LTE-WLAN aggregation (LWA: convergence with Wi-Fi Radio), but different options for cell and Wi-Fi are limited in scope for convergence. However, significant improvements in cellular performance specifications in 5G, combined with convergence with Wi-Fi and cellular networks can potentially bridge the gap between Wi-Fi and cellular networks in dense and indoor deployment. Radio convergence could lead to sharing, starting with the collecting and using the same spectrum. The use of a single silicon device for multiple radiotechnologies [quote required] RENT (non-orthogonal multiple access) is offered a multi-access technology for future cellular systems by allocating power. SD-WAN Software-defined networking SD-WAN Network function virtualization and 5G Network slicing Initially, cellular mobile communications technologies were developed in the context of voice services and Internet access. Today, a new era of innovative tools and technologies aims to develop a new list of applications. This application pool consists of different areas, such as the Internet of Things connect autonomous vehicles, remotely controlled robots and heterogeneous sensors connected to serve versatile applications, web. [73] In this context, network production has become a key technology to effectively embrace this new market model. [74] Channel coding 5G NR channel encoding methods have changed from Turbo codes to 4G to polar codes for data channels and LDPC (low density parity check codes) data channels. [75] [76] The operation in the unlicensed spectrum Like LTE in the unlicensed spectrum 5G NR will also support the operation in the unlicensed spectrum (NR-U). [77] In addition to LTE's licensed access (LAA), which allows carriers to use these unlicensed spectrums to maximise their performance to users, 5G NR will support the unlicensed operation of individual NR-Us, which will allow the creation of new 5G NR networks in different environments without purchasing an operating licence on a licensed spectrum, such as a localised private network or a low-input barrier to provide 5G Internet services to the public. [77] Electromagnetic interference The spectrum used in the various 5G proposals will be close to passive remoteness such as weather and Earth observation satellites, in particular water vapour monitoring. The disruption will occur and will probably be significant without effective control. The increase in intervention has already occurred with some other previous applications of the proximal range. [78] [79] Interference with satellite activities aggravates a numerical weather forecast with a significantly damaging impact on the economy and society in areas such as commercial aviation. [80] [81] Concerns prompted US Commerce Secretary Wilbur Ross and the US Administrator J. Christopher Krebs to urge the FCC in February 2019 to delay some spectrum auction proposals that were rejected. [82] The Chairman of the House Appropriations Committee and the House Science Committee write separate letters to FCC Chairman Ajit Pai asking for further review and consultation with NOAA, NASA and NOAA, as well as to warn of harmful effects on national security. [83] The actions of NOAA Director Neil Jacobs in May 2019 showed in a parliamentary committee that 5G out-of-line emissions could lead to a 30% reduction in the accuracy of the weather forecast and that, as a result, the performance degradation of the ECMWF model would have led to an inability to predict the track and thus affect Superstorm Sandy in 2012. In March 2019, the United States Navy issued a deteriorating warning and issued technical recommendations to control lane bleeding, testing and instigation, as well as coordinating wireless industries and regulators with weather forecasting organizations. [84] At the 2019 Four-Year World Radio Communications Conference (WRCC), a refresher who supported a strong -55 dBm margin, European regulators agreed on a 42 dBW recommendation, and US regulators (FCC) recommended limiting -20 dBW to 150 times stronger than the European proposal. By 1 September 2027, the ITU decided on an interim standard of 33 dBW followed by 39 dBW. [85] It is closer to the European recommendation, but even the delayed higher standard is much weaker than the request of atmospheric scientists, leading to warnings from the World Meteorological Organisation (WMO) that the ITU standard is 10 times less stringent than its recommendation creates the potential to significantly impair the accuracy of the data collected. [86] A representative of the American Meteorological Society (AMS) also warned of interference.[87] and the European Centre for Medium-Range Weather Forecasts (ECMWF), strongly warned, claiming that society risks a repetition of history by ignoring warnings from atmospheric scientists (referring to global warming, the monitoring of which should be imperiled). [88] In December 2019, the US Parliament's Scientific Committee sent a bipartisan request from the Government Accountability Office (GAO) to clarify why there is such a discrepancy between the FCC's recommendations of the US Civil and Military Science Agency and the regulators FCC. [89] Additional information on security: Concerns about China involvement in 5G wireless networks and critics of Huawei espionage and security [publishers of the European Commission and the European Cybersecurity Agency on security issues related to 5G. Report warns against the use of a single supplier for the core 5G infrastructure, in particular for infrastructure outside the European Union. (Nokia and Ericsson are only European manufacturers of 5G equipment). [90] On 18 October 2018, a team of researchers from ETH Zurich, the University of Lorraine and the University of Dundee issued a document entitled Official Analysis of 5G Authentication. [91] [92] It warned that 5G technology could open the ground for a new era of security threats. The document describes the technology as immature and insufficiently tested, and that one allows you to move and access significantly larger amounts of data and thus widens the attack surfaces. At the same time, network security companies such as Fortinet,[93] Arbor Networks,[94] AIO Networks,[95] and Voxility[96] reported personalised and mixed security deployments against massive DDoS attacks following the 5G deployment. IoT Analytics estimated that the number of IoT devices provided by 5G technology increased from 7 billion in 2018 to 21.5 billion by 2025. [97] This may increase the surface of the attack on these devices to a significant scale, and the capability of DDoS attacks, cryptocoins and other cyber attacks could increase proportionally. [92] In view of concerns about the alleged espionage of Chinese equipment vendor users, several countries (including the US, Australia and the United Kingdom since the beginning of 2019)[98] have taken steps to limit or eliminate the use of Chinese equipment in the relevant 5G networks. Chinese vendors and The Chinese government has denied claims of espionage. On 7 October 2020, parliament's Defence Committee issued a report claiming that there was clear collusion between Huawei and the Chinese State and the Chinese Communist Party. The UK Parliament's Defence Committee said the government should consider removing all Huawei equipment from 5G networks earlier than planned. [99] Disinformation and conspiracy theories There are several exposed claims and conspiracy theories around 5G, some of which became particularly prevalent during the COVID-19 pandemic. Health See also: Wireless device radiation and health effects and COVID-19 conspiracy theories. The COVID-19 pandemic has led to a resurgence of conspiracy theories claiming a link between 5G and COVID-19. The World Health Organization has stated that there is no evidence of a link between 5G and COVID-19. [100] [101] [102] [103] [104] [105] [106] [107] [108] [109] [110] [111] [112] [113] [114] [115] [116] [117] [118] [119] [120] [121] [122] [123] [124] [125] [126] [127] [128] [129] [130] [131] [132] [133] [134] [135] [136] [137] [138] [139] [140] [141] [142] [143] [144] [145] [146] [147] [148] [149] [150] [151] [152] [153] [154] [155] [156] [157] [158] [159] [160] [161] [162] [163] [164] [165] [166] [167] [168] [169] [170] [171] [172] [173] [174] [175] [176] [177] [178] [179] [180] [181] [182] [183] [184] [185] [186] [187] [188] [189] [190] [191] [192] [193] [194] [195] [196] [197] [198] [199] [200] [201] [202] [203] [204] [205] [206] [207] [208] [209] [210] [211] [212] [213] [214] [215] [216] [217] [218] [219] [220] [221] [222] [223] [224] [225] [226] [227] [228] [229] [230] [231] [232] [233] [234] [235] [236] [237] [238] [239] [240] [241] [242] [243] [244] [245] [246] [247] [248] [249] [250] [251] [252] [253] [254] [255] [256] [257] [258] [259] [260] [261] [262] [263] [264] [265] [266] [267] [268] [269] [270] [271] [272] [273] [274] [275] [276] [277] [278] [279] [280] [281] [282] [283] [284] [285] [286] [287] [288] [289] [290] [291] [292] [293] [294] [295] [296] [297] [298] [299] [300] [301] [302] [303] [304] [305] [306] [307] [308] [309] [310] [311] [312] [313] [314] [315] [316] [317] [318] [319] [320] [321] [322] [323] [324] [325] [326] [327] [328] [329] [330] [331] [332] [333] [334] [335] [336] [337] [338] [339] [340] [341] [342] [343] [344] [345] [346] [347] [348] [349] [350] [351] [352] [353] [354] [355] [356] [357] [358] [359] [360] [361] [362] [363] [364] [365] [366] [367] [368] [369] [370] [371] [372] [373] [374] [375] [376] [377] [378] [379] [380] [381] [382] [383] [384] [385] [386] [387] [388] [389] [390] [391] [392] [393] [394] [395] [396] [397] [398] [399] [400] [401] [402] [403] [404] [405] [406] [407] [408] [409] [410] [411] [412] [413] [414] [415] [416] [417] [418] [419] [420] [421] [422] [423] [424] [425] [426] [427] [428] [429] [430] [431] [432] [433] [434] [435] [436] [437] [438] [439] [440] [441] [442] [443] [444] [445] [446] [447] [448] [449] [450] [451] [452] [453] [454] [455] [456] [457] [458] [459] [460] [461] [462] [463] [464] [465] [466] [467] [468] [469] [470] [471] [472] [473] [474] [475] [476] [477] [478] [479] [480] [481] [482] [483] [484] [485] [486] [487] [488] [489] [490] [491] [492] [493] [494] [495] [496] [497] [498] [499] [500] [501] [502] [503] [504] [505] [506] [507] [508] [509] [510] [511] [512] [513] [514] [515] [516] [517] [518] [519] [520] [521] [522] [523] [524] [525] [526] [527] [528] [529] [530] [531] [532] [533] [534] [535] [536] [537] [538] [539] [540] [541] [542] [543] [544] [545] [546] [547] [548] [549] [550] [551] [552] [553] [554] [555] [556] [557] [558] [559] [560] [561] [562] [563] [564] [565] [566] [567] [568] [569] [570] [571] [572] [573] [574] [575] [576] [577] [578] [579] [580] [581] [582] [583] [584] [585] [586] [587] [588] [589] [590] [591] [592] [593] [594] [595] [596] [597] [598] [599] [600] [601] [602] [603] [604] [605] [606] [607] [608] [609] [610] [611] [612] [613] [614] [615] [616] [617] [618] [619] [620] [621] [622] [623] [624] [625] [626] [627] [628] [629] [630] [631] [632] [633] [634] [635] [636] [637] [638] [639] [640] [641] [642] [643] [644] [645] [646] [647] [648] [649] [650] [651] [652] [653] [654] [655] [656] [657] [658] [659] [660] [661] [662] [663] [664] [665] [666] [667] [668] [669] [670] [671] [672] [673] [674] [675] [676] [677] [678] [679] [680] [681] [682] [683] [684] [685] [686] [687] [688] [689] [690] [691] [692] [693] [694] [695] [696] [697] [698] [699] [700] [701] [702] [703] [704] [705] [706] [707] [708] [709] [710] [711] [712] [713] [714] [715] [716] [717] [718] [719] [720] [721] [722] [723] [724] [725] [726] [727] [728] [729] [730] [731] [732] [733] [734] [735] [736] [737] [738] [739] [740] [741] [742] [743] [744] [745] [746] [747] [748] [749] [750] [751] [752] [753] [754] [755] [756] [757] [758] [759] [760] [761] [762] [763] [764] [765] [766] [767] [768] [769] [770] [771] [772] [773] [774] [775] [776] [777] [778] [779] [780] [781] [782] [783] [784] [785] [786] [787] [788] [789] [790] [791] [792] [793] [794] [795] [796] [797] [798] [799] [800] [801] [802] [803] [804] [805] [806] [807] [808] [809] [810] [811] [812] [813] [814] [815] [816] [817] [818] [819] [820] [821] [822] [823] [824] [825] [826] [827] [828] [829] [830] [831] [832] [833] [834] [835] [836] [837] [838] [839] [840] [841] [842] [843] [844] [845] [846] [847] [848] [849] [850] [851] [852] [853] [854] [855] [856] [857] [858] [859] [860] [861] [862] [863] [864] [865] [866] [867] [868] [869] [870] [871] [872] [873] [874] [875] [876] [877] [878] [879] [880] [881] [882] [883] [884] [885] [886] [887] [888] [889] [890] [891] [892] [893] [894] [895] [896] [897] [898] [899] [900] [901] [902] [903] [904] [905] [906] [907] [908] [909] [910] [911] [912] [913] [914] [915] [916] [917] [918] [919] [920] [921] [922] [923] [924] [925] [926] [927] [928] [929] 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