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American sport-utility vehicle For the compact crossover SUV produced since 2020, see Ford Bronco Sport. For the compact SUV produced from 1984–1990, see Ford Bronco II. Motor vehicle Ford Bronco2021 Ford Bronco 4-door Outer BanksOverviewManufacturerFord Motor CompanyProduction1965–19962021–presentModel years1966–19962021–presentBody and chassisClassCompact SUV (1965–1977)Full-size SUV (1977–1996)Mid-size SUV (2021–present)Body style2-door SUV (1965–1996, 2021–present)4-door SUV (2021–present)LayoutFront-engine, four-wheel-driveChronologySuccessorFord Expedition (for full-size model) The Ford Bronco is a model line of sport utility vehicles manufactured and marketed by Ford. The first SUV model developed by the company, five generations of the Bronco were sold from the 1966 to 1996 model years. A sixth generation of the model line is sold from the 2021 model year.[1] The nameplate has been used on other Ford SUVs, namely the 1984–1990 Bronco II compact SUV and the 2021 Bronco Sport compact crossover. Originally developed as a compact off-road vehicle using its own chassis,[2] the Bronco initially competed against the Jeep CJ-5 and International Harvester Scout. For 1978, Ford enlarged the Bronco, making it a short-wheelbase version of the F-Series pickup truck; the full-size Bronco competed against the Chevrolet K5 Blazer and Dodge Ramcharger. Following a decline in demand for large two-door SUVs, Ford discontinued the Bronco after the 1996 model year, replacing it with the four-door Ford Expedition; followed by the larger Ford Excursion. After a 25-year hiatus, the sixth-generation Bronco is now for the first time a mid-size two-door SUV, also offered as a 16 in (41 cm) longer wheelbase, full-size four-door, competing directly with the Jeep Wrangler as both a two-door and a four-door (hardtop) convertible. From 1965 to 1996, the Ford Bronco was manufactured by Ford at its Michigan Truck Plant in Wayne, Michigan, where it will also manufacture the sixth-generation version.[3][4][5] First generation (1966) Motor vehicle First generationFord Bronco Wagon (First generation)OverviewProductionAugust 1965–1977Model years1966–1977AssemblyUnited States: Wayne, Michigan (Michigan Assembly Plant)DesignerDonald N. Frey (1964) Paul G. Axelrad, McKinley Thompson Jr. (1964)[6]Body and chassisClassCompact SUVBody style3-door SUV[7]2-door pickup[7]0-door roadster[7]LayoutF4 layoutPowertrainEngine170 cu in (2.8 L) Straight-6200 cu in (3.3 L) Straight-6289 cu in (4.7 L) small block V8302 cu in (4.9 L) small block V8Transmission3-speed manual3-speed automaticDimensionsWheelbase92 in (2,337 mm)[8]Length151.5 in (3,848 mm)[8]Width68.5 in (1,740 mm)[8]Height71.6 in (1,819 mm)[8] The idea behind the Bronco began with Ford product manager Donald N. Frey in the early 1960s (who also conceived the Ford Mustang) and engineered by Ford engineer Paul G. Axelrad, with Lee Iacocca approving the final model for production in February 1964, after the first clay models were built in mid-1963. Developed as an off-road vehicle (ORV), the Bronco was intended as a competitor for the Jeep CJ-5, International Harvester Scout and Toyota Land Cruiser. Today a compact SUV in terms of size, Ford marketing shows a very early example of promoting a civilian off-roader as a "Sports Utility" (the two-door pickup version).[9][10] Initially selling well, following the introduction of the Chevrolet Blazer, Jeep Cherokee, and International Scout II (from 1969 to 1974), demand shifted towards SUVs with better on-road capability, leading to a decline in demand for the Bronco. Chassis The first-generation Bronco is built upon a chassis developed specifically for the model range, shared with no other Ford or Lincoln-Mercury vehicle. Built on a 92-inch wheelbase (sized between the CJ-5 and Scout; only an inch shorter than the later CJ-7), the Bronco used box-section body-on-frame construction. To simplify production, all examples were sold with four-wheel drive; a shift-on-the-fly Dana 20 transfer case and locking hubs were standard.[11] The rear axle was a Ford 9-inch axle, with Hotchkiss drive and leaf springs; the front axle was a Dana 30, replaced by a Dana 44 in 1971.[11] In contrast to the Twin I-Beams of larger Ford trucks, the Bronco used radius arms to locate the coil-sprung front axle, along with a lateral track bar, allowing for a 34-foot turning circle, long wheel travel, and antidive geometry (useful for snowplowing). A heavier-duty suspension system was an option, along with air front springs.[11] Powertrain At its August 1965 launch, the Bronco was offered with a 170-cubic-inch inline six.[11] Derived from the Ford Falcon, the 105-hp engine was modified with solid valve lifters, a 6-US-quart (6 L) oil pan, heavy-duty fuel pump, oil-bath air cleaner, and carburetor with a float bowl compensated against tilting. In March 1966, a 200-hp 289-cubic-inch V8 was introduced as an option.[11] For the 1969 model year, the 289 V8 was enlarged to 302 cubic inches, remaining through the 1977 model year. For 1973, a 200 cubic-inch inline six became the standard engine, offered through 1977. To lower production costs, at its launch, the Bronco was offered solely with a three-speed, column-shifted manual transmission and floor-mounted transfer case shifter (with a floor-mounted transmission shifter later becoming a popular modification).[11] In 1973, in response to buyer demand, a three-speed automatic transmission was offered as an option.[11] Body design In a central theme of the first-generation Bronco, styling was subordinated to simplicity and economy, so all glass was flat, bumpers were straight C-sections, and the left and right door skins were symmetrical (prior to the fitment of door-mounting hardware). For 1966, three Bronco body configurations were offered, including a two-door wagon, a half-cab pickup, and an open-body roadster.[11] At its $2,194 base price ($17,507 in 2018 dollars), the Bronco included few amenities as standard. However, a large number of options were offered through both Ford and its dealers, including front bucket seats, a rear bench seat, a tachometer, and a CB radio, as well as functional items such as a tow bar, an auxiliary gas tank, a power take-off, a snowplow, a winch, and a posthole digger.[11] Aftermarket accessories included campers, overdrive units, and the usual array of wheels, tires, chassis, and engine parts for increased performance. For 1967, Ford introduced the Sport option package for the Bronco wagon. Consisting primarily of chrome exterior trim and wheelcovers, the Sport package was distinguished by red-painted FORD grille lettering.[11] For 1970, the Bronco Sport became a freestanding model rather than an option package.[11] To comply with federal regulations, the Bronco was fitted with backup lights and side marker lamps (in 1967 and 1968, respectively). After struggling with sales, the open-body Bronco roadster was withdrawn after the 1968 model year.[11] After 1972, the Bronco half-cab was withdrawn; along with its lower sales compared to the wagon, Ford had introduced the larger Ford Courier compact pickup. In a minor revision, for 1977, the exterior-mounted fuel tank caps were replaced behind hinged doors (as on all other Ford trucks).[11] 1966-1977 Ford Bronco body styles 1966 Bronco roadster, left side 1966 Bronco roadster, right side 1966 Bronco roadster, rear 1966 Bronco roadster instrument panel 1972–1976 Bronco Ranger wagon 1972–1976 Bronco Ranger wagon, rear 1966–1967 Bronco pickup 1966–1967 Bronco pickup interior Trim Initially offered as a single trim level with a long option list, for 1967, Ford introduced the Sport option package for the Bronco wagon. Consisting primarily of chrome exterior trim and wheelcovers, the Sport package was distinguished by red-painted FORD grille lettering.[11] For 1970, the Bronco Sport became a freestanding model rather than an option package.[11] For 1972, in line with the F-Series trucks, the Ranger trim became the top-of-the-line Bronco, offering body stripes, model-specific wheel covers, cloth seats, woodgrain door panels, and carpeted interior.[11] In a 1975 interior revision, the Bronco Sport and Bronco Ranger adapted the two-spoke steering wheel from the F-Series.[11] The optional full wheel covers on all first generation Broncos were the same ones used on the 1966 Galaxie. Sales 1966–1977 Ford Bronco production[11] Year Units 1966 23,776 1967 14,230 1968 16,629 1969 20,956 1970 18,450 1971 19,784 1972 21,115 1973 21,894 1974 25,824 1975 13,125 1976 15,256 1977 14,546 Racing In 1965, race car builder Bill Stroppe assembled a team of Broncos for long-distance off-road competition. Partnering with Holman-Moody, the Stroppe/Holman/Moody (SHM) Broncos competed in the Mint 400, Baja 500, and Mexican 1000 (later named the Baja 1000). In 1969, SHM again entered a team of six Broncos in the Baja 1000. In 1971, a "Baja Bronco" package was marketed through Ford dealers, featuring quick-ratio power steering, automatic transmission, fender flares covering Gates Commando tires, a roll bar, reinforced bumpers, a padded steering wheel, and distinctive red, white, blue, and black paint. Priced at US$5,566, versus the standard V8 Bronco price of $3,665, only 650 were sold over the next four years.[12] In 1966, a Bronco "funny car" built by Doug Nash for the quarter-mile dragstrip finished with a few low 8-second times, but it was sidelined by sanctioning organizations when pickups and aluminum frames were outlawed.[13] Second generation (1978) Motor vehicle Second generation1979 Ford Bronco with Free-Wheelin' packageOverviewProduction1977[14]–1979[15]AssemblyUnited States: Wayne, Michigan (Michigan Assembly Plant)DesignerDick Nesbitt (1972)Body and chassisClassFull-size SUVBody style3-door SUVLayoutF4 layoutPowertrainEngine351 cu in (5.8 L) 351M V8400 cu in (6.6 L) 400 V8Transmission4-speed Borg-Warner T-18 manual4-speed New Process NP435 manual3-speed C6 automaticDimensionsWheelbase104 in (2,642 mm)Length180.3 in (4,580 mm)Width79.3 in (2,014 mm)Height75.5 in (1,918 mm)Curb weight4,663–4,718 lb (2,115–2,140 kg) For the 1978 model year, the second-generation Bronco was introduced; to better compete with the Chevrolet K5 Blazer, Dodge Ramcharger, and Jeep Cherokee, the Bronco entered the full-size SUV segment.[16] In place of a model-specific chassis, the Bronco was adapted directly from the Ford F-Series, becoming a shortened version of the F-100 4x4.[16] Originally intended for a 1974 launch,[16] the second-generation Bronco (named "Project Shorthorn" during its development) was postponed to 1978 in response to fuel economy concerns related to the 1973 fuel crisis; the second-generation Bronco was released for sale after development was nearly finalized on its 1980 successor.[16] In a notable break from a period of downsizing in the American automotive industry, the second-generation Bronco grew significantly in size, adding 12 inches of wheelbase, approximately 28 inches of length, 11 inches of width, and 4 inches of height; based on powertrain configuration, the Bronco gained 1,100 to 1,600 pounds of curb weight over its predecessor. The second-generation Bronco marks the introduction of design commonality with the Ford F-Series and retained the lift-off hardtop bodystyle for the three-door wagon, though now fiberglass over the rear seat area only (and not a full-length steel top), continued through the 1996 withdrawal of the model line. In spite of its short production cycle (only two years), the second-generation Bronco proved successful, overtaking the Blazer and Ramcharger in sales for the first time; initial demand was so strong that customers waited several months to receive vehicles from dealers.[16] Chassis The second generation Bronco is based on the Ford F-100 pickup truck chassis (1973–1979 sixth generation). Approximately one foot shorter than the shortest F-100, the Bronco has a 104-inch wheelbase (12 inches longer than the previous Bronco). The second generation Bronco is still fitted exclusively with four-wheel drive;[17] a part-time system was standard with a New Process 205 gear-driven transfer case with the option of permanent four-wheel drive and a New Process 203 chain-driven transfer case. The second generation Bronco has a coil-sprung Dana 44 front axle and a leaf-sprung rear Ford 9-inch axle (similar to the later first generation Broncos). The first and second generation Broncos both have non-independent front suspension (solid front axle). Third generation and later have the Ford/Dana twin traction beam independent front suspension system. These were also later used in the Ford Transit 4x4 range. Two different V8 engines were offered for the second generation Bronco: the 5.8L 351M and the 6.6L 400. While offering virtually the same horsepower output, the 400 produced a higher torque output over the 351M. As the 460 V8 was restricted to rear-wheel drive F-Series trucks, it was not offered in the Bronco. For 1979, Ford added emissions controls to its light-truck engines; the Bronco gained a catalytic converter (among other equipment) in both engine configurations.[16][18] 1978–1979 Ford Bronco powertrain details Engine Production Configuration Carburetion Output Horsepower Torque Ford 351M (335/Cleveland) V8 1978–1979 352 cu in (5.8 L) 16-valve V8 2-bbl 156 hp (1978) 158 hp (1979) 262 lb-ft Ford 400 (335/Cleveland) V8 402 cu in (6.6 L) 16-valve V8 2-bbl 158 hp (1978) 156 hp (1979) 277 lb-ft Body Replacing the multiple body configurations of the first generation, the second-generation Bronco was offered solely as a 3-door wagon with a lift-off rear hardtop. During its development as Project Shorthorn, a central requirement by Ford was to adopt bodywork from the F-100 with minimal modification.[16] As with its chassis, the second-generation Bronco derives much of its body from the F-Series truck line, sharing the doors, front roofline and sheetmetal, and interior with the F-Series.[19] Retaining the wagon body from its predecessor, Ford designers shifted from a full-length hardtop (as with the previous Bronco and on the Jeep CJ-7) to a lift-off hardtop from behind the B-pillars. Designed by Dick Nesbitt, the configuration achieved higher commonality with the F-100 (sharing the doors and overhead roof stamping); attention was focused on minimizing leaks around the top seals (a problem related to the design of the K5 Blazer hardtop of the time).[16] In a configuration similar to the Ford LTD Country Squire, the glass of the rear window rolled down into the tailgate (via a dash-mounted switch or from using the key on the outside), allowing the tailgate to fold down. Coinciding with its commonality with the F-100, the second-generation Bronco introduced features new to the model line for the first time, including air conditioning, radio, and tilt steering.[17][20] While a two-seat interior remained standard, the 11-inch wider interior allowed for a three-passenger front bench seat; with a folding and removable rear seat, the Bronco became a six-passenger vehicle for the first time.[21][20] For 1979, the Bronco saw little change from 1978 models. Along with the F-Series, rectangular headlamps (introduced on the Ranger trim for 1978) became standard on all Broncos. In an interior revision, captain's chair front seats became an option.[16] 1978-1979 Ford Bronco 1978 Bronco Custom (aftermarket wheels/tires) 1978 Bronco Custom 1978 Bronco (aftermarket tires) 1979 Bronco Ranger XLT Trim For the second-generation Bronco, the model line adopted the same trim nomenclature as the F-Series.[21] The Bronco Custom served as the standard-trim model with the Bronco Ranger XLT as the top-level trim. For 1978, as with the F-Series trucks, Customs were fitted with round headlamps while Ranger XLTs had rectangular units, which became standard for all Broncos for 1979.[18] During 1978 and 1979, alongside the Econoline, F-Series, and Courier, the Bronco was sold with a "Free-Wheelin'" cosmetic option package for both Custom and Ranger XLT trims. Featuring tricolor striping and blacked-out exterior trim, the package featured revised exterior striping for 1979.[16] Sales 1978–1979 Ford Bronco production Year Units 1978 77,917 1979 104,038 Third generation (1980) Motor vehicle Third generationOverviewProduction1979–1986[22]Model years1980-1986AssemblyUnited States: Wayne, Michigan (Michigan Assembly Plant) Australia: Broadmeadows[23]DesignerDon Kopka (design director)John Najjar (1977)[24][25]Body and chassisClassFull-size SUVBody style3-door SUVPowertrainEngine300 cu in (4.9 L) Straight-6302 cu in (4.9 L) 302 V8351 cu in (5.8 L) 351M V8351 cu in (5.8 L) Windsor V8Transmission4-speed Borg-Warner T-18 manual4-speed New Process NP435 manual4-speed Tremec RTS OverDrive3-speed C6 automatic4-speed AODDimensionsWheelbase104 in (2,642 mm)Length180.4 in (4,582 mm)Width79.3 in (2,014 mm)Height75.5 in (1,918 mm)Curb weight4,343–4,374 lb (1,970–1,984 kg) Beginning production development in 1977[16] (before its predecessor was released for sale) the 1980–1986 Bronco was designed to address many concerns that held the 1978–1979 Bronco out of production. Nominally shorter and lighter, the 1980 Bronco was designed to adopt a more efficient powertrain while retaining its full-size dimensions. In 1982, the Ford Bronco II made its debut; unrelated to the full-size Bronco, the Bronco II was a compact SUV based on a shortened Ranger pickup truck and sized similarly to the 1966–1977 Bronco. Chassis Again based on the Ford F-Series, the 1980–1986 Bronco is based upon the Ford F-150 (1980–1986 seventh generation). Although based on an all-new chassis, the Bronco retained its 104 in (2,642 mm) wheelbase. Ford engineers attempting to get as much fuel economy from weight reduction of 375 lb (170 kg) curb weight from the previous year, the 1980-81 models had a much weaker frame with holes stamped out at the factory.[26] This extra lightened frame was dropped in 1982 for more strength and rigidity gaining 31 lb (14 kg) curb weight. Both transfer cases were replaced with a New Process 208 or Borg Warner 1345 version.[18] In front, the 1980–1986 Bronco is fitted with a Dana 44 front axle with Ford TTB (Twin Traction Beam) independent front suspension.[18] As with the 1978–1979 Bronco, the rear axle was first a leaf-sprung Ford 9-inch axle in early models, however Ford transitioned all half ton trucks to their 8.8 rear axle by the end of 1986.[18] For the first time since 1977, the Bronco came with an inline-six engine as standard; the 4.9L 300 I6 was available solely with a manual transmission. The 400 V8 was discontinued, with the 351M taking its place and the 302 V8 making its return as the base-equipment V8.[18] The 351 Windsor made its debut in the Bronco as it replaced the 351M in 1982; gaining a 210 hp "high-output" version in 1984.[18][27] In 1985, the 5.0L V8 (302) saw its carburetor replaced by a multiport electronic fuel-injection system, rising to 190 hp (the standard 156 hp 5.8L V8 was discontinued for 1986).[18] Body As with its 1978–1979 predecessor, the 1980–1986 Bronco shares much of its external sheetmetal with the F-Series pickup line, with the same parts from the doors forward. Based on a design proposal originally used in the development of the previous-generation Bronco, the B-pillar of the roofline was modified slightly to produce an improved seal for the hardtop.[16] Prior to 1984, the hardtop included sliding window glass as an option. For 1982, the Bronco saw a slight facelift as it adopted Ford's blue oval emblem, taking the place of "F-O-R-D" lettering on the hood,[28] and the bronco horse was removed from the fender emblems. Trim The 1980–1986 Bronco adopted the same trim levels as the Ford F-Series pickups. Following the introduction of the Ford Ranger compact pickup, the Bronco adopted Bronco (base, replacing Custom), Bronco XL, and Bronco XLT. In 1985, Ford added an Eddie Bauer trim package for the Bronco.[28] Featuring a color-keyed two-tone exterior, the trim package featured an outdoors-themed interior. Sales 1980–1986 Ford Bronco production Year Units 1980 44,353 1981 39,853 1982 40,782 1983 40,376 1984 40,376 1985 54,562 1986 62,127 Australian assembly Outside of the US, the third generation Bronco was also assembled in Australia by Ford Australia, utilizing locally produced 4.1-litre six-cylinder and 5.8-litre V8 engines.[23] It was marketed in Australia from March 1981 through to 1987.[29] Fourth generation (1987) Motor vehicle Fourth generationOverviewProduction1986[30]–1991Model years1987-1991AssemblyUnited States: Wayne, Michigan (Michigan Assembly Plant) Venezuela: Valencia, Carabobo (Valencia Assembly)Body and chassisClassFull-size SUVBody style3-door SUVPowertrainEngine300 cu in (4.9 L) Straight-6302 cu in (4.9 L) 302 V8351 cu in (5.8 L) Windsor V8Transmission4-speed Borg-Warner T-18 manual5-speed M5OD-R2 manual3-speed C6 automatic4-speed AOD automatic4-speed E4OD automaticDimensionsWheelbase104.7 in (2,660 mm)Length180.5 in (4,580 mm)Width79.1 in (2,010 mm)Height1987–1989: 74.0 in (1,880 mm).1990–1991: 74.5 in (1,890 mm) For the 1987 model year, the fourth-generation Bronco was designed as a short-wheelbase version of the eighth-generation Ford F-150. Sharing its chassis with the previous generation, the 1987 Bronco was given a number of updates to both the exterior and interior. Sharing a common front fascia with the F-Series, the Bronco received a reshaped front bumper, flatter front grille, and reshaped hood; composite headlamps replaced the previous sealed-beam units. In another body revision, the wheel openings were reshaped. The interior was given redesigned front seats, door panels, dashboard and controls (including a new steering wheel), and instrument panels. The Bronco returned its 4.9L inline-6, 5.0L V8, and the 5.8L H.O. V8 engines from the previous generations; first introduced on the 5.0L V8 in 1985, fuel injection was added to the inline-6 for 1987 and to the 5.8L V8 for 1988.[28] For the 1988 model year, a Mazda-sourced 5-speed manual was introduced.[28] The 3-speed C6 automatic was offered from 1987 to 1990, phased out in favor of the overdrive-equipped 4-speed AOD (1990 only) and heavier-duty E4OD (1990-1991).[28] In the interest of safety, rear-wheel anti-lock brakes (ABS) became standard for the 1987 model.[31][28] As an option, push-button control was introduced for the four-wheel drive system for 1987.[28][32] For 1988, skid plates for the transfer case became standard equipment.[28] Special editions To commemorate 25 years of production, Ford offered a Silver Anniversary Edition Bronco for the 1991 model year. A cosmetic option package, the Silver Anniversary Edition featured Currant Red exterior paint (package exclusive) and a gray leather interior (the first time leather seating was available for a Bronco).[28] For 1991 through 1992, the Nite option package featured a completely blacked-out exterior with contrasting graphics. Alongside the top-line Eddie Bauer trim, both special editions were available only with a V8 engine and automatic transmission. Sales 1987–1991 Ford Bronco production Year Units 1987 43,074 1988 43,074 1989 69,470 1990 54,832 1991 25,001 Fifth generation (1992) Motor vehicle Fifth generationOverviewProduction1991[33]–1996Model years1992-1996AssemblyUnited States: Wayne, Michigan (Michigan Assembly Plant) Venezuela: Valencia, Carabobo (Valencia Assembly)Body and chassisClassFull-size SUVBody style3-door SUVPowertrainEngine300 cu in (4.9 L) Straight-6 (1992)302 cu in (4.9 L) 302 V8351 cu in (5.8 L) WindsorTransmission4-speed AOD-E automatic4-speed E4OD automatic5-speed M5OD-R2 manualDimensionsWheelbase104.7 in (2,660 mm)Length183.6 in (4,660 mm)Width79.1 in (2,010 mm)Height1995–1996: 74.4 in (1,890 mm)1992–1994: 74.5 in (1,890 mm) For the 1992 model year, the fifth-generation Bronco followed the design development of the ninth-generation Ford F-150. Again retaining the chassis introduced for the 1980 model year, the front fascia of the Bronco adopted additional aerodynamic revisions. While designed with a larger grille, front bumper, and headlight units, the front fascia was given a slightly rounded design. Model changes 1992–1996 Ford Bronco, rear viewThe interior again saw updates to the dashboard and instrument panel, with the addition of leather front seats as an option for XLT and Eddie Bauer trims as well as optional remote keyless entry with an anti-theft alarm.[34] Maroon and blue leather seats were offered from 1992 through the end of production. After having power windows and locks as an option throughout the 1980s, power mirrors were offered for the first time for 1992.[28] For 1996, the Ford Bronco became the first Ford vehicle to incorporate turn signal lights into its side mirrors.[28] The fifth generation introduced additional changes related to safety. 4-wheel anti-lock braking system (ABS) replaced rear-wheel ABS for 1993, with a driver-side airbag introduced for 1994.[28] The redesign included a safety front crumple zone into the frame [26] and a center-mounted brake light to the hardtop; the hardtop was now the mounting point of 3-point seatbelts for the rear passengers. In the aftermath of the safety upgrades, the Bronco was no longer able to be marketed as a lift-off hardtop (from a legal standpoint). While still physically possible, the hardtop contained the upper mounts for the now required 3 point seat seatbelts and the required center brake light was mounted above the rear window on this hardtop (unlike Jeep mounting the 3rd brake light to the spare tire). To discourage owners from doing removing the hardtop, Ford removed all literature in the vehicle owner's manual related to its removal. To further inhibit its removal, Ford secured the hardtop in place with #40 Security Torx bolts, instead of the standard bolts used on previous model years. Removal of the hardtop could lead to a traffic citation, for tampering with the center brake light and/or inoperable rear seatbelts, depending on local and State laws. Powertrain The fifth-generation Bronco carried over the previous 4.9L inline-6, 5.0L V8, and the 5.8L H.O. V8 engines from the previous generation. For 1994, the Bronco became powered solely by V8 engines, as the 4.9L inline-6 was withdrawn from the model line.[28] For 1996, the two V8 powertrains became OBD-II compliant.[28] Special editions 1995–1996 Ford Bronco Eddie Bauer The monochrome Nite edition was again available, though 1992 was its last offering. Monochrome paint versions were reintroduced from 1993 (1994 model) to 1996, as the XLT Sport variant of the Bronco available in black, red, or white. Another variant of the XLT was a two-tone light teal green and white (charcoal gray interior); approximately 600 were produced each year. The Eddie Bauer outdoors-themed edition made its return, offered from 1992 to 1996. Again combining nearly every option for the Bronco with a trim-specific exterior and interior combination, the Bronco Eddie Bauer introduced an overhead console for 1994 along with lighted sun visors and an auto-dimming rearview mirror (both offered as option on the XLT). For 1995, the Eddie Bauer saw the addition of front bumper vents (added to the XLT for 1996). Sales 1992–1996 Ford Bronco production Year Production 1992 25,516 1993 32,281 1994 33,083 1995 37,693 1996 34,130 Discontinuation 1997 Ford Expedition XLT The last fifth-generation Bronco built rolled off the Wayne, Michigan assembly line on June 12, 1996.[citation needed] According to Ford, the discontinuation of the model line was unrelated to any stigma created from the then-recent O.J. Simpson police chase, as sales of the model line had been in decline previous to the incident.[35] To better compete with the Chevrolet/GMC Suburban and the Chevrolet Tahoe/GMC Yukon, Ford introduced the Ford Expedition for 1997 to replace the Bronco. Following the lineage of the 1978-1996 Bronco, the Expedition was derived from the tenth-generation F-150, but shifted from a two-door body with a lift-off hardtop to a five-door wagon/SUV body, slotted above the Ranger-based Ford Explorer. Centurion Classic (1987–1996) A 1989 Centurion Classic; a Ford F-350 crew cab mated with rear bodywork of a Bronco A four-door Ford competitor for the Chevrolet Tahoe was not released until the introduction of the Expedition for the 1997 model year (and the 2000 Excursion, competing against the ¾-ton version known as the Chevrolet Suburban 2500). As the Bronco was produced solely as a two-door wagon after 1972, all four-door Broncos were developed and produced on a license-built basis by the aftermarket. During the 1980s and early 1990s, Centurion Vehicles, a converter specializing in Ford trucks based in White Pigeon, Michigan,[36] constructed the Centurion Classic, a four-door version of the fourth- and fifth-generation Bronco. In the construction of each Classic, Centurion would mate the cab of an F-Series crew-cab pickup (from the C-pillar forward) to body of a Bronco (from the B-pillar rearward), including the rear quarter panels, hardtop, and tailgate of the SUV.[37] Early models used fiberglass rear body panels, but later, these were made from steel.[38] As the body conversion retained the rear seat of the Bronco, a Centurion Classic was equipped with three-row seating for up to nine people.[36] Centurion Vehicles offered two models of the Classic: the C-150 (based on the Ford F-150 chassis, with optional four-wheel drive) and the C-350 (based on the F-350, four-wheel drive was standard).[36][37] Both models used a 140-inch wheelbase (9 inches longer than the Suburban[36]); as the F-150 was not produced as a crew cab, a C-150 was constructed from three different vehicles (crew cab, Bronco rear, and F-150 frame). In contrast to the ¾-ton Suburban 2500, the C-350 Classic utilized a one-ton chassis. The C-150 was offered with 5.0L and 5.8L V8 engines; the C-350 used the 7.3L diesel V8 and 7.5L gasoline V8 (the only Bronco variants to use these engines).[36] The Centurion Classic was offered until the end of Bronco production in 1996; though the Bronco was directly replaced by the Expedition, the C-150/C-350 is closest in size to the Ford Excursion introduced for the 2000 model year.[36][37] As of current production, the C-350 is the only SUV produced on a one-ton chassis (the 2000–2005 Ford Excursion was produced on a ¾-ton chassis). O.J. Simpson chase A white Ford Bronco XLT similar to the 1993 example in the OJ Simpson police pursuit Main article: O.J. Simpson Ford Bronco chase The Ford Bronco gained notoriety on June 17, 1994, when Al Cowlings drove his white 1993 Bronco XLT with his accused friend O.J. Simpson in the back seat, in a low-speed police chase on Interstate 405, ending in his eventual surrender.[39] The incident was simulcast on television worldwide, with approximately 95 million Americans watching live.[40] Sixth generation (U725; 2021) For the Escape-based crossover version, see Ford Bronco Sport. Motor vehicle Sixth generation (U725)[41]2021 Ford Bronco 2-door Big BendOverviewProductionJune 2021 – present[42]Model years2021–presentAssemblyUnited States: Wayne, Michigan (Michigan Assembly)DesignerPaul Wraith (chief program designer, 2018)[43]Robert Gelardi (design manager, 2018)[44]Daniel Kangas (Bronco R, 2019)Body and chassisClassMid-size SUVBody style2-door convertible SUV4-door convertible SUVRelatedFord Ranger (T6)Ford Everest/EndeavourPowertrainEngine2.3 L EcoBoost I4 turbo (gasoline)2.7 L EcoBoost V6 twin-turbo (gasoline)3.0 L EcoBoost V6 twin-turbo (gasoline)Power output300 hp (304 PS; 224 kW) (2.3)330 hp (335 PS; 246 kW) (2.7)[45]400 hp (406 PS; 298 kW) (3.0)Transmission7-speed Getrag MTI550 manual (2.3 only) 10-speed Ford 10R60 automaticDimensionsWheelbase100.4 in (2,550 mm) (2-door)116.1 in (2,949 mm) (4-door)Length174.8 in (4,440 mm) (2-door)189.4–190.5 in (4,811–4,839 mm) (4-door)Width75.9–79.3 in (1,928–2,014 mm)Height70.2–71.4 in (1,783–1,814 mm)Curb weight4,294–4,699 lb (1,948–2,131 kg) (2-door)4,466–5,109 lb (2,026–2,317 kg) (4-door) Ford released its sixth generation Bronco for model year 2021, after a 25-year hiatus of the Bronco nameplate. Styling recalls many elements from the 1966–1977 series, and the design chief's 1976 Bronco was digitally scanned as a reference during the design process.[46] Conceived as a direct competitor to the Jeep Wrangler, the Bronco is offered in a two and four door SUV, each reconfigurable as a convertible. Moreover, just like on a Wrangler, the doors can easily be removed, but unlike the Jeep's, the Bronco's doors are frameless, and with the door-glass wound down, the doors can be carried in dedicated covers, within the vehicle, while riding door-less. A "Bronco" and a "bucking horse" emblem on the tailgate and steering wheel replace the Ford Blue Oval.[47] The Bronco is now a mid-size SUV, bringing its chassis and powertrain closer in size to the Ford Ranger.[48] Background 2021 Bronco 2-door Big Bend 2021 Bronco 4-door Outer Banks The potential revival of the Bronco came up in 2016 negotiations between Ford and the UAW.[49][50] At the time, it was discussed that Michigan Assembly would cancel production of the fourth-generation Ford Focus and the C-Max, which would move to Mexico.[49] The UAW ultimately announced the factory would remain open, to be retooled for the revival of the Ford Ranger in North America and the Ford Bronco.[49] The Bronco was developed as Ford expected the Ranger would not be enough to fill factory capacity, and needed a second model to be built alongside it.[51] While Ford did not share future product plans with the UAW, the company confirmed the return of the Bronco at the 2017 North American International Auto Show.[4][52] Packaged as a direct competitor to the Jeep Wrangler, Ford announced two and four-door variants.[53] Intended for a 2021 model year release, the sixth generation would be based on the Ford Ranger, retaining body-on-frame construction.[53] In contrast to the Ford Everest sold overseas, the Bronco would receive a distinct body recalling the first generation with further off-road capability.[53] Ford showed a pre-production prototype to a group of dealers in March 2019.[54] On November 1, 2019, an announcement was made for a spring 2020 reveal, intended for the 2021 model year.[55] Originally scheduled for a March 2020 unveiling, the Bronco was unveiled on July 13, 2020, following multiple delays, mostly in relation to the global COVID-19 pandemic;[56] Ford unintentionally scheduled the unveiling for July 9 (the date of O.J. Simpson's birthday[57]). On March 27, 2021, at the Barrett-Jackson Scottsdale Auto Auction, the first production Bronco, a First Edition, sold for $1,075,000 with all the funds going to a charity Ford helped establish to help preserve forests.[58] When the reveal officially premiered, Ford accepted $100 reservations, with production scheduled for 2021.[59] The first production units rolled off the assembly line, on Monday, June 14, 2021 at Michigan Assembly Plant in Wayne, Michigan, the production facility of the previous five generations. The take rate for the seven-speed manual transmission was reported to be around 15% for the initial orders.[60] Specifications Interior The standard engine is a 2.3-liter turbocharged EcoBoost inline-four that makes 300 hp (304 PS; 224 kW) and 325 lb·ft (441 N·m; 45 kg·m) of torque. A 2.7-liter twin-turbocharged EcoBoost V6 is optional; the larger variant makes 330 hp (335 PS; 246 kW) and 415 lb·ft (563 N·m; 57 kg·m) of torque.[61] The 2.7-liter V6 is only available with a 10-speed automatic transmission while the 2.3-liter can be mated with either the 10-speed automatic or a standard 7-speed Getrag manual.[62] Despite the nomenclature, the Getrag transmission is not a true seven-speed transmission, instead being a traditional six-speed unit with a dedicated crawler gear (the "C" on the shift knob) as the "seventh gear". Recalling the original Bronco Roadster, removable doors with frameless glass combined with a detachable roof allow open-air driving on both two- and four-door models, each with both a 11.6 in (295 mm) ground clearance.[48] Doors can be user-removed and stored in the rear cargo area, and the mirrors are attached to the body cowl instead of on the doors, allowing the user to remove the doors and still have the mirrors attached to the vehicle.[63] The leading edge of the front fenders feature raised black brackets, called trail sights, to facilitate navigation and serve as tie-downs and accessory mounts.[46] The body-on-frame construction uses front twin A-arm independent suspension and a rear five-link coilover suspension and a solid axle. The optional HOSS (High-Performance Off-Road Stability Suspension) setup replaces these with position-sensitive Bilstein shocks, with multiple compression and rebound zones, at all four corners. The front sway bar features a hydraulic disconnect to increase articulation when crawling, automatically reconnecting when brought back to speed. An option package, marketed as Sasquatch, includes a mild suspension lift, and 35-inch tires - the largest of any production vehicle besides the upcoming 3rd generation Ford Raptor, which has optional 37-inch tires. Standard equipment includes Dana axles with front and rear electronic differentials, both user-lockable via dashboard switches. The drivetrain can toggle between 4WD Low, 4WD High, 4WD Automatic, and 2WD High (rear-wheel drive), controlled by a dial near the gear selector rather than a secondary shifter aside the main shift lever.[48] Optional equipment includes a terrain management system, marketed as "G.O.A.T. Modes" (Goes Over Any Type of Terrain).[64] The system calibrates throttle response, four-wheel drive, traction control, and transmission shifts to maximize traction when offroading. Up to seven modes are available with this system: Normal, Eco, Sport, Slippery, and Sand, along with Baja, Mud and Ruts, and Rock Crawl. The available Trail One-Pedal Drive automatically applies and holds the brakes when the driver lifts off the gas pedal, removing the need for left-foot braking and preventing unexpected rollbacks. The sixth-generation Bronco also offers Trail Turn Assist, which utilizes the torque-vectoring system to help the vehicle turn in tight offroad corners. An optional topographical map software, marketed as Trail Maps, allows owners to share smartphone-downloaded topo maps to the vehicle's In-car entertainment system and record videos of trail runs, display telemetry or map data, and upload to the cloud.[65] The sixth generation features a tray that slides from under the rear cargo compartment. An action mount on the front dash to allow for phone and camera mounting, waterproof switches and rubber floors are also available.[66] Bronco Raptor 2023 Ford Bronco Raptor Ford announced a Raptor trim level for 2022 in a 4-door version only. Developed by Ford Performance, the Bronco Raptor will have a EcoBoost 3.0 TT V6 with a "Baja Mode", the engine specifications will be close to the Lincoln Aviator and the Ford Explorer ST. The vehicle will also have an upgraded cooling system, which would allow the Bronco Raptor to run better in higher temperatures. The Bronco Raptor is also wider at 85.7 inches (2,180 mm) and sits on a new Fox suspension with 13.1 inches (330 mm) of ground clearance (1.6 inches (41 mm) more than the Bronco with the Sasquatch package). Many other components in the Bronco Raptor have been upgraded or added such as stronger axles, more rigid cross bars, a dual exhaust with several different exhaust modes, 37 inch tires, a higher strength frame, reinforced front bumper, larger drive shafts for increased wheel torque, better brakes (from the F-150 Raptor), Ford nameplate grill (unlike Bronco on other trims), and a tow/haul mode. The Bronco Raptor is capable of towing 4,500 pounds (2,000 kg) which is 1,000 pounds (450 kg) more than the standard Bronco. Due to the Bronco Raptor's width, there is additional government-mandated lighting. The interior of the Bronco Raptor is also different from other trims. Unique "code orange" accents and stitching, additional bolstering to the seats with Raptor embroidered stitching, carbon fiber trim, a thicker steering wheel, magnesium paddle shifters, a leather stitched dashboard, and a larger center touchscreen.[67] Trim levels The Ford Bronco is available in several trim levels: The entry-level trim of the Bronco is known as the Base. Available as either a two-door or a four-door model, the Base comes equipped with the 2.3L EcoBoost Twin-Turbocharged Inline Four-Cylinder (I4) gasoline engine mated to a seven-speed manual transmission, the SYNC 4 eight-inch touchscreen infotainment system with wired and wireless Apple CarPlay and Android Auto smartphone integration, a six-speaker audio system, SiriusXM Satellite Radio, a 4G LTE wireless modem, cloth seating surfaces, air conditioning, sixteen-inch (30" tall) tires and silver-painted steel wheels, and keyless entry. The Big Bend trim level of the Bronco, available as either a two-door or a four-door model, adds more convenience and styling features to the Base trim, including seventeen-inch (32" tall) tires and Carbonized Gray-finished aluminum-alloy wheels, and a leather-wrapped steering wheel and gear lever. The Black Diamond trim level of the Bronco is marketed as the "rugged" trim level of the Bronco lineup. Available as either a two-door or a four-door model, the Black Diamond adds features to the Big Bend trim such as seventeen-inch black-painted steel wheels, marine-grade vinyl-trimmed seating surfaces, a powder coated steel front bumper with LED front fog lamps and tow hooks, and rubberized flooring with drain plugs. The Outer Banks trim level of the Bronco, available as either a two-door or a four-door model, is the luxury-oriented trim level of the Bronco lineup. Added standard equipment to the Big Bend trim level includes eighteen-inch (32" tall) tires and machined-face aluminum-alloy wheels, dual heated front bucket seats, powder coated side steps, and LED front headlamps and fog lamps. The Badlands is one of three off-road oriented Bronco trim levels. Available as either a two-door or a four-door model, the Badlands trim adds features onto the Outer Banks trim level such as seventeen-inch (33" tall) tires and Carbonized Gray-finished aluminum-alloy wheels, additional G.O.A.T. modes for the four wheel drive system, an upgraded suspension system, a front stabilizer bar disconnect, a powder coated steel front bumper with integrated LED front fog lamps and tow hooks, and marine-grade vinyl-trimmed seating surfaces. The Wildtrak is another off-road oriented Bronco trim level. Available as either a two-door or a four-door model, the Wildtrak trim adds features onto the Badlands trim level such as the Sasquatch Package, the 2.7L EcoBoost Twin-Turbocharged V6 gasoline engine mated to a tern-speed automatic transmission, a unique front hood graphic, cloth seating surfaces, and dual heated front bucket seats. The Everglades trim, available for the 2022 model year and available only as a four-door model, is a special-edition model based on the standard equipment of the rugged Black Diamond trim, but adds unique front fender graphics that double as a depth meter for fording water, unique aluminum-alloy wheels, a heavy-duty modular front bumper, and the SYNC 4A twelve-inch touchscreen infotainment system with wired and wireless Apple CarPlay and Android Auto smartphone integration and SiriusXM Satellite Radio with 360L. The Raptor, introduced for the 2022 model year and only available as a four-door model, is the top-tier Bronco trim level. The Raptor trim adds features onto the Wildtrak trim level such as 37" tall tires and beadlock-capable aluminum-alloy wheels, the 3.0L EcoBoost Twin-Turbocharged V6 gasoline engine mated to a ten-speed automatic transmission, a heavy-duty modular front bumper with Rigid Industries-branded front fog lamps, marine-grade vinyl-trimmed seating surfaces with cloth inserts, specially-bolstered front bucket seats, a 360-degree off-road camera system, the SYNC 4A twelve-inch touchscreen infotainment system with wired and wireless Apple CarPlay and Android Auto smartphone integration and SiriusXM Satellite Radio with 360L, and heavy-duty steel bash plates. The Raptor is the second of three vehicles to join the Raptor lineup, following the Ford F-150 Raptor, and will also be followed by an all-new Ford Ranger Raptor model. The First Edition model, based on the equipment of the Badlands trim and available as either a two-door or a four-door model, was also available for the 2021 model year. Production was initially limited to only 7,000 units, although Ford later increased the amount of First Edition Broncos it would build due to increased demand. Sales Year U.S.[68] 2021 35,023 Concepts and prototypes 1966 Bronco Dune Duster For the 1965 Detroit Auto Show Ford constructed a special Bronco roadster. According to Ford, A special, customized version of Ford Division's 1966 Bronco, the Dune Duster, will be displayed at the Detroit Auto Show from November 27 through December 5. The utility/sports-type vehicle was designed in Ford's Styling Center in Dearborn and built by Parris Kustom in North Hollywood, California. Exterior paint is a specially formulated Golden Saddle Pearl and modifications include an NHRA-approved roll bar with integral headrests, a windshield designed to complement the contour of the roll bar, walnut appliques on the rear side panels and exposed chrome exhaust pipes. Custom interior appointments include a walnut steering wheel and front bucket seats with russet suede bolsters and perforated leather cushions and seatbacks. The instrument panel is trimmed with suede padding and outfitted with walnut-trimmed control knobs. Jump seats have been added to the rear compartment over the wheels and a tonneau cover for rear compartment protection was added for attachment with quick-fastening snaps.[69] 1970 Bronco Wildflower For 1970, Ford re-dressed the Dune Duster as the Wildflower: The Wildflower, a specially customized version of Ford Division's popular four-wheel-drive Bronco, is sure to be one of the most colorful show cars on display at automobile shows this year. The unique vehicle, planned in Ford's Design Center in Dearborn, Mich., was extensively modified, inside and out, to achieve a lively carefree appearance with added luxury and safety features. The dominant exterior characteristic of the Wildflower is the lively multi-colored paint treatment. The psychedelic design of blues, yellows and reds is topped off by a pink grille.[70] 1973 Big Bronco prototypes In 1973, Ford Advanced Light Truck Engineering developed four future Ford Bronco prototypes. To better match the market success of the Chevrolet Blazer, Ford required its designers to shift from a dedicated chassis used by the model line to a shortened F-100 as the basis for a future Bronco.[71][72] Dubbed "Project Shorthorn", the prototype was constructed using the top and tailgate from a Chevrolet K5 Blazer, mating it to a shortened-wheelbase F-100.[71] While the use of Chevrolet components was used purely for proof of concept, further development by Ford adopted a half-cab design (one design objective was the use of F-Series doors, along with a removable top).[72] Project Shorthorn was among four prototypes, alongside Longhorn (a four-door wagon-style SUV, similar to the Chevrolet Suburban), Midhorn (sized between the Jeep Wagoneer and International Travelall; a precursor to the Chevrolet Tahoe), and the Widehorn (a wide-body F-100 4x4, a precursor to the Ford Raptor).[71][73] As the development of Project Shorthorn happened during the OPEC oil crisis, the model program was postponed to the 1978 model year as Ford sought a more promising outcome.[71][73] While the Longhorn/Midhorn four-door wagons saw a positive response, they were ultimately shelved, as the Project Shorthorn was introduced for only a two-year production (before a full redesign). Ford would not produce a production four-door SUV until the 1991 Ford Explorer (smaller than the Midhorn) and the 1997 Ford Expedition (between the Midhorn and Longhorn in size). 1981 Bronco Montana Lobo Built on a 1977 Bronco chassis, it included "a pair of expansive Plexiglas bubble doors that were removable and that had a vague resemblance to the expanse of clear plastic that passed for four-weather doors on the Dune Duster. It included a rollbar that – though likely not NHRA certified and though integrated with side louvers and lights – still had a rough airfoil shape like the Dune Duster's. It included side pipes like the Dune Duster's. It included fold-up bench seats for bed seating like the Dune Duster's In addition, the Montana Lobo included foam bumpers, a winch integrated into the front bumper, a retractable loading ramp built into the tailgate, storage compartments integrated into the bed sides, a T-top roof, and a massive tinted window between the cab and the bed that slid open."[73][74] 1988 Bronco DM-1 Built on a Ford Escort platform, the DM-1 concept was a "4-wheel drive concept vehicle was the winning design in a Ford sponsored contest for industrial art students.[citation needed] Mr. Derek Millsap, who created the 5-seat sport-utility vehicle, lent his initials to the Bronco DM-1 name. The bulbous body was made of steel-reinforced fiberglass, and the large hatch extended into the roof."[citation needed] 2001 U260 In 1999, a new Bronco was secretly developed under Moray Callum, as a simple inexpensive off-roader in the spirit of the first generation Bronco, rather than the later full-size models. Planned as a 2-door and 4-door, it was codenamed U260, U meaning utility, 2 meaning 2-door, and 60 referring to the Ford Ranger's T6 platform it would have used. Land Rover underpinnings were considered but was deemed too costly. The project did not progress to a drivable state and was canceled in 2001 due to company cutbacks stemming from the Firestone and Ford tire incident.[75][51] The project was publicly revealed for the first time in the leadup to the sixth gen Bronco's release, with a full-size research model displayed at the 2021 Concours d'Elegance Of America.[76] 2004 Bronco Concept Bronco concept at the 2004 New York Auto Show At the 2004 North American International Auto Show, a Ford Bronco concept vehicle was unveiled. Inspired by the first-generation (1966–1977) Ford Bronco, the 2004 concept adapted a short wheelbase, round headlamps, and squared-off roofline; the concept marked one of the first uses of a three-bar grille on Ford vehicles. Using a minimalist exterior design, the Bronco design was unveiled alongside a Shelby Cobra Concept at the same show. Using the Ford CD2 platform of the Ford Escape,[77][78] the Bronco concept was powered by a 2.0L four-cylinder turbodiesel (from the Ford Mondeo) and a six-speed manual transmission. Replacing ControlTrac II, an "Intelligent" 4-wheel drive system was intended for improved stability and fuel economy. A new production Bronco was attempted in 2006, adapting the Bronco concept's design over the International Ford Ranger's chassis. It was to be exported to the US from South Africa, where it would have been built alongside the Ranger in Pretoria. It was canceled as it was seen as a risk due to rising gas prices, slowing SUV sales and weakening economy ahead of the Great Recession.[51] Dwayne Johnson's character drives the Bronco concept in his 2018 movie, Rampage.[79] 2013 Expedition "special edition" concept Ford marketer Mark Grueber spoke of a Ford Expedition show build concept that wore an intentionally nondescript rear Bronco badge, solely to prevent expiration of the Bronco trademark.[51] It is unclear which concept he is referring to. 2020 Bronco R Prototype At the 2019 Baja 1000, Ford introduced the Ford Bronco R prototype with the drivetrain of the new as-yet unreleased 2021 Bronco with the intent of testing the engine, transmission and four wheel drive system to be used in the production-spec sixth-generation Bronco. The Baja 1000 was thought to be the perfect test for the new off-road vehicle Ford is producing, with 1000 miles of some of the world's roughest terrain. The 2020 race was also tougher after being delayed for 24 hours due to excessive rainfall in the days before the event. With the excessive rainfall, one of the Class One co-drivers Ford used in the race referred to it as the "Mud Bog 1000". While the Bronco R prototype model used for the Baja 1000 shared some components with the production Bronco, Ford upfitted the Bronco R with off-road-tuned racing suspension as well as off-road wheels and 37-inch off-road tires.[80] The Bronco R also used a 70-gallon fuel tank during the race, allowing the prototype to travel up to 315 miles of the course before refueling.[80] While this would have been a significant advantage to the Bronco R team, it was not taken advantage of. The Bronco R team made a stop every 130 miles to swap drivers, as well as checking the vehicle's condition and making sure there were no repairs needed at the time. Ford did not disclose details of the engine used in the Bronco R. The only information that is known was that the engine was a twin-turbo EcoBoost engine. When it came to the four-wheel drive system, the vehicle experienced no issues with muddy sections of the course. While the drivers only had to use four-wheel drive with low gearing to get out of thick mud, the Bronco R stopped multiple times along the course to tug other competitors out of the mud, including a near 6,000 pound trophy truck. While the Bronco R's engine, transmission and four-wheel drive held up with no issues, many of the aftermarket suspension components did not fare the same. Around mile 495 of the 1000 mile journey, the passenger side spindle, lower-control arm and CV joint had been destroyed. The team was able to fix most issues and were able to continue the race until around mile 580, when the engine cooling fans began giving out (one fan had completely seized up, while the other was not working at max speed) causing the Bronco R to overheat and needing to be towed about eight miles to the next filling station. After about 30 minutes of working on the Bronco R to try to get it back on course, Ford pulled the vehicle out of the race due to severe mechanical issues.[81] References ^ Takahashi, Mark (August 18, 2020). "Ford Bronco Prices, Reviews, and Pictures | Edmunds". Edmunds.com. ^ Clarke, R. M. (1998). Ford Bronco, 1966–1977. Brooklands Books. ISBN 978-1-85520-474-4. ^ "Ford announces return of Ranger in 2019, Bronco in 2020 at Detroit auto show". MLive.com. Retrieved March 15, 2018. ^ a b "YouTube". YouTube. July 24, 2019. Archived from the original on July 24, 2019. Retrieved July 20, 2020. ^ "Edmunds.com". Retrieved August 13, 2019. 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Official website Retrieved from " 2Broadband cellular network technology This article is about the mobile internet access standard. For other uses, see 4G (disambiguation). Part of a series on theMobile phone generations Mobile telecommunications Analog 0G 1G Digital 2G 2.5G 2.75G 3G 3.5G 3.75G 3.9G/3.95G 4G 4G/4.5G 4.5G/4.9G 5G 6G vte 4G[1] is the fourth generation of broadband cellular network technology, succeeding 3G, and preceding 5G. A 4G system must provide capabilities defined by ITU in IMT Advanced. Potential and current applications include amended mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing, and 3D television. However, in December 2010 the ITU expanded its definition of 4G to include Long Term Evolution (LTE), Worldwide Interoperability for Microwave Access (WiMAX), and Evolved High Speed Packet Access (HSPA+).[2] The first-release WiMAX standard was commercially deployed in South Korea in 2006 and has since been deployed in most parts of the world. The first-release LTE standard was commercially deployed in Oslo, Norway, and Stockholm, Sweden in 2009, and has since been deployed throughout most parts of the world. It has, however, been debated whether first-release versions should be considered 4G LTE. The 4G wireless cellular standard was defined by the International Telecommunication Union (ITU) and specifies the key characteristics of the standard, including transmission technology and data speeds. Each generation of wireless cellular technology has introduced increased bandwidth speeds and network capacity. 4G users get speeds of up to 100 Mbit/s, while 3G only promised a peak speed of 14 Mbit/s. Technical overview In November 2008, the International Telecommunication Union-Radio communications sector (ITU-R) specified a set of requirements for 4G standards, named the International Mobile Telecommunications Advanced (IMT-Advanced) specification, setting peak speed requirements for 4G service at 100 megabits per second (Mbit/s)(=12.5 megabytes per second) for high mobility communication (such as from trains and cars) and 1 gigabit per second (Gbit/s) for low mobility communication (such as pedestrians and stationary users).[3] Since the first-release versions of Mobile WiMAX and LTE support much less than 1 Gbit/s peak bit rate, they are not fully IMT-Advanced compliant, but are often branded 4G by service providers. According to operators, a generation of the network refers to the deployment of a new non-backward-compatible technology. On December 6, 2010, ITU-R recognized that these two technologies, as well as other beyond-3G technologies that do not fulfill the IMT-Advanced requirements, could nevertheless be considered "4G", provided they represent forerunners to IMT-Advanced compliant versions and "a substantial level of improvement in performance and capabilities with respect to the initial third generation systems now deployed".[4] Mobile WiMAX

Release 2 (also known as WirelessMAN-Advanced or IEEE 802.16m) and LTE Advanced (LTE-A) are IMT-Advanced compliant backwards compatible versions of the above two systems, standardized during the spring 2011,[citation needed] and promising speeds in the order of 1 Gbit/s. Services were expected in 2013.[needs update] As opposed to earlier generations, a 4G system does not support traditional circuit-switched telephony service, but instead relies on all-Internet Protocol (IP) based communication such as IP telephony. As seen below, the spread spectrum radio technology used in 3G systems is abandoned in all 4G candidate systems and replaced by OFDMA multi-carrier transmission and other frequency-domain equalization (FDE) schemes, making it possible to transfer very high bit rates despite extensive multi-path radio propagation (echoes). The peak bit rate is further improved by smart antenna arrays for multiple-input multiple-output (MIMO) communications. Background In the field of mobile communications, a "generation" generally refers to a change in the fundamental nature of the service, non-backwards-compatible transmission technology, higher peak bit rates, new frequency bands, wider channel frequency bandwidth in Hertz, and higher capacity for many simultaneous data transfers (higher system spectral efficiency in bit/second/Hertz/site). New mobile generations have appeared about every ten years since the first move from 1981 analog (1G) to digital (2G) transmission in 1992. This was followed, in 2001, by 3G multi-media support, spread spectrum transmission and a minimum peak bit rate of 200 kbit/s, in 2011/2012 to be followed by "real" 4G, which refers to all-Internet Protocol (IP) packet-switched networks giving mobile ultra-broadband (gigabit speed) access. While the ITU has adopted recommendations for technologies that would be used for future global communications, they do not actually perform the standardization or development work themselves, instead relying on the work of other standard bodies such as IEEE, WiMAX Forum, and 3GPP. In the mid-1990s, the ITU-R standardization organization released the IMT-2000 requirements as a framework for what standards should be considered 3G systems, requiring 2000 kbit/s peak bit rate.[5] In 2008, ITU-R specified the IMT Advanced (International Mobile Telecommunications Advanced) requirements for 4G systems. The fastest 3G-based standard in the UMTS family is the HSPA+ standard, which has been commercially available since 2009 and offers 21 Mbit/s downstream (11 Mbit/s upstream) without MIMO, i.e. with only one antenna, and in 2011 accelerated up to 42 Mbit/s peak bit rate downstream using either DC-HSPA+ (simultaneous use of two 5 MHz UMTS carriers)[6] or 2x2 MIMO. In theory speeds up to 672 Mbit/s are possible, but have not been deployed yet. The fastest 3G-based standard in the CDMA2000 family is the EV-DO Rev. B, which is available since 2010 and offers 15.67 Mbit/s downstream. Frequencies for 4G LTE networks See here: LTE frequency bands IMT-Advanced requirements This article refers to 4G using IMT-Advanced (International Mobile Telecommunications Advanced), as defined by ITU-R. An IMT-Advanced cellular system must fulfill the following requirements:[7] Be based on an all-IP packet switched network. Have peak data rates of up to approximately 100 Mbit/s for high mobility such as mobile access and up to approximately 1 Gbit/s for low mobility such as nomadic/local wireless access.[3] Be able to dynamically share and use the network resources to support more simultaneous users per cell. Use scalable channel bandwidths of 5–20 MHz, optionally up to 40 MHz.[3][8] Have peak link spectral efficiency of 15 bit/s·Hz in the downlink, and 6.75 bit/s·Hz in the up link (meaning that 1 Gbit/s in the downlink should be possible over less than 67 MHz bandwidth). System spectral efficiency is, in indoor cases, 3 bit/s·Hz·cell for downlink and 2.25 bit/s·Hz·cell for up link.[3] Smooth handovers across heterogeneous networks. In September 2009, the technology proposals were submitted to the International Telecommunication Union (ITU) as 4G candidates.[9] Basically all proposals are based on two technologies: LTE Advanced standardized by the 3GPP 802.16m standardized by the IEEE Implementations of Mobile WiMAX and first-release LTE were largely considered a stopgap solution that would offer a considerable boost until WiMAX 2 (based on the 802.16m specification) and LTE Advanced was deployed. The latter's standard versions were ratified in spring 2011. The first set of 3GPP requirements on LTE Advanced was approved in June 2008.[10] LTE Advanced was standardized in 2010 as part of Release 10 of the 3GPP specification. Some sources consider first-release LTE and Mobile WiMAX implementations as pre-4G or near-4G, as they do not fully comply with the planned requirements of 1 Gbit/s for stationary reception and 100 Mbit/s for mobile. Confusion has been caused by some mobile carriers who have launched products advertised as 4G but which according to some sources are pre-4G versions, commonly referred to as 3.9G, which do not follow the ITU-R defined principles for 4G standards, but today can be called 4G according to ITU-R. Vodafone Netherlands for example, advertised LTE as 4G, while advertising LTE Advanced as their '4G+' service. A common argument for branding 3.9G systems as new-generation is that they use different frequency bands from 3G technologies; that they are based on a new radio-interface paradigm; and that the standards are not backwards compatible with 3G, whilst some of the standards are forwards compatible with IMT-2000 compliant versions of the same standards. System standards IMT-2000 compliant 4G standards As of October 2010, ITU-R Working Party 5D approved two industry-developed technologies (LTE Advanced and WirelessMAN-Advanced)[11] for inclusion in the ITU's International Mobile Telecommunications Advanced program (IMT-Advanced program), which is focused on global communication systems that will be available several years from now. LTE Advanced Main article: LTE Advanced LTE Advanced (Long Term Evolution Advanced) is a candidate for IMT-Advanced standard, formally submitted by the 3GPP organization to ITU-T in the fall 2009, and expected to be released in 2013.[needs update] The target of 3GPP LTE Advanced is to reach and surpass the ITU requirements.[12] LTE Advanced is essentially an enhancement to LTE. It is not a new technology, but rather an improvement on the existing LTE network. This upgrade path makes it more cost effective for vendors to offer LTE and then upgrade to LTE Advanced which is similar to the upgrade from WCDMA to HSPA. LTE and LTE Advanced will also make use of additional spectrums and multiplexing to allow it to achieve higher data speeds. Coordinated Multi-point Transmission will also allow more system capacity to help handle the enhanced data speeds. Data speeds of LTE-Advanced LTE Advanced Peak download 1000 Mbit/s Peak upload 0500 Mbit/s IEEE 802.16m or WirelessMAN-Advanced This section needs to be updated. Please help update this article to reflect recent events or newly available information. (August 2021) The IEEE 802.16m or WirelessMAN-Advanced (WiMAX 2) evolution of 802.16e is under development, with the objective to fulfill the IMT-Advanced criteria of 1 Gbit/s for stationary reception and 100 Mbit/s for mobile reception.[13] Forerunner versions Long Term Evolution (LTE) Main article: LTE (telecommunication) Telia-branded Samsung LTE modem Huawei 4G+ Dual Band Modem The pre-4G 3GPP Long Term Evolution (LTE) technology is often branded "4G – LTE", but the first LTE release does not fully comply with the IMT-Advanced requirements. LTE has a theoretical net bit rate capacity of up to 100 Mbit/s in the downlink and 50 Mbit/s in the uplink if a 20 MHz channel is used — and more if multiple-input multiple-output (MIMO), i.e. antenna arrays, are used. The physical radio interface was at an early stage named High Speed OFDM Packet Access (HSOPA), now named Evolved UMTS Terrestrial Radio Access (E-UTRA). The first LTE USB dongles do not support any other radio interface. The world's first publicly available LTE service was opened in the two Scandinavian capitals, Stockholm (Ericsson and Nokia Siemens Networks systems) and Oslo (a Huawei system) on December 14, 2009, and branded 4G. The user terminals were manufactured by Samsung.[14] As of November 2012, the five publicly available LTE services in the United States are provided by MetroPCS,[15] Verizon Wireless,[16] AT&T Mobility, U.S. Cellular,[17] Sprint,[18] and T-Mobile US.[19] T-Mobile Hungary launched a public beta test (called friendly user test) on 7 October 2011, and has offered commercial 4G LTE services since 1 January 2012.[citation needed] In South Korea, SK Telecom and LG U+ have enabled access to LTE service since 1 July 2011 for data devices, slated to go nationwide by 2012.[20] KT Telecom closed its 2G service by March 2012 and completed nationwide LTE service in the same frequency around 1.8 GHz by June 2012. In the United Kingdom, LTE services were launched by EE in October 2012,[21] by O2 and Vodafone in August 2013,[22] and by Three in December 2013.[23] Data speeds of LTE LTE Peak download 0100 Mbit/s Peak upload 0050 Mbit/s Mobile WiMAX (IEEE 802.16e) The Mobile WiMAX (IEEE 802.16e-2005) mobile wireless broadband access (MWBA) standard (also known as WiBro in South Korea) is sometimes branded 4G, and offers peak data rates of 128 Mbit/s downlink and 56 Mbit/s uplink over 20 MHz wide channels.[citation needed] In June 2006, the world's first commercial mobile WiMAX service was opened by KT in Seoul, South Korea.[24] Sprint has begun using Mobile WiMAX, as of 29 September 2008, branding it as a "4G" network even though the current version does not fulfill the IMT Advanced requirements on 4G systems.[25] In Russia, Belarus and Nicaragua WiMax broadband internet access were offered by a Russian company Scartel, and was also branded 4G, Yota.[26] Data speeds of WiMAX WiMAX Peak download 0128 Mbit/s Peak upload 0056 Mbit/s In the latest version of the standard, WiMax 2.1, the standard has been updated to be not compatible with earlier WiMax standard, and is instead interchangeable with LTE-TDD system, effectively merging WiMax standard with LTE. TD-LTE for China market This section possibly contains synthesis of material which does not verifiably mention or relate to the main topic. Relevant discussion may be found on the talk page. (April 2017) (Learn how and when to remove this template message) Just as Long-Term Evolution (LTE) and WiMAX are being vigorously promoted in the global telecommunications industry, the former (LTE) is also the most powerful 4G mobile communications leading technology and has quickly occupied the Chinese market. TD-LTE, one of the two variants of the LTE air interface technologies, is not yet mature, but many domestic and international wireless carriers are, one after the other turning to TD-LTE. IBM's data shows that 67% of the operators are considering LTE because this is the main source of their future market. The above news also confirms IBM's statement that while only 8% of the operators are considering the use of WiMAX, WiMAX can provide the fastest network transmission to its customers on the market and could challenge LTE. TD-LTE is not the first 4G wireless mobile broadband network data standard, but it is China's 4G standard that was amended and published by China's largest telecom operator – China Mobile. After a series of field trials, is expected to be released into the commercial phase in the next two years. Ulf Ewaldsson, Ericsson's vice president said: "the Chinese Ministry of Industry and China Mobile in the fourth quarter of this year will hold a large-scale field test, by then, Ericsson will help the hand." But viewing from the current development trend, whether this standard advocated by China Mobile will be widely recognized by the international market is still debatable. Discontinued candidate systems UMB (formerly EV-DO Rev. C) Main article: Ultra Mobile Broadband UMB (Ultra Mobile Broadband) was the brand name for a discontinued 4G project within the 3GPP2 standardization group to improve the CDMA2000 mobile phone standard for next generation applications and requirements. In November 2008, Qualcomm, UMB's lead sponsor, announced it was ending development of the technology, favoring LTE instead.[27] The objective was to achieve data speeds over 275 Mbit/s downstream and over 75 Mbit/s upstream. Flash-OFDM At an early stage the Flash-OFDM system was expected to be further developed into a 4G standard. iBurst and MBWA (IEEE 802.20) systems The iBurst system (or HC-SDMA, High Capacity Spatial Division Multiple Access) was at an early stage considered to be a 4G predecessor. It was later further developed into the Mobile Broadband Wireless Access (MBWA) system, also known as IEEE 802.20. Principal technologies in all candidate systems This section needs additional citations for verification. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed. (August 2015) (Learn how and when to remove this template message) Key features The following key features can be observed in all suggested 4G technologies: Physical layer transmission techniques are as follows:[28] MIMO: To attain ultra high spectral efficiency by means of spatial processing including multi-antenna and multi-user MIMO Frequency-domain-equalization, for example multi-carrier modulation (OFDM) in the downlink or single-carrier frequency-domain-equalization (SC-FDE) in the uplink: To exploit the frequency selective channel property without complex equalization Frequency-domain statistical multiplexing, for example (OFDMA) or (single-carrier FDMA) (SC-FDMA, a.k.a. linearly precoded OFDMA, LP-OFDMA) in the uplink: Variable bit rate by assigning different sub-channels to different users based on the channel conditions Turbo principle error-correcting codes: To minimize the required SNR at the reception side Channel-dependent scheduling: To use the time-varying channel Link adaptation: Adaptive modulation and error-correcting codes Mobile IP utilized for mobility IP-based femtocells (home nodes connected to fixed Internet broadband infrastructure) As opposed to earlier generations, 4G systems do not support circuit switched telephony. IEEE 802.20, UMB and OFDM standards[29] lack soft-handover support, also known as cooperative relaying. Multiplexing and access schemes This section contains information of unclear or questionable importance or relevance to the article's subject matter. Please help improve this section by clarifying or removing indiscriminate details. If importance cannot be established, the section is likely to be moved to another article, pseudo-redirected, or removed.Find sources: "4G" – news · newspapers · books · scholar · JSTOR (May 2010) (Learn how and when to remove this template message) Recently, new access schemes like Orthogonal FDMA (OFDMA), Single Carrier FDMA (SC-FDMA), Interleaved FDMA, and Multi-carrier CDMA (MC-CDMA) are gaining more importance for the next generation systems. These are based on efficient FFT algorithms and frequency domain equalization, resulting in a lower number of multiplications per second. They also make it possible to control the bandwidth and form the spectrum in a flexible way. However, they require advanced dynamic channel allocation and adaptive traffic scheduling. WiMax is using OFDMA in the downlink and in the uplink. For the LTE (telecommunication), OFDMA is used for the downlink; by contrast, Single-carrier FDMA is used for the uplink since OFDMA contributes more to the PAPR related issues and results in nonlinear operation of amplifiers. IFDMA provides less power fluctuation and thus requires energy-inefficient linear amplifiers. Similarly, MC-CDMA is in the proposal for the IEEE 802.20 standard. These access schemes offer the same efficiencies as older technologies like CDMA. Apart from this, scalability and higher data rates can be achieved. The other important advantage of the above-mentioned access techniques is that they require less complexity for equalization at the receiver. This is an added advantage especially in the MIMO environments since the spatial multiplexing transmission of MIMO systems inherently require high complexity equalization at the receiver. In addition to improvements in these multiplexing systems, improved modulation techniques are being used. Whereas earlier standards largely used Phase-shift keying, more efficient systems such as 64QAM are being proposed for use with the 3GPP Long Term Evolution standards. IPv6 support Main articles: Network layer, Internet protocol, and IPv6 Unlike 3G, which is based on two parallel infrastructures consisting of circuit switched and packet switched network nodes, 4G is based on packet switching only. This requires low-latency data transmission. As IPv4 addresses are (nearly) exhausted,[Note 1][30] IPv6 is essential to support the large number of wireless-enabled devices that communicate using IP. By increasing the number of IP addresses available, IPv6 removes the need for network address translation (NAT), a method of sharing a limited number of addresses among a larger group of devices, which has a number of problems and limitations. When using IPv6, some kind of NAT is still required for communication with legacy IPv4 devices that are not also IPv6-connected. As of June 2009[update], Verizon has posted Specifications [1] that require any 4G devices on its network to support IPv6.[31] Advanced antenna systems Main articles: MIMO and MU-MIMO The performance of radio communications depends on an antenna system, termed smart or intelligent antenna. Recently, multiple antenna technologies are emerging to achieve the goal of 4G systems such as high rate, high reliability, and long range communications. In the early 1990s, to cater for the growing data rate needs of data communication, many transmission schemes were proposed. One technology, spatial multiplexing, gained importance for its bandwidth conservation and power efficiency. Spatial multiplexing involves deploying multiple antennas at the transmitter and at the receiver. Independent streams can then be transmitted simultaneously from all the antennas. This technology, called MIMO (as a branch of intelligent antenna), multiplies the base data rate by (the smaller of) the number of transmit antennas or the number of receive antennas. Apart from this, the reliability in transmitting high speed data in the fading channel can be improved by using more antennas at the transmitter or at the receiver. This is called transmit or receive diversity. Both transmit/receive diversity and transmit spatial multiplexing are categorized into the space-time coding techniques, which does not necessarily require the channel knowledge at the transmitter. The other category is closed-loop multiple antenna technologies, which require channel knowledge at the transmitter. Open-wireless Architecture and Software-defined radio (SDR) One of the key technologies for 4G and beyond is called Open Wireless Architecture (OWA), supporting multiple wireless air interfaces in an open architecture platform. SDR is one form of open wireless architecture (OWA). Since 4G is a collection of wireless standards, the final form of a 4G device will constitute various standards. This can be efficiently realized using SDR technology, which is categorized to the area of the radio convergence. History of 4G and pre-4G technologies The 4G system was originally envisioned by the DARPA, the US Defense Advanced Research Projects Agency.[citation needed] DARPA selected the distributed architecture and end-to-end Internet protocol (IP), and believed at an early stage in peer-to-peer networking in which every mobile device would be both a transceiver and a router for other devices in the network, eliminating the spoke-and-hub weakness of 2G and 3G cellular systems.[32][page needed] Since the 2.5G GPRS system, cellular systems have provided dual infrastructures: packet switched nodes for data services, and circuit switched nodes for voice calls. In 4G systems, the circuit-switched infrastructure is abandoned and only a packet-switched network is provided, while 2.5G and 3G systems require both packet-switched and circuit-switched network nodes, i.e. two infrastructures in parallel. This means that in 4G traditional voice calls are replaced by IP telephony. In 2002, the strategic vision for 4G—which ITU designated as IMT Advanced—was laid out. In 2004, LTE was first proposed by NTT DoCoMo of Japan.[33] In 2005, OFDMA transmission technology is chosen as candidate for the HSOPA downlink, later renamed 3GPP Long Term Evolution (LTE) air interface E-UTRA. In November 2005, KT Corporation demonstrated mobile WiMAX service in Busan, South Korea.[34] In April 2006, KT Corporation started the world's first commercial mobile WiMAX service in Seoul, South Korea.[35] In mid-2006, Sprint announced that it would invest about US$5 billion in a WiMAX technology buildout over the next few years[36] ($6.72 billion in real terms[37]). Since that time Sprint has faced many setbacks that have resulted in steep quarterly losses. On 7 May 2008, Sprint, Imagine, Google, Intel, Comcast, Bright House, and Time Warner announced a pooling of an average of 120 MHz of spectrum; Sprint merged its Xohm WiMAX division with Clearwire to form a company which will take the name "Clear". In February 2007, the Japanese company NTT DoCoMo tested a 4G communication system prototype with 4×4 MIMO called VSF-OFCDM at 100 Mbit/s while moving, and 1 Gbit/s while stationary. NTT DoCoMo completed a trial in which they reached a maximum packet transmission rate of approximately 5 Gbit/s in the downlink with 12×12 MIMO using a 100 MHz frequency bandwidth while moving at 10 km/h,[38] and is planning on releasing the first commercial network in 2010. In September 2007, NTT Docomo demonstrated e-UTRA data rates of 200 Mbit/s with power consumption below 100 mW during the test.[39] In January 2008, a U.S. Federal Communications Commission (FCC) spectrum auction for the 700 MHz former analog TV frequencies began. As a result, the biggest share of the spectrum went to Verizon Wireless and the next biggest to AT&T.[40] Both of these companies have stated their intention of supporting LTE. In January 2008, EU commissioner Viviane Reding suggested re-allocation of 500–800 MHz spectrum for wireless communication, including WiMAX.[41] On 15 February 2008, Skyworks Solutions released a front-end module for e-UTRAN.[42][43][44] In November 2008, ITU-R established the detailed performance requirements of IMT-Advanced, by issuing a Circular Letter calling for candidate Radio Access Technologies (RATs) for IMT-Advanced.[45] In April 2008, just after receiving the circular letter, the 3GPP organized a workshop on IMT-Advanced where it was decided that LTE Advanced, an evolution of current LTE standard, will meet or even exceed IMT-Advanced requirements following the ITU-R agenda. In April 2008, LG and Nortel demonstrated e-UTRA data rates of 50 Mbit/s while travelling at 110 km/h.[46] On 12 November 2008, HTC announced the first WiMAX-enabled mobile phone, the Max 4G[47] On 15 December 2008, San Miguel Corporation, the largest food and beverage conglomerate in southeast Asia, has signed a memorandum of understanding with Qatar Telecom QSC (Qtel) to build wireless broadband and mobile communications projects in the Philippines. The joint-venture formed wi-tribe Philippines, which offers 4G in the country.[48] Around the same time Globe Telecom rolled out the first WiMAX service in the Philippines. On 3 March 2009, Lithuania's LRTC announcing the first operational "4G" mobile WiMAX network in Baltic states.[49] In December 2009, Sprint began advertising "4G" service in selected cities in the United States, despite average download speeds of only 3–6 Mbit/s with peak speeds of 10 Mbit/s (not available in all markets).[50] On 14 December 2009, the first commercial LTE deployment was in the Scandinavian capitals Stockholm and Oslo by the Swedish-Finnish network operator TeliaSonera and its Norwegian brandname NetCom (Norway). TeliaSonera branded the network "4G". The modem devices on offer were manufactured by Samsung (dongle GT-B3710), and the network infrastructure created by Huawei (in Oslo) and Ericsson (in Stockholm). TeliaSonera plans to roll out nationwide LTE across Sweden, Norway and Finland.[51][52] TeliaSonera used spectral bandwidth of 10 MHz, and single-in-single-out, which should provide physical layer net bit rates of up to 50 Mbit/s downlink and 25 Mbit/s in the uplink. Introductory tests showed a TCP throughput of 42.8 Mbit/s downlink and 5.3 Mbit/s uplink in Stockholm.[53] On 4 June 2010, Sprint released the first WiMAX smartphone in the US, the HTC Evo 4G.[54] On November 4, 2010, the Samsung Craft offered by MetroPCS is the first commercially available LTE smartphone[55] On 6 December 2010, at the ITU World Radiocommunication Seminar 2010, the ITU stated that LTE, WiMAX and similar "evolved 3G technologies" could be considered "4G".[4] In 2011, Argentina's Claro launched a pre-4G HSPA+ network in the country. In 2011, Thailand's Truemove-H launched a pre-4G HSPA+ network with nationwide availability. On March 17, 2011, the HTC Thunderbolt offered by Verizon in the U.S. was the second LTE smartphone to be sold commercially.[56][57] In February 2012, Ericsson demonstrated mobile-TV over LTE, utilizing the new eMBMS service (enhanced Multimedia Broadcast Multicast Service).[58] Since 2009, the LTE-Standard has strongly evolved over the years, resulting in many deployments by various operators across the globe. For an overview of commercial LTE networks and their respective historic development see: List of LTE networks. Among the vast range of deployments, many operators are considering the deployment and operation of LTE networks. A compilation of planned LTE deployments can be found at: List of planned LTE networks. Disadvantages 4G introduces a potential inconvenience for those who travel internationally or wish to switch carriers. In order to make and receive 4G voice calls, the subscriber handset must not only have a matching frequency band (and in some cases require unlocking), it must also have the matching enablement settings for the local carrier and/or country. While a phone purchased from a given carrier can be expected to work with that carrier, making 4G voice calls on another carrier's network (including international roaming) may be impossible without a software update specific to the local carrier and the phone model in question, which may or may not be available (although fallback to 3G for voice calling may still be possible if a 3G network is available with a matching frequency band).[59] Beyond 4G research Main article: 5G A major issue in 4G systems is to make the high bit rates available in a larger portion of the cell, especially to users in an exposed position in between several base stations. In current research, this issue is addressed by macro-diversity techniques, also known as group cooperative relay, and also by Beam-Division Multiple Access (BDMA).[60] Pervasive networks are an amorphous and at present entirely hypothetical concept where the user can be simultaneously connected to several wireless access technologies and can seamlessly move between them (See vertical handoff, IEEE 802.21). These access technologies can be Wi-Fi, UMTS, EDGE, or any other future access technology. Included in this concept is also smart-radio (also known as cognitive radio) technology to efficiently manage spectrum use and transmission power as well as the use of mesh routing protocols to create a pervasive network. Past 4G networks This section is about WiMAX & LTE network shutdowns. For shutdowns of HSPA+ (UMTS) networks that are sometimes labeled as 4G, see 3G § Phase out. Country Network Shutdown date Standard Notes Jamaica Digicel 2018-10-31 WiMAX [61] Malaysia Yes 4G 2019-10-01 WiMAX [62][63] Nepal Nepal Telecom 2021-12-?? WiMAX [64] Trinidad and Tobago Blink bmobile (TSTT) 2015-03-03 WiMAX [65] United States Sprint 2016-03-31 WiMAX [66][67] T-Mobile (Sprint) 2022-06-30 LTE [68][69][70] See also 4G-LTE filter Comparison of mobile phone standards Comparison of wireless data standards Wireless device radiation and health Notes ^ The exact exhaustion status is difficult to determine, as it is unknown how many unused addresses exist at ISPs, and how many of the addresses that are permanently unused by their owners can still be freed and transferred to others. References ^ Li, Zhengmao; Wang, Xiaoyun; Zhang, Tongxu (August 11, 2020), "From 5G to 5G+", 5G+, Singapore: Springer Singapore, pp. 19–33, ISBN 978-981-15-6818-3, retrieved August 3, 2022 ^ "ITU says LTE, WiMax and HSPA+ are now officially 4G". phonearena.com. December 18, 2010. 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