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Your GPS Devices May Stop Working On April 6 If You Don't Or Can't Update Firmware (theregister.co.uk)

Posted by BeauHD on Thursday February 14, 2019 @02:00AM from the properly-screwed dept.

Zorro shares a report from The Register: *Older satnavs and such devices won't be able to use America's Global Positioning System properly after April 6 unless they've been suitably updated or designed to handle a looming epoch rollover. GPS signals from satellites include a timestamp, needed in part to calculate one's location, that stores the week number using ten binary bits. That means the week number can have 210 or 1,024 integer values, counting from zero to 1,023 in this case. Every 1,024 weeks, or roughly every 20 years, the counter rolls over from 1,023 to zero. The first Saturday in April will mark the end of the 1,024th week, after which the counter will spill over from 1,023 to zero. The last time the week number overflowed like this was in 1999, nearly two decades on from the first epoch in January 1980. No can see where this is going. If devices in use today are not designed or patched to handle this latest rollover, they will revert to an earlier year after that 1,024th week in April, causing attempts to calculate position to potentially fail. System and navigation data could even be corrupted, we're warned.* U.S. Homeland Security explained the issue in a write-up this week. GPS.gov also notes that the new CNAV and MNAV message formats will use a 13-bit week number, so this issue shouldn't happen again anytime soon. The site recommend users consult the manufacturer of their equipment to make sure they have the proper updates in place.

data gps math

→

Electric Car Batteries Might Be Worth Recycling, But Bus Batteries Aren't Yet
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Submission: GPS uses 10 bits to store the week. That means it runs out April 6, 2019
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- **Thans for the forewarning (Score:2)**
by Anon-Y-Mous ( )
Going to ask our hardware supplier about this as soon as I arrive st work.
1 hidden reply
- **Re: (Score:2)**
by CaptainDork (3678879)
We need American Sign Language-keyboard translators when a GPS-enabled device determines that our coordinates are variable in three dimensions.
- **Re: (Score:2)**
by liquid_schwartz (530085)
Interesting sig. Were you on the committee that also redefined the word racism to be not even close to it's traditional and still common usage?
- **210 (Score:2)**
by Askmum (1038780)
That means the week number can have 210 or 1,024 integer values
Only after reading the original article I understood the connection between 210 and 1024. Copy-paste is so wonderful.
1 hidden comment
- **Re:210 (Score:5, Informative)**
by Racemaniac (1099281) on Thursday February 14, 2019 @02:54AM (#58119734)
for the poor souls who don't want to go to the article, it's supposed to be 2^10
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- **Re: (Score:2)**
by Mister Transistor (259842)
Ah, thank you! I was trying to figure out what that was all about!
It sounds like the new format will still have a similar problem, but by adding 3 bits, now it will still happen, but 8x less often. So what, every 160 years instead of 20 after the protocol changes?
Feh. Don't hash dates!! What is it with these people? /seinfeld
- **Re: (Score:1)**
by Cmdln Disco (1183119)
Things that are overly'styled' *should* disappear.
Me, I think the eighth bit should be stripped from chars on Slashdot. (Also control-g should sound the bell.)
- **Seriously? (Score:2)**
by Calydor (739835)
The last time this happened was while the world was in a complete panic over the Y2K doomsday prophecies, and you're telling me that new GPS units made since then STILL do not have a way of handling this?!
2 hidden comments
- **13 Bit ? really ? (Score:1)**
by Crashmarik (635988)
They couldn't just go to a 16 bit number they had to save 3 freaking bits ? and for what to have an odd length numeric ?
- **Re: (Score:3)**
by hawguy (1600213)
They couldn't just go to a 16 bit number they had to save 3 freaking bits ? and for what to have an odd length numeric ?
When you're sending data at 50 bits/second over an unreliable transport that makes retransmissions likely, every bit counts.
But in the updated CNAV block, they increased the week number to 13 bits, which will extend the next time to zero to 2037
- **Re: (Score:2)**
by mentil (1748130)
I wonder if instead of doing that again, they'll just decide that something less susceptible to jamming, that's easier to deploy than a satellite constellation, might be better for positioning. Say, some self-calibrating optical system using image recognition, a high-res camera sensor, and maths, that looks at the position of the stars and combines that with an onboard clock to determine latitude and longitude. An auto-sextant, if you will, far more precise than one operated with eye and hand.
5 hidden comments
- **Re: (Score:3)**
by hawguy (1600213)
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Isn't that system easily jammed by smoke screens, clouds, and daylight?
- **Re: (Score:2)**
by CaptainDork (3678879)
We're sorry, but in the US most school zones, in addition to limiting speeds, provide penalties for sextanting while driving.
- **Re: (Score:2)**
by CaptainDork (3678879)
The Sun and its planets and their satellites move around the center of the Milky Way, which is moving through the universe.
The current topology works better because it has less moving parts.
The problem lies not in our stars ...
- **Re: (Score:2)**
by Shotgun (30919)
Great. A system that I can disable with a hand flair.
- **Re: (Score:2)**
by AmiMojo (196126)
13 bits of week numbers is about 137 years... Shouldn't it be good for at least a century? Presumably they moved the epoch for the new field as well.
- **Re: (Score:2)**
by CaptainDork (3678879)
No we're getting somewhere.
The Mysterious 137 [feynman.com]
If you have ever read Cargo Cult Science by Richard Feynman, you know that he believed that there were still many things that experts, or in this case, physicists, did not know. One of these 'unknowns' that he pointed out often to all of his colleagues was the mysterious number 137.
- **Delayed failures (Score:5, Informative)**
by cpt kangaroo (3723) on Thursday February 14, 2019 @02:50AM (#58119728) Homepage
Another thing to watch out for are delayed failures caused by date windowing. Basically, some developers of devices using GPS-derived time were aware of the problem, and put in a pivot so that dates from before the device was made are treated as being in the future. (e.g. a device built in 2009, ten years after the last time this happened with GPS might treat dates from the 1999-2008 time period as being in 2019-2028, since that's when the device would first encounter them)
So this may be causing random failures of devices for years.
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- **Re:Delayed failures (Score:5, Interesting)**
by mueckesteiner (102093) on Thursday February 14, 2019 @03:10AM (#58119762)
Right, thanks a lot for this piece of information, which probably solves an issue that has been puzzling to me for years.
In my free time, I fly gliders. These things are very simple craft, but usually still have some sort of on-board computer which is used for basic navigation tasks (such as *"given our glide capabilities, can we still reach airfield X from where we are right now?"*). And as part of that, these on-board computers of course have to use GPS. As they are permanently installed in the cockpit, these devices tend to be quite rugged, and usually are kept around for many, many years: replacements are costly, and changing something in the panel of an aircraft, no matter how small, is a major PITA (what with the necessary regulatory paperwork, and all that). So a lot of gliders fly around with positively antique - but functional - electronics on their dashboards.
In my particular glider, which is not exactly a new plane, this function is provided by a slightly ancient device from the early 90ies: a Filser DX50, which has been in the plane since it was built. And few years ago, this thing developed the classical sort of "GPS dementia" which is typical for devices that can't handle a roll-over. For my purposes (purely recreational flying), this is not a big issue: I don't care that the thing thinks it's 1995 all over again, as long as the position is correct. Which it, interestingly, still is.
The only thing about the failure which was (and still is) a bit of a head-scratcher was that it occurred far away from any actual GPS decade roll-over: as far as I remember, it croaked during the change-over from 2014 to 2015. But your explanation might be the answer: when they created the device, they probably assumed "no one will use this device beyond 20 or 22 years after manufacture", and only patched the loop-around for that long.
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- **Re: (Score:2)**
by AmiMojo (196126)
Could also be a rollover of days since some time in 1923 (16 bit signed int). 1923 is a popular epoch as that was when it was decided to settle on the modern calendar and dates before then can be ambiguous. It's also possible that it's just an overflow in the calculation using that value, that wasn't tested when it gets very large.
Either way, I wouldn't rely on it working after April 6th. There doesn't appear to be a firmware fix either.
- **Re: (Score:2)**
by tepples (727027)
1923 is also when US copyright expiration was held up for two decades on account of Gershwin and Disney.
- **Re: (Score:2)**
by Falconhell (1289630)
Just built a new panel for my Glider, bought new Borgelt B800 vario and 7" tablet and only needed to replace 80mm altimeter with 57mm Winter. With the Borgelt vario I got a Bluetooth combiner, which combine FLARM and B800 outputs and makes them available to the tablet, which has its own GPS, baro altitude and accelerometers.
Given my DG200-17C has a very small panel, it shouldn't be they hard to do other gliders. I carry a Sony Z3

android phone in the side pocket as a fully independent backup.
Mo

- **Bingo (Score:2)**
by ISoldat53 (977164)
Buzzword Bingo - Glider edition.

- **Deja vu? (Score:5, Funny)**
by Superlarion (1286310) on Thursday February 14, 2019 @02:54AM (#58119740)
Oh no, it's Y2K all over again!

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- **Re: (Score:3)**
by sad_ (7868)
on April 6, planes will fall out of the sky!
elevators won't know if they need to go up or down!

- **Re: (Score:2)**
by CaptainDork (3678879)
Each and every goddam entity, be it a small business providing cupcakes or enterprises manufacturing the muffin pans will be sending compliance letters to each other 1.) demanding that suppliers better not mess up and that 2.) the author of the demand will do its best to be in compliance, but no promises, and no liability for failures beyond their control.

- **Re: (Score:2)**
by houghi (78078)
To be fair, if it acxtually IS 2000/01/01 00:00 GMT again, that could indeed cause a problem.

- **Re: Deja vu? (Score:1)**
by AngryOnions (1285144)
That's supposed to happen again in 2038. Because no one has done more than the patch they deployed back in 1999.

- **Re: (Score:2)**
by pushing-robot (1037830)
13 bits of weeks = 157.5 years. It's safe to assume there will be entirely new navigation systems by the year 2175.
1 hidden comment

- **Re:They went backwards... (Score:4, Interesting)**
by Sique (173459) on Thursday February 14, 2019 @04:07AM (#58119844) Homepage
That's what the developers in 1978 also assumed. There is an old saying in engineering: Nothing stays around as long as an interim solution.

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- **Re: (Score:1)**
by thereddaikon (5795246)
At this point there is no reason any system should be using anything less than a 64bit value for time moving forward. I can sort of understand the limitations from back in the day and trying to save resources. Although making one integer smaller is not going to save you anything measurable even on a system from the 70's. Its one integer. But with 64bit processors and OS's being the standard today there is no reason time should be kept in anything less. Its probably overkill to make it more than that but t

- **Re: (Score:2)**
by Shotgun (30919)
Never worked in a shop that makes commercial hardware have you? The pencil pushers driving those guys are still clawing back every bit they can in order to use a chip that is one copper penny cheaper.

- **Re: (Score:2)**
by CaptainDork (3678879)
Early computers were designed with the same mentality. "The year 2000 is WAY off."

- **Good, this is when we attack (Score:4, Funny)**
by Gabest (852807) on Thursday February 14, 2019 @03:12AM (#58119766)
Hope you have a bunker and supplies.

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- **Re: (Score:2)**
by chrono (783793)
Won't help much, because you won't be able to find it.

- **Re: Good, this is when we attack (Score:1)**
by AngryOnions (1285144)
Well they'll find SOMETHING. Just might be a different target than what was intended. I wonder how far off the target would be?

- **Re: (Score:2)**
by CaptainDork (3678879)
Is there an app for locating the bunker I built out in an abandoned oil field in Lufkin, Texas back in 1955?
Asking for a friend.

- **Re: (Score:2)**
by _merlin (160982)
The 13-bit week number is in a completely different message format broadcast using different modulation. Using that signal will require completely new hardware, not just a firmware update. But they're likely to keep the current '70s-style signal around for a couple of decades yet.

- **Google Maps (Score:2)**
by SeaFox (739806)
I can only hope the date string is interpreted by Google Maps itself, and not handled by Android or the handset hardware.
Imagine you GPS functionality becoming useless because you're not getting an Android update since the handset manufacturer considers your phone EOL.
5 hidden comments

- **Re: (Score:1)**
by Anonymous Coward
The problem is you're assuming GPS uses geostationary orbits and it doesn't. When you first start up a GPS receiver, that first fix can take a while. This is because it needs to download an almanac. This almanac basically calculates where the birds are in the sky. Then based off of timing signals, combined with the satellite location information, you can figure out exactly where you are. If you think it's 1999, rather than 2019, you're location calculation will be based on where those satellites were i

- **Re: (Score:2)**
by Dhericean (158757)
Each satellite transmits its location (ephemeris) as well as the exact time in each 30 second message. This means that the GPS device does not need to calculate the location. Though the ephemeris updates every 2 hours, a value is considered valid for 4 hours.
The Almanac, a list of the status and rough location for each satellite, is also part of the message and takes over 12 minutes for complete transmission (25 messages). It is used to help determine which satellites to look for on acquisition amongst

- **Re: Google Maps (Score:1)**
by AngryOnions (1285144)
Verizon will be releasing that patch next year. (snark)

- **Re: Trigonometry, anyone? (Score:2, Informative)**
by Anonymous Coward
You don't know the angle to the satellites. What you know is the run time difference of the signal. You have to compute the distance from that, compensate for things like the impact of gravity and after all that, you can do compute the intersection of the spheres.

- **The 13-bit week number is actually a bug IMHO (Score:4, Informative)**
by Torje Mathisen (128806) on Thursday February 14, 2019 @05:16AM (#58119964)
I have been a member of the NTP Hackers [ntp.org] team for 25+ years: As many of you probably know most reference clocks on the Internet are based on GPS timing receivers. The last time we had a week rollover a small percentage of Stratum 1 servers went temporarily offline, or they were marked as "falsetickers" due to announcing a date which was nearly 20 years wrong. Most servers were either unaffected or got back online shortly after.
The key here is that 1024 weeks is a short enough time span that most competent developers will realize that their (embedded or otherwise) product might still be in operation during the next rollover so they have to handle this, while a 13-bit week counter is so long (8192 weeks or 157.5 years) that it is likely that many will simply forget about the issue until it comes back to bite everyone in 2137. :-(
BTW, there are _many_ ways to handle rollovers like this, the easiest is probably to compile in the build date in your firmware and then simply make sure that the date calculated from the week number is greater than this, adding blocks of 1024 (or 8192) weeks if needed. Another option, if you have any kind of non-volatile memory, is to write the current date to permanent storage regularly, like once a month or once a year.
Terje

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- **Re: (Score:1)**
by Anonymous Coward
until it comes back to bite everyone in 2137. :-(
The satellites will not be operating by that time. Why do you think this is a bug?
In addition, lets say for some reason they boost the orbits of all the GPS satellites by that time so they don't degrade to unusability or death....if they can do that for 1000s of satellites in the 22nd centure, why wouldn't we have the technology to work around a few 130+ year old servers who spit out the bad time?????
This is seriously the craziest comment I've heard from someone who seems relatively intelligent in a LONG T

- **Re: (Score:1)**
by Anonymous Coward
This isn't about hardware (satellites), but the protocol. Whenever new satellites are launched, they should work with the existing devices and new devices have to work with the existing satellites. This means we can easily be stuck with the same protocol for many generations of hardware. Think about IPv4 vs IPv6.
The Roman empire had really dirty roads and in order to cross them without getting wet/dirty, they made pedestrian crossings, which were a row of stone blocks, which were raised. For wagons to pass

- **So let me get this straight (Score:2)**
by cyber-vandal (148830)
After the widely publicised Y2K debacle, avoiding a similar scenario wasn't considered by GPS manufacturers at about the same time?

- **Re: (Score:3)**
by drinkypoo (153816)
My Garmin GPS 12 units predate Y2K substantially, you insensitive clod! And they're my only standalone GPS-without-map units. The last firmware update was in 2003. I presume they're about to be rendered useless, which is sad to me because they're reasonably sensitive, have serial output, and support DGPS.

- **Why though? (Score:2)**
by stealth_finger (1809752)
Why does it even need to send a week number? Don't they just do the time and satellite number, and they are all in as fixed a position as they can be so you just get 3+ signals and triangulate. Easy peasy. Where does week number come in and why is it relevant?

- **Re: (Score:2)**
by pz33 (739471)
It's part of the time, which is actually date and time.

- **Re: (Score:2)**
by AmiMoJo (196126)
My understanding is that it's to do with the way the almanac data describing the satellite orbits is transmitted. They send data for one point in time and the receiver extrapolates from there for the next 7 days. So the week number is associated with almanac data packages, and there is one package per week.
The data rate is extremely low (50 bps) so this trades some accuracy (as the predictions are never perfect and the error increases over time) for the ability to receive the data for all the satellites in

- **Re: (Score:2)**
by CaptainDork (3678879)
I'm really scared.
I used to have a straight day job, 9-5.
I'm planning to embrace the gig economy and the week will be unpredictable.

- **car manufacturers may charge $250-$500 for update (Score:2)**
by Joe_Dragon (2206452)
car manufacturers / dealers may charge $250-$500 for update

- **Comparing sizes (Score:2)**
by slipped_bit (2842229)
"10 bits should be enough for anyone" - US DOD

- **Re: (Score:1)**
by AHuxley (892839)
Anything stolen, lost from the US mil that needs a new upgrade won't work :)

- **Re:Stupid n1gger GPASS (Score:5, Informative)**
by Rosco P. Coltrane (209368) on Thursday February 14, 2019 @02:59AM (#58119746)
Before posting judgmental crap like that, you should know your history: the Global Positioning System project was launched in 1973, and the first satellite went up in 1978. The design was done sometime in-between.
Well guess what: in the mid-seventies, EVERYBODY was coding stuff without thinking it'd still be there 40 years later; saving bits and CPU cycles everywhere they could thinking X or Y weeks / years / kilobytes / megahertz should be enough. Even the long-term thinking Unix people thought 2038 [wikipedia.org] should be far enough in the future.

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- **Re:Stupid n1gger GPASS (Score:5, Interesting)**
by AmiMojo (196126) <mojoNO@SPAMworld3.net> on Thursday February 14, 2019 @04:25AM (#58119890)
Homepage Journal
With Unix they didn't really pick 32 bits as being "good enough", it was just the largest they could easily handle at the time.
With GPS they probably just assumed that the military would update or replace receivers when necessary. Civilian use wasn't a major concern, and due to the cost of the equipment they probably didn't consider the use-case where every cheap $10 smart device from China has a GPS receiver in it.
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- **Re: (Score:3)**
by kurkosdr (2378710)
Some programmers are STILL designing stuff with the assumption something won't still be there 40 years later. The DVB standard has a roll-over date in 2038 (that's a project created in 1992 no less!) and Go has UnixNano which has a rollover date in 2262 (because of course the graybeards that gave us the original 2038 bug and unsafe arrays couldn't build a decent language the third time). BTW you don't need a 64-bit number to have dates that go beyond 2038. You may need 2 or 3 32-bit numbers too It's all a

- **Re: (Score:2)**
by Megane (129182)
NeXTstep (and by extension OS X) uses a double float seconds since 1970 in its NSDate class. This not only avoids the Y2038 (and Y10000) problem, but gives you microsecond accuracy for dates that are inside the current era. There is also no floating-point round-off error for any whole number of seconds because they are the base unit.

- **Re: (Score:2)**
by kurkosdr (2378710)
And as usual the best technology didn't make it. Oh well, at least this state of affairs will keep us computer people employed.

- **Re: (Score:2)**
by kurkosdr (2378710)
Missed the OS X part. Sometimes I forget significant part of OS X is NextStep. Anyway, still a minority OS.

- **Floating point for time (Score:2)**
by hawkfish (8978)
NeXTstep (and by extension OS X) uses a double float seconds since 1970 in its NSDate class. This not only avoids the Y2038 (and Y10000) problem, but gives you microsecond accuracy for dates that are inside the current era. There is also no floating-point round-off error for any whole number of seconds because they are the base unit. The problem with using floating point for time is that the precision varies with distance from the epoch. Over the course of a century, this comes to 100 * 365 = 36500 or over 15 bits for representing (say) the number of days, which reduces the precision for fractions of a day by the same amount. Conversely, if you want ns precision, 64 bits will only give you ~20,000 days, which is less than a century. But 128 bits will give you ~10^20 years at ns precision. Which should cover the big bang to the effective

- **Not perceived as fundamental limets (Score:2)**
by Junta (36770)
In the case here, assumption was that GPS firmware would know which window of 20 years would make most sense. A GPS designed to be remotely viable over a large timespan would generally have to have persistent writable storage for map data, so storing the current general 20 year window should be feasible. Similarly, I seem to recall some man page back in the day defining the timestamp as being in terms of the 'current' epoch and explictly saying the epoch would change. Of course I don't think any agreement

- **Re: Stupid n1gger GPASS (Score:1)**
by AngryOnions (1285144)
I believe this is similar to the Y2K problem in computers (I am admittedly not an expert), the fix for which delays another event until 2038. That bug isn't about bad programmers, it's about programmers using a register size that seemed reasonable and worked within the limits of the hardware they had at the time.

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Some of my readers ask me what a "Serial Port" is. The answer is: I don't know. Is it some kind of wine you have with breakfast?

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