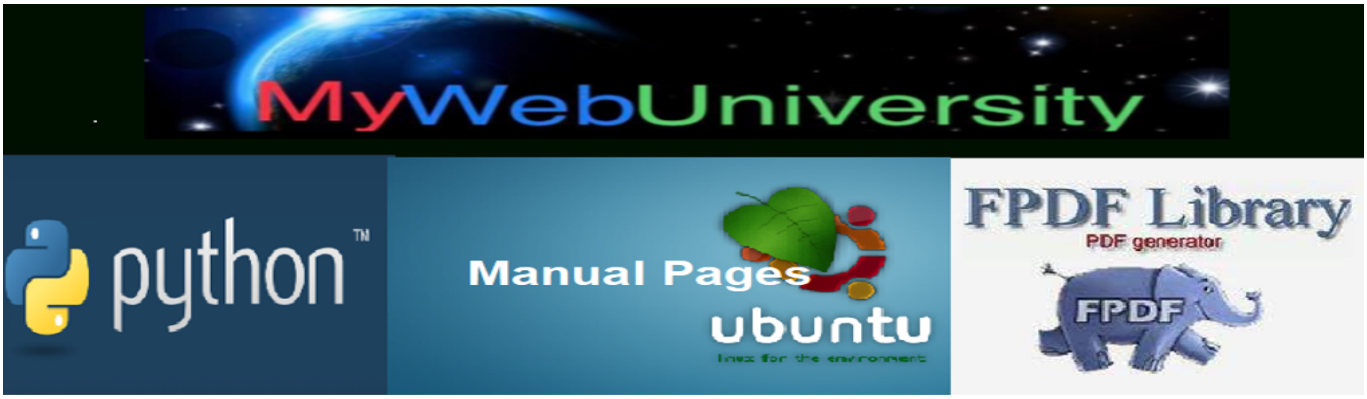

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Rocky Enterprise Linux 9.2 Manual Pages on command 'ntp_adjtime.3'

$ man ntp_adjtime.3

ADJTIMEX(2) Linux Programmer's Manual ADJTIMEX(2)

NAME

adjtimex, clock_adjtime, ntp_adjtime - tune kernel clock

SYNOPSIS

```
#include <sys/timex.h>

int adjtimex(struct timex *buf);

int clock_adjtime(clockid_t clk_id, struct timex *buf);

int ntp_adjtime(struct timex *buf);
```

DESCRIPTION

Linux uses David L. Mills' clock adjustment algorithm (see RFC 5905). The system call ad? jtimex() reads and optionally sets adjustment parameters for this algorithm. It takes a pointer to a timex structure, updates kernel parameters from (selected) field values, and returns the same structure updated with the current kernel values. This structure is de? clared as follows:

```
    struct timex {
        int  modes;      /* Mode selector */
        long offset;     /* Time offset; nanoseconds, if STA_NANO
                            status flag is set, otherwise
                            microseconds */
        long freq;       /* Frequency offset; see NOTES for units */
        long maxerror;   /* Maximum error (microseconds) */
        long esterror;   /* Estimated error (microseconds) */
        int  status;     /* Clock command/status */
```

```
    long constant;   /* PLL (phase-locked loop) time constant */
    long precision;  /* Clock precision
                        (microseconds, read-only) */
    long tolerance;  /* Clock frequency tolerance (read-only);
                        see NOTES for units */
    struct timeval time;
                    /* Current time (read-only, except for
                        ADJ_SETOFFSET); upon return, time.tv_usec
                        contains nanoseconds, if STA_NANO status
                        flag is set, otherwise microseconds */
    long tick;       /* Microseconds between clock ticks */
    long ppsfreq;    /* PPS (pulse per second) frequency
                        (read-only); see NOTES for units */
    long jitter;     /* PPS jitter (read-only); nanoseconds, if
                        STA_NANO status flag is set, otherwise
                        microseconds */
    int  shift;      /* PPS interval duration
                        (seconds, read-only) */
    long stabil;     /* PPS stability (read-only);
                        see NOTES for units */
    long jitcnt;     /* PPS count of jitter limit exceeded
                        events (read-only) */
    long calcnt;     /* PPS count of calibration intervals
                        (read-only) */
    long errcnt;     /* PPS count of calibration errors
                        (read-only) */
    long stbcnt;     /* PPS count of stability limit exceeded
                        events (read-only) */
    int tai;         /* TAI offset, as set by previous ADJ_TAI
                        operation (seconds, read-only,
                        since Linux 2.6.26) */
    /* Further padding bytes to allow for future expansion */
};
```

The modes field determines which parameters, if any, to set. (As described later in this page, the constants used for ntp_adjtime() are equivalent but differently named.) It is a bit mask containing a bitwise-or combination of zero or more of the following bits:

ADJ_OFFSET

Set time offset from buf.offset. Since Linux 2.6.26, the supplied value is clamped to the range (-0.5s, +0.5s). In older kernels, an EINVAL error occurs if the sup? plied value is out of range.

ADJ_FREQUENCY

Set frequency offset from buf.freq. Since Linux 2.6.26, the supplied value is clamped to the range (-32768000, +32768000). In older kernels, an EINVAL error oc? curs if the supplied value is out of range.

ADJ_MAXERROR

Set maximum time error from buf.maxerror.

ADJ_ESTERROR

Set estimated time error from buf.esterror.

ADJ_STATUS

Set clock status bits from buf.status. A description of these bits is provided be? low.

ADJ_TIMECONST

Set PLL time constant from buf.constant. If the STA_NANO status flag (see below) is clear, the kernel adds 4 to this value.

ADJ_SETOFFSET (since Linux 2.6.39)

Add buf.time to the current time. If buf.status includes the ADJ_NANO flag, then buf.time.tv_usec is interpreted as a nanosecond value; otherwise it is interpreted as microseconds.

The value of buf.time is the sum of its two fields, but the field buf.time.tv_usec must always be nonnegative. The following example shows how to normalize a timeval with nanosecond resolution.

```
while (buf.time.tv_usec < 0) {
    buf.time.tv_sec  -= 1;
    buf.time.tv_usec += 1000000000;
}
```

ADJ_MICRO (since Linux 2.6.26)

Select microsecond resolution.

ADJ_NANO (since Linux 2.6.26)

Select nanosecond resolution. Only one of ADJ_MICRO and ADJ_NANO should be speci?
fied.

ADJ_TAI (since Linux 2.6.26)

Set TAI (Atomic International Time) offset from buf.constant.

ADJ_TAI should not be used in conjunction with ADJ_TIMECONST, since the latter mode
also employs the buf.constant field.

For a complete explanation of TAI and the difference between TAI and UTC, see BIPM
?http://www.bipm.org/en/bipm/tai/tai.html?

ADJ_TICK

Set tick value from buf.tick.

Alternatively, modes can be specified as either of the following (multibit mask) values,
in which case other bits should not be specified in modes:

ADJ_OFFSET_SINGLESHOT

Old-fashioned adjtime(3): (gradually) adjust time by value specified in buf.offset,
which specifies an adjustment in microseconds.

ADJ_OFFSET_SS_READ (functional since Linux 2.6.28)

Return (in buf.offset) the remaining amount of time to be adjusted after an earlier
ADJ_OFFSET_SINGLESHOT operation. This feature was added in Linux 2.6.24, but did
not work correctly until Linux 2.6.28.

Ordinary users are restricted to a value of either 0 or ADJ_OFFSET_SS_READ for modes.
Only the superuser may set any parameters.

The buf.status field is a bit mask that is used to set and/or retrieve status bits associ?
ated with the NTP implementation. Some bits in the mask are both readable and settable,
while others are read-only.

STA_PLL (read-write)

Enable phase-locked loop (PLL) updates via ADJ_OFFSET.

STA_PPSFREQ (read-write)

Enable PPS (pulse-per-second) frequency discipline.

STA_PPSTIME (read-write)

Enable PPS time discipline.

STA_FLL (read-write)

Select frequency-locked loop (FLL) mode.

STA_INS (read-write)

Insert a leap second after the last second of the UTC day, thus extending the last minute of the day by one second. Leap-second insertion will occur each day, so long as this flag remains set.

STA_DEL (read-write)

Delete a leap second at the last second of the UTC day. Leap second deletion will occur each day, so long as this flag remains set.

STA_UNSYNC (read-write)

Clock unsynchronized.

STA_FREQHOLD (read-write)

Hold frequency. Normally adjustments made via ADJ_OFFSET result in dampened fre? quency adjustments also being made. So a single call corrects the current offset, but as offsets in the same direction are made repeatedly, the small frequency ad? justments will accumulate to fix the long-term skew.

This flag prevents the small frequency adjustment from being made when correcting for an ADJ_OFFSET value.

STA_PPSSIGNAL (read-only)

A valid PPS (pulse-per-second) signal is present.

STA_PPSJITTER (read-only)

PPS signal jitter exceeded.

STA_PPSWANDER (read-only)

PPS signal wander exceeded.

STA_PPSERROR (read-only)

PPS signal calibration error.

STA_CLOCKERR (read-only)

Clock hardware fault.

STA_NANO (read-only; since Linux 2.6.26)

Resolution (0 = microsecond, 1 = nanoseconds). Set via ADJ_NANO, cleared via ADJ_MICRO.

STA_MODE (since Linux 2.6.26)

Mode (0 = Phase Locked Loop, 1 = Frequency Locked Loop).

STA_CLK (read-only; since Linux 2.6.26)

Clock source (0 = A, 1 = B); currently unused.

Attempts to set read-only status bits are silently ignored.

clock_adjtime ()

The clock_adjtime() system call (added in Linux 2.6.39) behaves like adjtimex() but takes an additional clk_id argument to specify the particular clock on which to act.

ntp_adjtime ()

The ntp_adjtime() library function (described in the NTP "Kernel Application Program API", KAPI) is a more portable interface for performing the same task as adjtimex(). Other than the following points, it is identical to adjtimex():

* The constants used in modes are prefixed with "MOD_" rather than "ADJ_", and have the same suffixes (thus, MOD_OFFSET, MOD_FREQUENCY, and so on), other than the exceptions noted in the following points.
* MOD_CLKA is the synonym for ADJ_OFFSET_SINGLESHOT.
* MOD_CLKB is the synonym for ADJ_TICK.
* The is no synonym for ADJ_OFFSET_SS_READ, which is not described in the KAPI.

RETURN VALUE

On success, adjtimex() and ntp_adjtime() return the clock state; that is, one of the fol? lowing values:

TIME_OK Clock synchronized, no leap second adjustment pending.

TIME_INS Indicates that a leap second will be added at the end of the UTC day.

TIME_DEL Indicates that a leap second will be deleted at the end of the UTC day.

TIME_OOP Insertion of a leap second is in progress.

TIME_WAIT A leap-second insertion or deletion has been completed. This value will be returned until the next ADJ_STATUS operation clears the STA_INS and STA_DEL flags.

TIME_ERROR The system clock is not synchronized to a reliable server. This value is re? turned when any of the following holds true:

* Either STA_UNSYNC or STA_CLOCKERR is set.
* STA_PPSSIGNAL is clear and either STA_PPSFREQ or STA_PPSTIME is set.
* STA_PPSTIME and STA_PPSJITTER are both set.
* STA_PPSFREQ is set and either STA_PPSWANDER or STA_PPSJITTER is set.

The symbolic name TIME_BAD is a synonym for TIME_ERROR, provided for backward compatibility.

Note that starting with Linux 3.4, the call operates asynchronously and the return value usually will not reflect a state change caused by the call itself.

On failure, these calls return -1 and set errno.

ERRORS

EFAULT buf does not point to writable memory.

EINVAL (kernels before Linux 2.6.26)

An attempt was made to set buf.freq to a value outside the range (-33554432, +33554432).

EINVAL (kernels before Linux 2.6.26)

An attempt was made to set buf.offset to a value outside the permitted range. In kernels before Linux 2.0, the permitted range was (-131072, +131072). From Linux 2.0 onwards, the permitted range was (-512000, +512000).

EINVAL An attempt was made to set buf.status to a value other than those listed above.

EINVAL The clk_id given to clock_adjtime() is invalid for one of two reasons. Either the System-V style hard-coded positive clock ID value is out of range, or the dynamic clk_id does not refer to a valid instance of a clock object. See clock_gettime(2) for a discussion of dynamic clocks.

EINVAL An attempt was made to set buf.tick to a value outside the range 900000/HZ to 1100000/HZ, where HZ is the system timer interrupt frequency.

ENODEV The hot-pluggable device (like USB for example) represented by a dynamic clk_id has disappeared after its character device was opened. See clock_gettime(2) for a dis? cussion of dynamic clocks.

EOPNOTSUPP

The given clk_id does not support adjustment.

EPERM buf.modes is neither 0 nor ADJ_OFFSET_SS_READ, and the caller does not have suffi? cient privilege. Under Linux, the CAP_SYS_TIME capability is required.

ATTRIBUTES

For an explanation of the terms used in this section, see attributes(7).

??????????????????????????????????????

?Interface ? Attribute ? Value ?

??????????????????????????????????????

?ntp_adjtime() ? Thread safety ? MT-Safe ?

??????????????????????????????????????

CONFORMING TO

None of these interfaces is described in POSIX.1

adjtimex() and clock_adjtime() are Linux-specific and should not be used in programs in? tended to be portable.

The preferred API for the NTP daemon is ntp_adjtime().

NOTES

In struct timex, freq, ppsfreq, and stabil are ppm (parts per million) with a 16-bit frac? tional part, which means that a value of 1 in one of those fields actually means 2^-16 ppm, and 2^16=65536 is 1 ppm. This is the case for both input values (in the case of freq) and output values.

The leap-second processing triggered by STA_INS and STA_DEL is done by the kernel in timer context. Thus, it will take one tick into the second for the leap second to be inserted or deleted.

SEE ALSO

clock_gettime(2), clock_settime(2), settimeofday(2), adjtime(3), ntp_gettime(3), capabili? ties(7), time(7), adjtimex(8), hwclock(8)

NTP "Kernel Application Program Interface" ?http://www.slac.stanford.edu/comp/unix/ package/rtems/src/ssrlApps/ntpNanoclock/api.htm?

COLOPHON

This page is part of release 5.10 of the Linux man-pages project. A description of the project, information about reporting bugs, and the latest version of this page, can be found at https://www.kernel.org/doc/man-pages/.