This chart is a compartion between NTPv4 and IEEE1588v2 capabilities, and a summary of the applications requirements. It is an output of the TICTOC Paris Interim June 2008.

	1588 wide-area	1588 constrained network	NTPv4 Internet	NTPv4 constrained	NTP NG (based on lab data)	GSM/WCDMA over packet Frequency/FDD
time type	TAI or arbitrary	TAI or arbitrary	UTC	UTC	UTC, monotonic (GPS)	frequency only
time resolution	250 femtosec	250 femtosec	232 picosec (NTP timestamp)	232 picosec (NTP timestamp)	232 picosec (NTP timestamp)	NA
client's time resolution			microseconds	microseconds	nanoseconds	
freq stability	Local osc dependent	Local osc dependent	not defined by protocol	not defined by protocol	not defined by protocol	50-250 ppb (1)
freq accuracy	short term: dependent on local oscillator, update rate, and algorithm (1)	short term: dependent on local oscillator, update rate, and algorithm (1)	1 x 10 E - 7 (100 ppm) (2)	1 x 10 -8 (100 ppm) (2)	1 x 10 - 11 (w/ Rb or OCXO) with current polling rates	50-250 ppb (1)
time/phase stability	HW dependent (mainly oscillator dependent)	h/w dependent (mainly osc)	10 microseconds (6)	10 microseconds (6)	8 nanoseconds with hardware support at egress (6)	NA
time/phase accuracy	limited by asymmetry	higher with on-path support	10 ms (7)	10 - 100 microseconds (small scale - few hops switched) (7)	sub microsecond has been demonstrated in lab	NA
acquisition time	good	very good	24 hours	8 minutes	10-20 seconds	as soon as possible, x minutes
service jitter			NA	NA	NA	Depends on oscillator stability
service wander		Protocol can not guarantee PRC mask but has been experimentaly achieved (cf. note 5)	NA	NA	NA	Depends on oscillator stability
asymmetry	Not an issue for frequency Can correct asymmetry if asymmetry is known	Not an issue for frequency Can correct asymmetry if asymmetry is known	YES	yes - asymmetry may possibly be constrained	must be less than 2 microseconds for this performance	NA
constrained network			no	yes	yes	Yes
on-path support	none	may be used	none	none	hardware timestamping (8)	No
clients/server	Not limited by protocol	Limited by states stored in on-path support device (unicast) (4)	millions (9)	100s - 1000s (9)	100s (9)	Under study, 100 to 1000's
update rate	Not practically limited by protocol	Not practically limited by protocol	16 seconds - 17 minutes (10)	16 seconds - 17 minutes (10)	more than 1 pps (10)	Depends on oscillator stability and network
server auth	Needs development	Needs development	yes	yes	no	No (3)
client auth	Needs specification	Needs specification (3)	no	no	no	No (3)
transaction auth	Needs specification (cf. note 3)	Needs specification (3)	no	no	no	No (3)
backwards compat	NA	N/A except industrial (backward compatibility with 1588-2002)	NTPv3	NTPv3	NTPv4	Yes
time alignment						
	Note (1): long term frequency accuracy should always converge to that of source clock	Note (3): IEEE1588 authentication and on-path support still needs clarification	Note (5): this applies to NTP; implementation and network specific	Note (7): limited by layering and asymmetry	(9) for NTP total clients in network	Note (1) This is requirement in the air interface. In practice more accurate frequency is required at the input. For example OBSAI RP1 defines 16 ppb
	Note (2): NTP supports oscillators as bad as 500 ppm; could be better simply by increasing polling rates	Note (4): in multicast P2P mode, can scale to 1000's slaves	Note (6): rms jitter on timestamp from server (phase noise on ntp packets)	Note (8): follow up packets have also been proposed	Note (10): polling interval	Note (2) In input

WCDMA TDD	LTE - TDD	Circuit emulation Traffic mask apps	Synch mask apps	Remote telco	instrumentation / measurement - automated test system (5)	industrial (5)
phase alignment	phase alignment	frequency only	frequency only	TAI + leap second information	UTC	TAI/UTC/arbitrary
e.g. 10 ns	e.g. 10 ns	NA	NA	10ns is fine	sub nanosecond, maybe pico seconds	10nS
		NA	NA			
50-250 ppb (1)	50-250 ppb (1)				1.00E+12	n/a
50-250 ppb (1)	50-250 ppb (1)				1.00E+12	n/a
Terminology TBD	Terminology TBD				meaning unclear	meaning unclear
'+/- 1.25 us relative (2)	1 us - 50 us (4a,4b)			within 100uS of GPS	unknown	10 - 100uS
as soon as possible, x minutes	as soon as possible, x minutes			5 minutes start up, 30 minutes for full accuracy	30 min	5 min
Depends on oscillator stability	Depends on oscillator stability	G.823/G824 traffic mask	G.823/G824 synch mask		meaning unclear	meaning unclear
Depends on oscillator stability	Depends on oscillator stability	G.823/G.824 traffic mask	G.823/G824 synch mask	less than 1uS MTIE relative to GPS	meaning unclear	meaning unclear
Should be taken into account	Should be taken into account	NA	NA	links are symmetric within 1uS	symmetry	yes
Yes	Yes	Yes	Yes	campus network, maybe 3-6 hops	yes	yes
In most cases	In most cases	yes (continuous physical line)	yes (continuous physical line, SSU)	unlikely	maybe	yes
Under study, 100 to 1000's	Under study, 100 to 1000's	1 to 1	1 to 1	perhaps 100	<100/1000's	100-1000 clients
Depends on many aspects	Depends on many aspects	data packet rate	typically 10s per second	perhaps 1000/sec/client permitted	implementation specific/1 per s	implementation specific
No (3)	No (3)	No need	No need	NA	no	yes
No (3)	No (3)	No	No	NA	no	no
No (3)	No (3)	No meaning	No meaning	NA	no	no
Yes	Yes		output should be 8KHz or 2M	preferred	maybe 1588 v1	ntp - 1588 V1 - IRIG
					100pS	100nS - 1mS
Note (3) assumes a private network	Note 4a : no precise phase accuracy requirements defined in standard. The actual requirement will depend on implementation and network scenario.				Note (5) draft answers based on unfair definition of terms	
	Note 4b : In general LTE TDD systems may be defined to operate with 10-50 microseconds phase accuracy by making some limitations on the deployment (e.g. cell range), and radio frame configuration, however further investigation are required. When no assumption possible, microsecond or sub-microsecond requirement would apply.					

power - sub station (5)	Networking SLA	Network CDR	TOD/Internet	legal time	metrology	sensor networks
3 UTC	arbitrary, UTC, TAI	UTC	UTC(k)+company local	UTC(k)	local clock	arbitrary time or only ordering
100nS	to achieve 1us we should timestamp to 100ns, moving to better than 10ns to have a unique ts per pkt in the future	10us	1us	infinite	10fs representation	short timestamp critical
	10ns good enough	10us				NA
don't care	accuracy + stability = 10-7 moving to 10-8	10ppm	3*10-15 (6)			not critical
almost don't care	see above	see above	6*10-13 (6)			not critical
meaning unclear	don't understand	don't understand	1us	infinite		don't understand concept
1uS	better than 1us	1ms	1us	infinite		1 ms
1 min	not critical	not critical	4 min	4 min		1 ms
dkm	NA	NA				NA
meaning unclear	NA	NA				NA
<100nS	must not limit one way measurement	must not limit	handle yes	handle yes		NA
yes	time delivery nw may be constrained, measurement n/w will not	if required	no	no		completely uncontrolled (random number and position of sensors)
maybe	if required	unlikely to be needed	no	no	out-of-band	NO
1 server (backup) - 100 clients	100K DSLAMs, 10k PEs, 1K P routers, ~200pops don't know how many servers	small number	25M	c/s s/c		distributed network - no servers no clients
implementation specific	better than 1pps	low	255spp-1000pps	155spp-1000pps	down to 1pps	variable, very low but with peaks
yes	depend on how controlled the environment is	depends	yes	yes	yes	NA
no	depends on how controlled the environment is	depends	no	yes	yes	NA
no	depends on how controlled the environment is	depends	no	yes (server log client?)	yes	possibly
yes if IRIG	would be nice if server NTP compatible for existing devices, but not a showstopper if new protocol needed to meet goal	not critical	yes	no		NO
						amount depends on application
			Note (6) value is for clock feeding master			