Unique Id Algorithm

- Java UUID
- Ticker
- Mongo Object Ids
- Time based

Unique Id Algorithm

- Unique Ids calculated using simple math algorithm
- No chance of duplicate ids
- No jar dependency and or external dependency to verify the uniqueness. No copyrights as it's a simple math.
- Works in distributed environment
- Generates unique numeric id which can be converted to alpha-numeric if required
- ID length varies from 16 to 19
  (depends on the node and sequence setting...covered in later part)

Unique ID

- All ids Comprises of 3 parts
  1) The time parameter (milli secs)
  2) The node or instance id (a unique number for each node)
  3) A sequence number maintained in each node / instance separately.
- Node id
  for 10 bits varies from 0 to 4095
  for 7 bits varies from 0 to 128
- Sequence (A local counter maintained per instance)
  for 12 bits varies from 0 to 4095
  for 5 bits varies from 0 to 31
- ID formula
  Current epoch * 2^(node bits + seq bits) + Node id* 2^(sequence bits) + sequence.

Unique ID

- ID formula

  Current epoch * 2^(node bits + seq bits) + Node id* 2^(seq bits) + seq

- Current epoch = 252141659884 (Wed Dec 28 12:50:59 IST 1977)
  Node bits = 10 bits
  Sequence bits = 12 bits
  Node Id= 341 (0 to 1023)
  Sequence = 2 (0 to 4095)

  252141659884 * 2^(10+12) + 341 * 2^(12) + 2

  1057558772618100736 + 1396736 + 2

  1057558772619497472

Algorithm working

- Current Time : 2521416598844 (Wed Dec 28 12:50:59 IST 1977)
- Node bits : 10 (0 to 1023) , sequence bits : 12 (0 to 4096)
- Max 4096 request per milli second

Node 0

1057558772618100736 + 0 + 0
(1057558772618100736)

To

1057558772618100736 + 0 + 4095
(1057558772618104831)

Node 1

1057558772618100736 + 1*4096 + 0
(1057558772618104832)

To

1057558772618100736 + 1*4096 + 4095
(1057558772618108927)

Node 1023

1057558772618100736 + 1023*4096 + 0
(1057558772622290944)

To

1057558772618100736 + 1023*4096 + 4095
(1057558772622295039)

Current epoch * 2^(*node bits* + *seq bits*) + *Node id* * 2^(*seq bits*) + *seq*

Algorithm working

- Current Time : 2521416598855 (Wed Dec 28 12:50:59 IST 1977)
- Node bits : 10 (0 to 1023) , sequence bits : 12 (0 to 4096)
- Max 4096 request per milli second

Node 0

1057558772622295040 + 0 + 0
(1057558772622295040)

To

1057558772622295040 + 0 + 4095
(1057558772622299135)

Node 1

1057558772622295040 + 1*4096 + 0
(1057558772622299136)

To

1057558772622295040 + 1*4096 + 4095
(1057558772622303231)

Node 1023

1057558772622295040 + 1023*4096 + 0
(1057558772626485248)

To

1057558772622295040 + 1023*4096 + 4095
(1057558772626489343)

Current epoch * 2^(*node bits* + *seq bits*) + *Node id* * 2^(*seq bits*) + *seq*

Unique ID

- Current Time : 2521416598844 (Wed Dec 28 12:50:59 IST 1977)
- Node bits : 8 (0 to 255) , sequence bits : 5 (0 to 32)
- Max 32 request per milli second

Node 0

2065544477769728 + 0 + 0
(2065544477769728)

To

2065544477769728 + 0 + 31
(2065544477769759)

Node 1

2065544477769728 + 1*32 + 0
(2065544477769760)

To

2065544477769728 + 1*32 + 31
(2065544477769791)

Node 255

2065544477769728 + 255*32 + 0
(2065544477777888)

To

2065544477769728 + 255*32 + 31
(2065544477777919)

Current epoch * 2^(*node bits* + *seq bits*) + *Node id* * 2^(*seq bits*) + *seq*

Unique ID

- Current Time : 2521416598855 (Wed Dec 28 12:50:59 IST 1977)
- Node bits : 8 (0 to 255) , sequence bits : 5 (0 to 32)
- Max 32 request per milli second

Node 0

2065544477777920 + 0 + 0
(2065544477777920)

To

2065544477777920 + 0 + 31
(2065544477777951)

Node 1

2065544477777920 + 1*32 + 0
(2065544477777952)

To

2065544477777920 + 1*32 + 31
(2065544477777983)

Node 255

2065544477777920 + 255*32 + 0
(2065544477786080)

To

2065544477777920 + 255*32 + 31
(2065544477786111)

Current epoch * 2^(*node bits* + *seq bits*) + *Node id* * 2^(*seq bits*) + *seq*

Unique ID

- All pods should clock for same time (since we use UTC instance this won't be an issue)
- Only numeric ids, and no point in converting them to alpha-num since the ids are themselves unique.
- Node ID we can either calculate using mac address of the instance or by providing a number on startup
- ID Repetition

No. of nodes / Instances	(SEQUENCE) / TPS per millisec	TPS/milli sec per node	Total ids per ms	Total ids in second	ID repeated after years	Repeats on (as per 4th Jan 2023 and for 16 or below digit id)	Length
1024	4096	4096	4194304	4194304000	0	Jan 25 2024	19
512	128	128	65536	65536000	5	Nov 05 2027	17
256	128	128	32768	32768000	10	Sep 06 2032	16
256	64	64	16384	16384000	19	May 09 2042	16
256	32	32	8192	8192000	39	Sep 10 2061	16
128	32	32	4096	4096000	77	May 17 2100	16
128	16	16	2048	2048000	155	Sep 27 2177	15