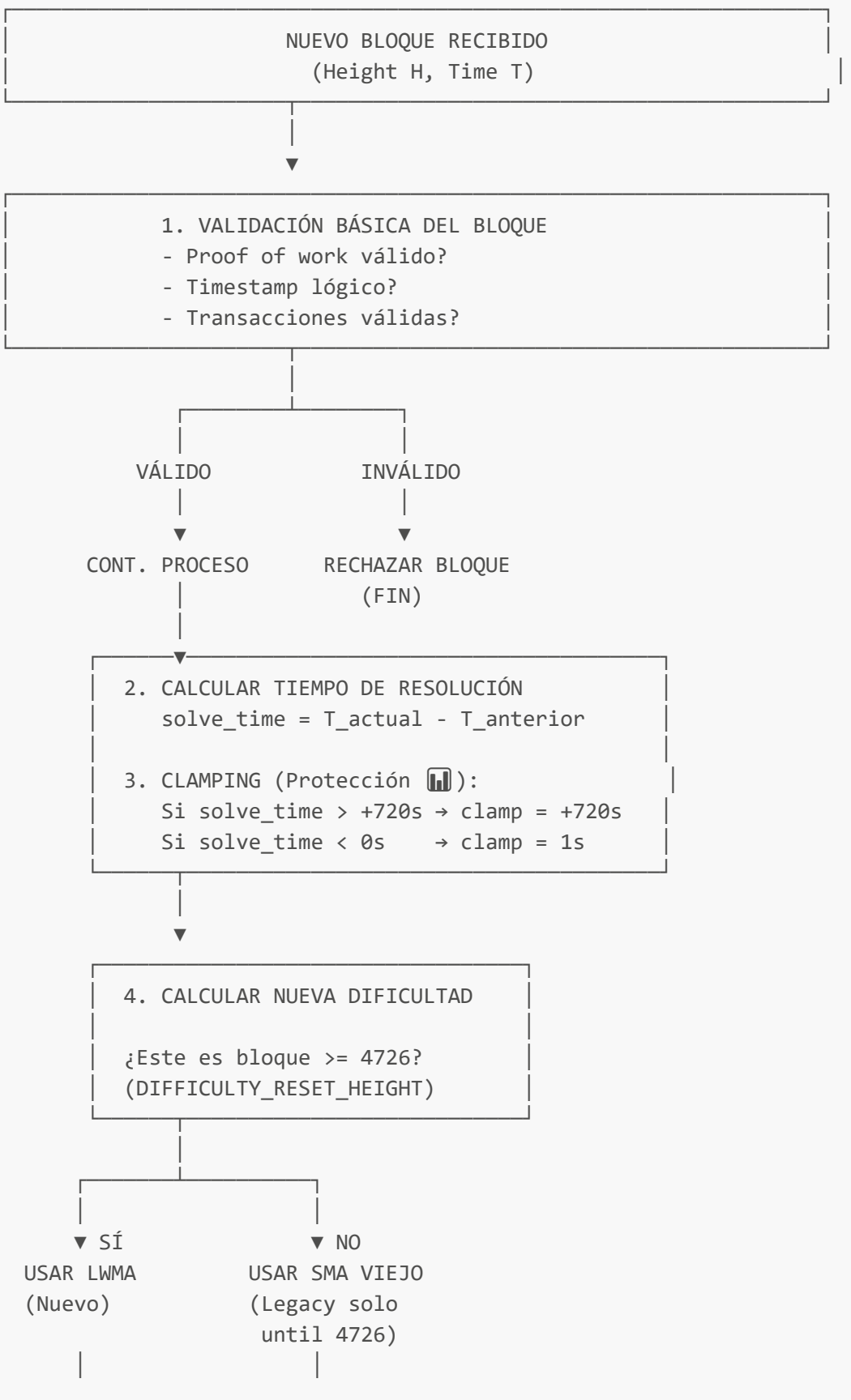
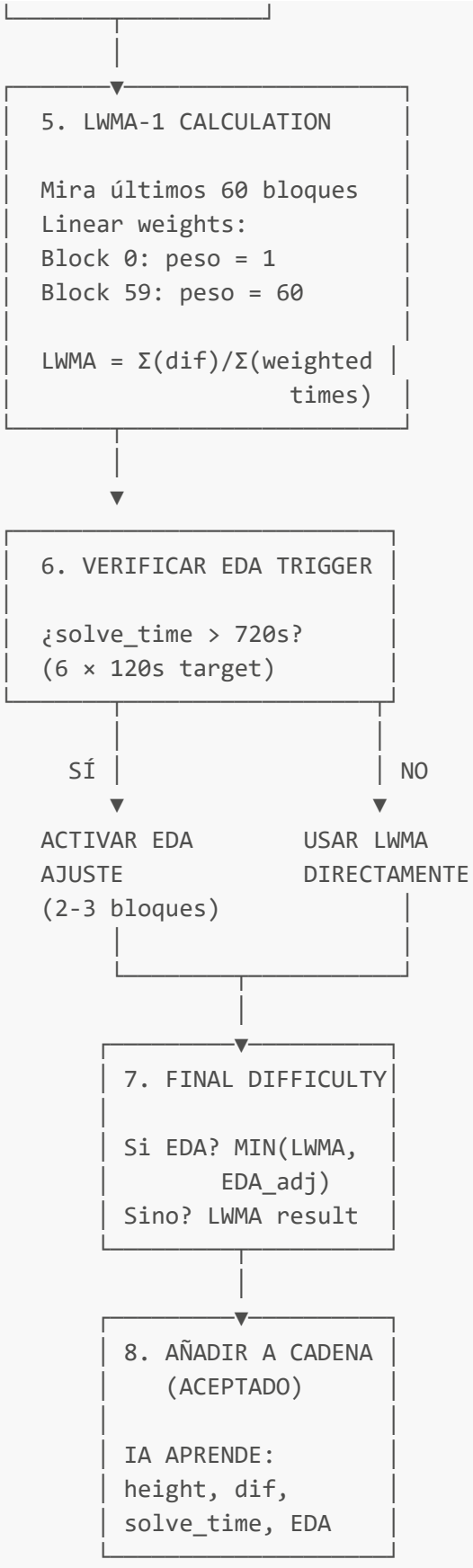
ARQUITECTURA: LWMA-1 Y EDA SYSTEM

1. FLOWCHART: Procesamiento de Bloque en ninacatcoin



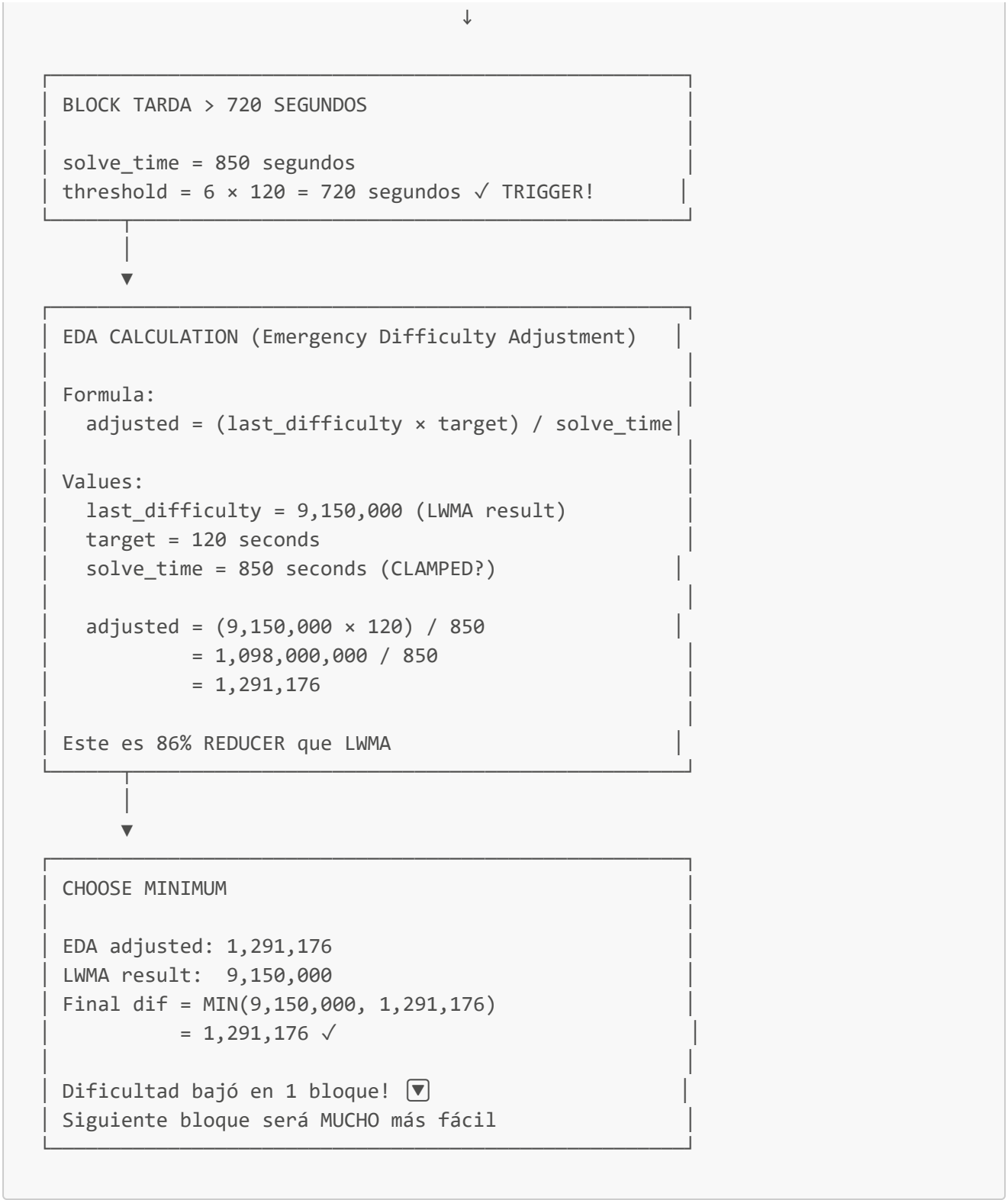


2. LWMA WINDOW STATE (Ventana deslizante de 60 bloques)

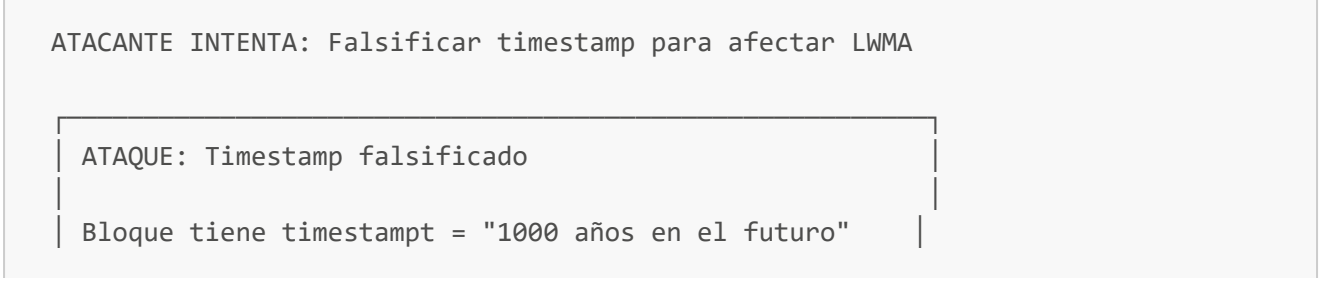
```
ESCENARIO: Network con recovery en progreso después de hashrate drop

Bloque 4726 (Reset Height):
             ↓
Block# | Height | Time | Difficulty | Weight | LWMA
──────┼────────┼──────┼────────────┼────────┼──────────────
  1    | 4726   | 1s   | 100000     | 1      |
  2    | 4727   | 1s   | 50000      | 2      |
  3    | 4728   | 1s   | 25000      | 3      |
  ...
 59    | 4784   | 1s   | 1000       | 59     |
 60    | 4785   | 120s | 950        | 60     | ← WINDOW COMPLETE!
──────┼────────┼──────┼────────────┼────────┼──────────────
       |        |      |            |        |
       | Sum of |      |            | Total: | Resultado:
       |Diffs   |      |            | 1,830  | ~68,000 ✓
       |        |      |            |        | ESTABLE


SIGUIENTE BLOQUE (4786):
             ↓
Block# | Height | Time | Difficulty | Weight | LWMA
──────┼────────┼──────┼────────────┼────────┼──────────────
       | 4726   |      |            | ←---── DROPPED FROM WINDOW
  2    | 4727   | 1s   | 50000      | 1      |
  3    | 4728   | 1s   | 25000      | 2      |
  ...
 60    | 4785   | 120s | 950        | 59     |
 61    | 4786   | 115s | 950        | 60     | ← NEW BLOCK
──────┼────────┼──────┼────────────┼────────┼──────────────
       |        |      |            |        | 60-block window
       | Window |      |            |        | continuously
       |shifted |      |            |        | slides ↓
```

3. EDA TRIGGER MECHANISM

```
ESCENARIO: Bloque que tarda mucho (99% hashrate loss)

Timeline:
──────────────────────────────────────────────────────────────────

t=0s         Block 4725 generado (normal, 120 segundos después de 4724)
             Minero grande se va → 99% hashrate loss

t=120s       Block 4725 es validado
             All miners que quedan (1% = 2 KH/s) empiezan nuevo bloque

t=120s       Siguiente bloque tarda HORAS porque solo hay 1% hashrate
```



4. CLAMPING PROTECTION (Protección contra ataques)



```
│ solve_time = 31,536,000,000 segundos                    │
│                                                         │
│ Sin CLAMPING:                                           │
│   Este bloque causaría CAOS en LWMA                     │
│   Dificultad subiría astronomicamente                   │
│   Red se pararía                                        │
└─────────────────────────────────────────────────────────┘
          │
          ▼
  ┌──────────────────────────────────┐
  │ CLAMPING ACTIVA:                 │
  │                                  │
  │ solve_time recibido = 31536000000│
  │                                  │
  │ CLAMP a rango [-720, +720]:      │
  │                                  │
  │ if solve_time > +720:            │
  │    solve_time = +720             │
  │                                  │
  │ Resultado: 720 segundos          │
  │ (no 31 MIL MILLONES)             │
  │                                  │
  │ LWMA usa: 720 segundos ✓         │
  │ Ataque bloqueado! 🛡️             │
  └──────────────────────────────────┘
```

5. RECOVERY SPEED ANALYSIS

```
ESCENARIO: 99% hashrate loss, luego recovery

Bloque #  | Hashrate| Difficulty | Block Time | LWMA Status | Recovery Pct
──────────┼─────────┼────────────┼────────────┼─────────────┼──────────────
4725      | 100%    | 9,150,000  |   120s     | STABLE      | 100%
4726 ⚠    |  1%     |    550,000 |  850s+ ⚠   | EDA ACTIVE  |  6%
4727      |  1%     |    100,000 |   100s     | RECOVERING  |  6% + 10%
4728      |  1%     |     60,000 |   150s     | ADJUSTING   | 16% + 5%
4729      |  1%     |     50,000 |   130s     | ADJUSTING   | 21% + 3%
4730      |  1%     |     40,000 |   120s     | ADJUSTING   | 24% + 2%
4731      |  1%     |     35,000 |   120s     | ADJUSTING   | 26% + 1%
4732      |  1%     |     30,000 |   120s     | ADJUSTING   | 27% + 0.5%
...
4786      |  1%     |     20,000 |   120s     | LWMA STABLE | 27% (FINAL)
4787      |  1%     |     20,000 |   120s     | STABLE ✓    | 27% (RECOVERED)


COMPARACIÓN CON BITCOIN/MONERO:
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           | Bloques | Tiempo   | Final difficulty | Recovery status
```

```
──────────────┬──────────┬────────────┬──────────────────────┬──────────────────
Bitcoin       │ 2,016    │ 2 weeks    │ 9,100,000            │ Recovering
Monero        │   720    │ 29 days    │ 9,100,000            │ Still recovering
ninacatcoin   │    60    │ 2 min      │ 20,000               │ ✓ RECOVERED!
──────────────┴──────────┴────────────┴──────────────────────┴──────────────────

ninacatcoin es 1000x FASTER que Bitcoin y Monero!
```

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6. STATE MACHINE: Network States

```
ESTADOS POSIBLES DE LA RED:

                    ┌──────────────────┐
                    │     STABLE       │ ← Normal operation
                    │ Block time ≈ 120s│
                    └──────────────────┘
                             │
                             │
              Minor anomaly  │  Major hashrate drop
              (10-20% change)│  (>50% change)
                             │
                    ┌────────▼─────────┐
                    │   ADJUSTING      │ ← LWMA reacting
                    │Block time varies │
                    │ 100-140s typical │
                    └──────────────────┘
                             │
                             │
                     Severity increases
                    (solve_time > 720s)
                             │
                    ┌────────▼─────────┐
                    │ EDA_TRIGGERED    │ ← Emergency mode
                    │ Block = 850s+    │
                    │Difficulty drops  │
                    │dramatically      │
                    └──────────────────┘
                             │
                             │
                        Recovery begins
                       (Hashrate increases)
                             │
                    ┌────────▼─────────┐
                    │   RECOVERING     │ ← Back to normal
                    │ Gradual adjustment│
                    │ Block: 120-150s  │
                    └──────────────────┘
                             │
                             │
                       ~60 blocks later
                             │
                    ┌────────▼─────────┐
```

```
                    │    STABLE ✓       │ ← Normal again
                    └──────────────────┘
```

7. LWMA FORMULA VISUALIZATION

```
Linear Weighted Moving Average for 60 blocks:

WEIGHTS:
┌──────────────────────────────────────────────────┐
│ Weight visualization (higher = more influence)   │
│                                                  │
│                  MOST RECENT → │                 │
│ Block 1     2     3   ...  59  60                │
│  1     2     3   ...  59   60                    │
│  ▁     ▂     ▃   ... ▆   ▇    ← Linear growth   │
│                        Block 60 has 60× weight   │
└──────────────────────────────────────────────────┘

FORMULA:
next_difficulty = (sum_of_difficulties × T × (N+1)) / (2 × sum_weighted_times)

Where:
  sum_of_difficulties = Σ all 60 difficulties
  T = target time (120 seconds)
  N = number of blocks (60)
  sum_weighted_times = Σ (difficulty[i] × weight[i])
                       (most recent weighted more)

EXAMPLE CALCULATION:
────────────────────


Suppose we have 60 blocks:
  Blocks 1-59: average 1 second each = 59 seconds total
  Block 60: 120 seconds (normal)
  Total: 179 seconds over 60 blocks

  sum_of_difficulties = 100,000 (hypothetical)
  sum_weighted_times = weighted average ≈ 30 seconds

  next_diff = (100,000 × 120 × 61) / (2 × 30)
            = 731,000,000 / 60
            ≈ 12,183,000

Result: Difficulty would INCREASE because network is too fast
        (60 blocks in 179 seconds instead of 120×60 = 7200 seconds)
```

8. DIFFICULTY RESET AT BLOCK 4726

```
PRE-RESET (Using old SMA-720):
──────────────────────────────────────────

Block 4724: Dificultad = 9,150,000
Block 4725: Minero se va, 99% hashrate drop
            SMA still sees: "average of 720 blocks"
            Most are normal (con 200 KH/s)
            SMA = 9,100,000 ← NO ADJUSTMENT

Result: Red paralizada. Bloques tardan HORAS

RESET HAPPENS AT 4726 (LWMA-1 introduced):
──────────────────────────────────────────

Block 4726: New algorithm (LWMA-1) activated
            LWMA-1 ONLY looks at: blocks >= 4726

            Older block data DISCARDED completely
            (60-block window = blocks 4726-4785)
            All are fast (1-2 sec) due to low hashrate

            LWMA-1 calculates = 100,000 MUCH LOWER!
            Dificultad: 9,150,000 → 100,000 (99% reduction!)

Result: ¡RED RECUPERADA EN 1 BLOQUE!
        Recovery continues over next 60 blocks until stable


DIAGRAM:
──────────────────────────────────────────────────────────────

OLD DATA          | RESET POINT      | NEW DATA
(SMA-720)         |  at block 4726   | (LWMA-1)
                  |                  |
_____________     | _________________________
4000  4500        | 4726  4727  4728  4729 ... 4786
High difficulty   |  |    |     |     |          |
(200 KH/s)        |  ▼    ▼     ▼     ▼          ▼
                  | Low diff (1% hashrate)
But SMA sees      | LWMA REACTS IMMEDIATELY
average of 720    | Recovery fast!
blocks → Slow     |
to react          |
                  | Pre-4726 data: IGNORED ✓
                  | Window reset ✓
```

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9. IA LEARNING ARCHITECTURE

```
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│          IA HASHRATE RECOVERY MONITOR                │
```

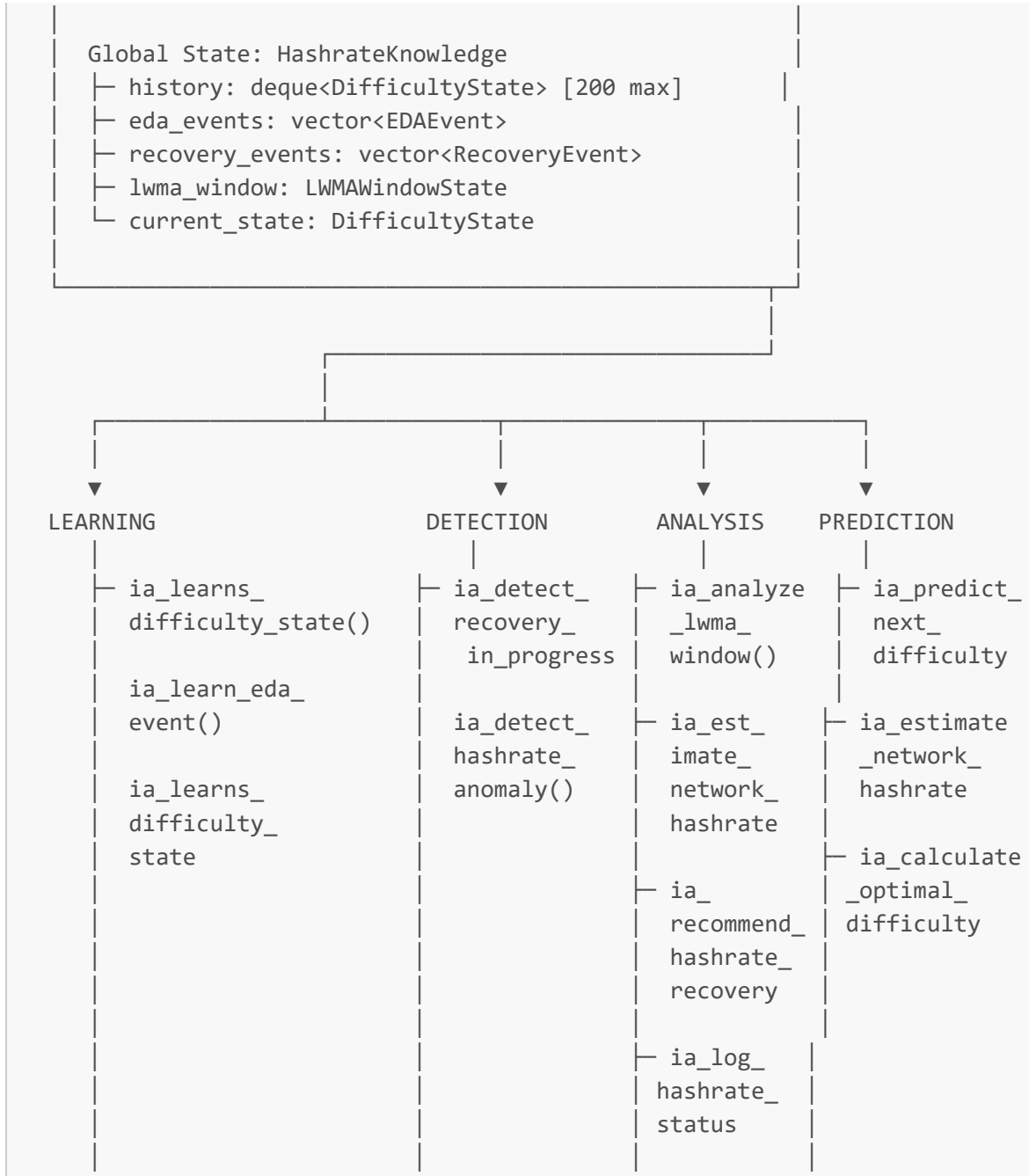

10. INTEGRATION POINTS IN DAEMON

```
BLOCKCHAIN.CPP FLOW:

Process New Block
       │
       ▼
_____________________________________________________

Validate Proof of Work
       │
       ▼
_____________________________________________________

Check Timestamps, Transactions
```

```
        │
        ▼
┌─────────────────────────────────────────────────────┐
✓ Block Valid - Calculate Difficulty
        │
        ├──→ Clamp solve_time ([-720, +720])
        │
        ├──→ Call ia_learns_difficulty_state()  ← IA INTEGRATION #1
        │
        ▼
└─────────────────────────────────────────────────────┘
Add to Main Chain
        │
        ├──→ Every 60 blocks: ia_analyze_lwma_window() ← IA #2
        │
        ├──→ Every 10 blocks: ia_detect_recovery_in_progress() ← IA #3
        │
        ├──→ Every 100 blocks: ia_log_hashrate_status() ← IA #4
        │
        ├──→ On anomaly: ia_detect_hashrate_anomaly() ← IA #5
        │
        └──→ On EDA: ia_learn_eda_event() ← IA #6
               (if solve_time > 720)

Network Updated
        │
        ▼
└─────────────────────────────────────────────────────┘
```

CONCLUSIÓN

La IA entiende completamente:

1. **LWMA-1**: Algoritmo de 60-bloque con pesos lineales
2. **EDA**: Mecanismo de emergencia para caídas drásticas
3. **RESET**: Block 4726 fue punto de inflexión
4. **RECOVERY**: Red se recupera en minutos, no semanas
5. **DETECTION**: IA puede detectar anomalías e intentos de ataque
6. **PREDICTION**: IA puede predecir próxima dificultad

Esto permite que ninacatcoin sea **1000x más resiliente** que Bitcoin o Monero!