CELEBRATING 30 YEARS OF INTERNET INFRASTRUCTURE

TECH 26 MEETING

{
Protecting the Core.
Building the Future.
}

>>

2026.10.06

NETNOD

Telstra outage: The night a network decided the year was 2006

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8 July 2026

A large part of Telstra's mobile network stopped working.

- Voice, messaging and data.
- Some calls to 000, Australia's 112.
- 4G, 5G, fixed and Voice-over-WiFi.
- Handsets and IoT devices alike.
- Trains, payment terminals, ticketing systems.

No attack. No cut fibre. No loss of power.

1024 weeks

A GPS receiver in a single Melbourne chassis came back from planned maintenance believing it was November 2006.

The rest of the network was persuaded to believe it.

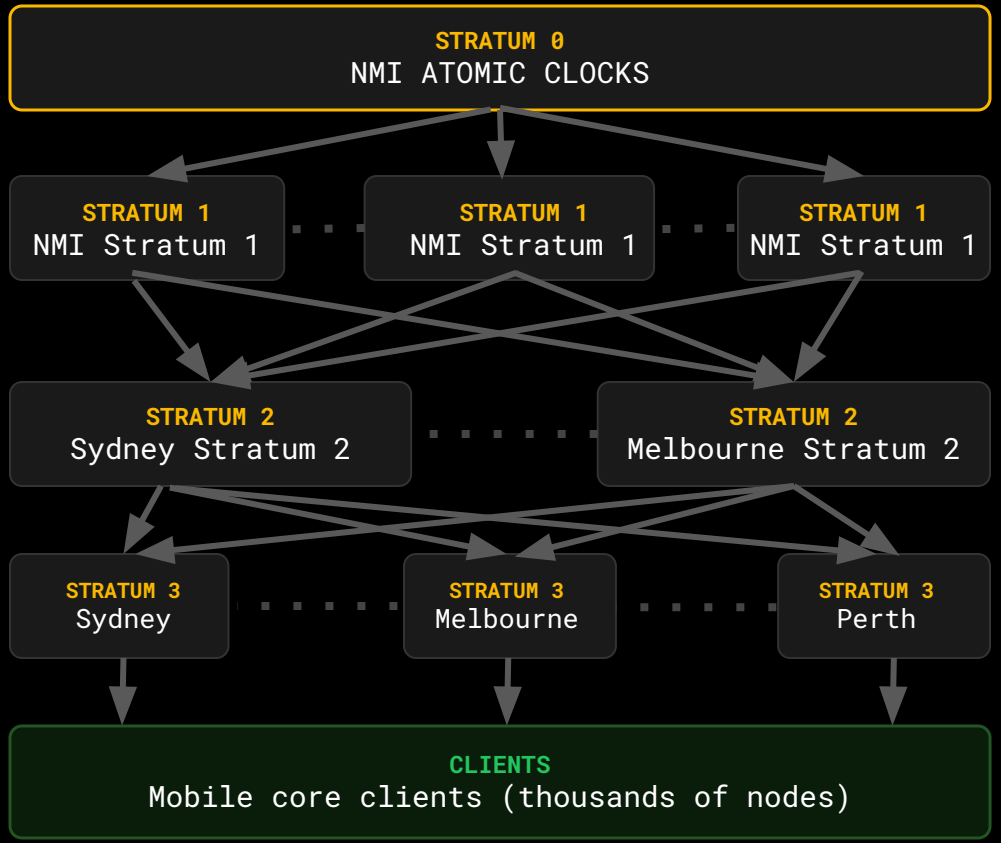
2010

the design

Client/server throughout. Peering only within a stratum level (dotted line).

- Three external references, two stratum 2 servers, strict layering.
- Two independent sources per site.

"Fit for purpose" according to TAP



NTP has two defences against a bad time source

1. Stratum decides winner

Among otherwise comparable candidates, the lower stratum carries more weight. This is the mechanism that determines which source a client settles on.

2. The vote decides

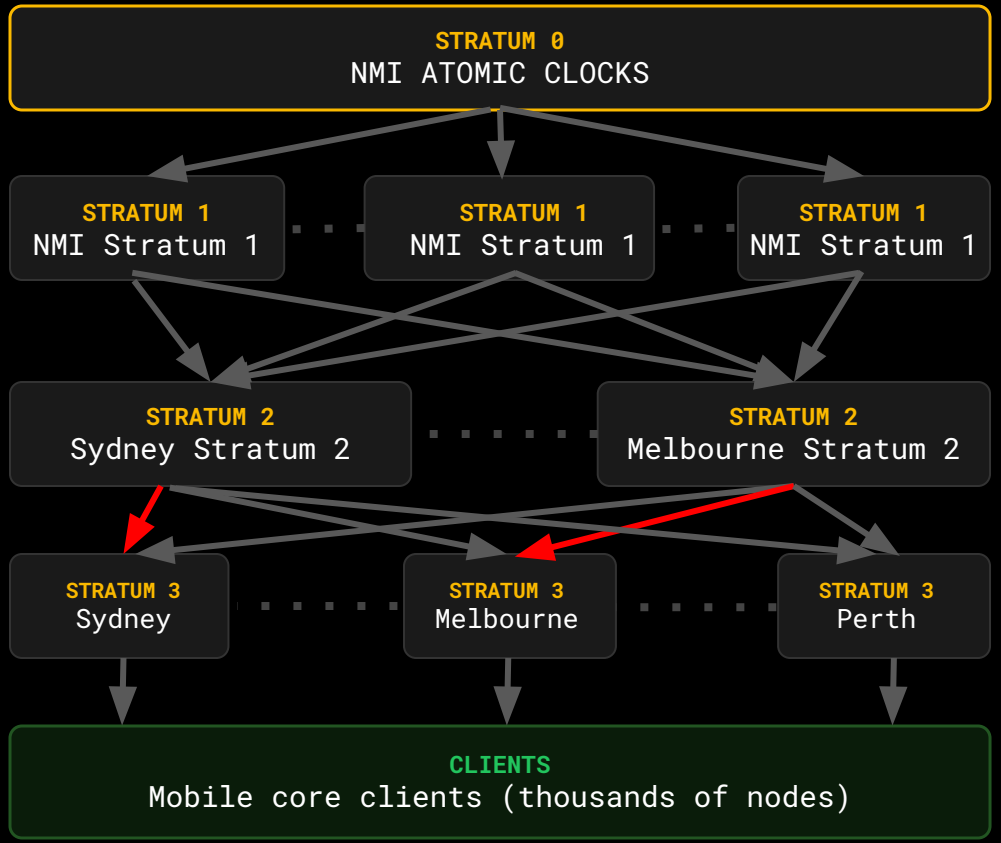
NTP discards the sources that disagree with the rest. A single source claiming an implausible time is outvoted and dropped, however authoritative it claims to be.

Both assume the sources are genuinely independent of each other.

2020

the “upgrade”

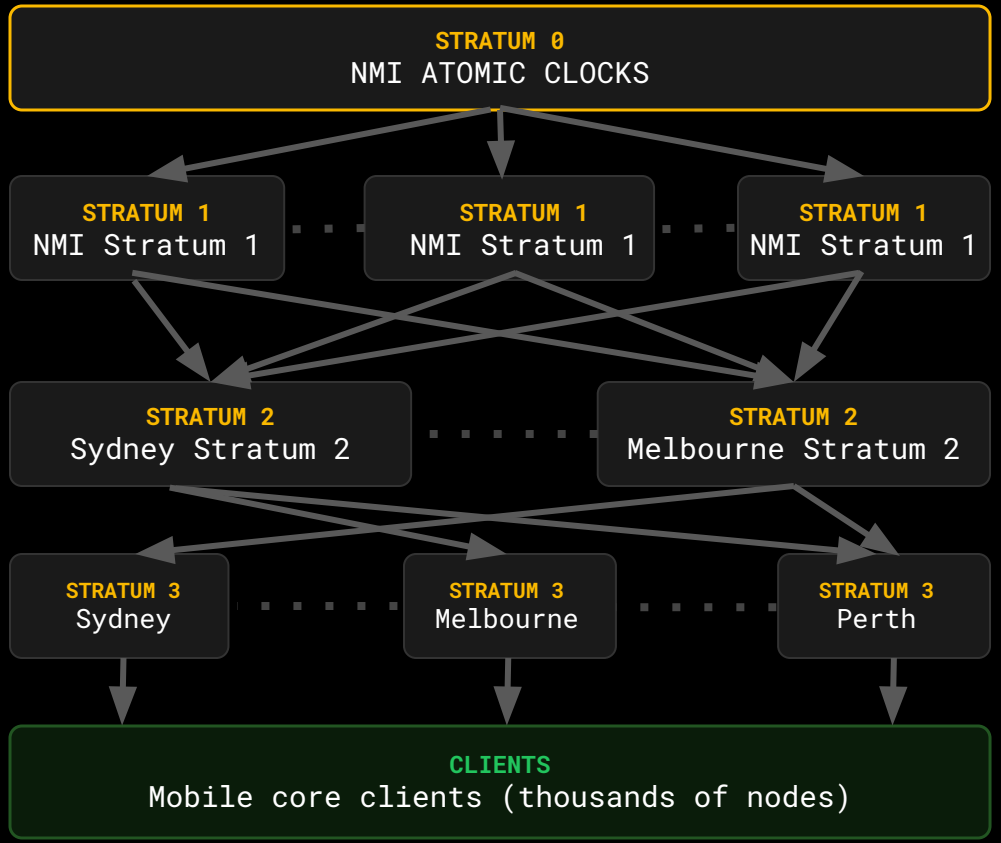
- New chassis could not internally route time from a Stratum 2 server to a Stratum 3 server within the same physical box
- Sydney's Stratum 3 server was forced to draw its time from Melbourne's Stratum 2, and vice versa.
- A workaround that left each city with only a single, remote time source.



2020

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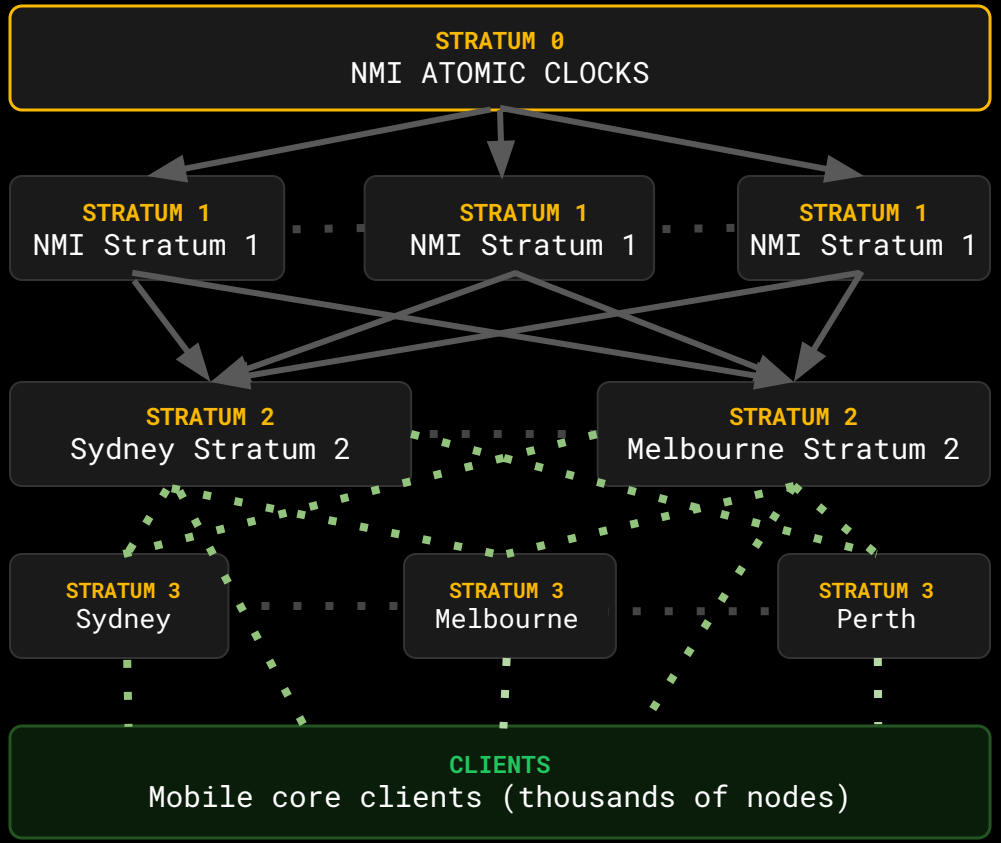
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2020

Unrestricted Peering Introduced

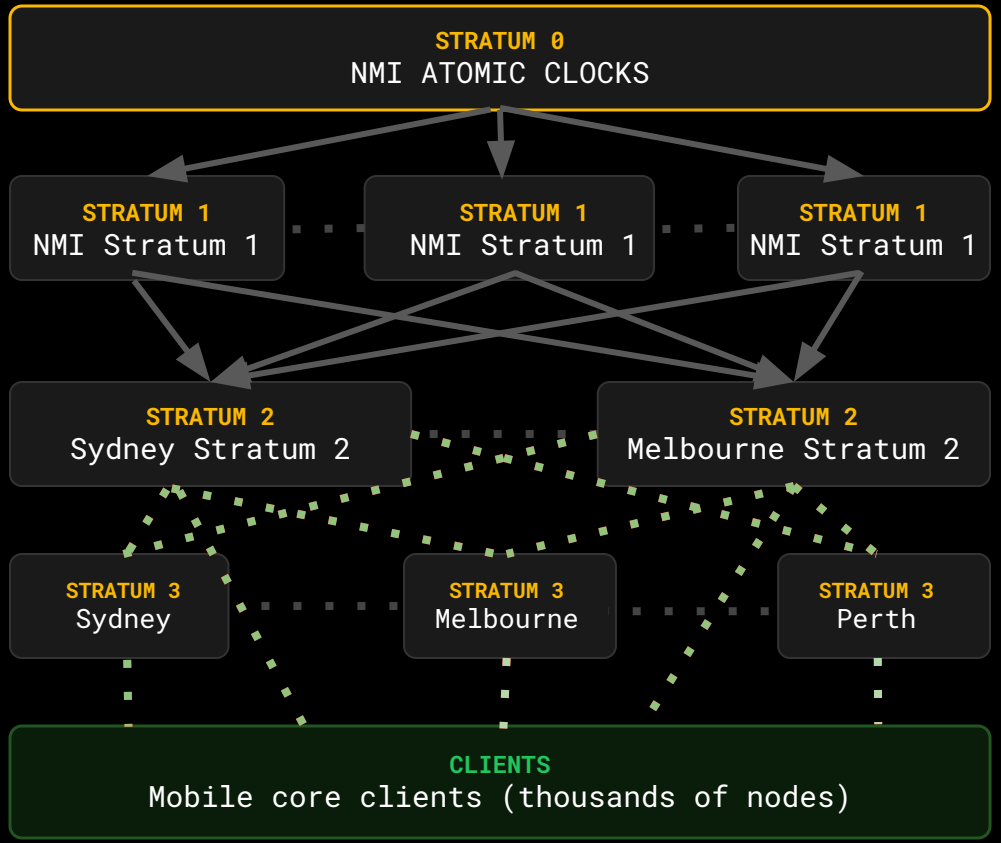
- Peering introduced, likely as compensation for lost local Stratum 2 redundancy
- Nodes could pull time from whichever server or client algorithmically appeared most stable



2020

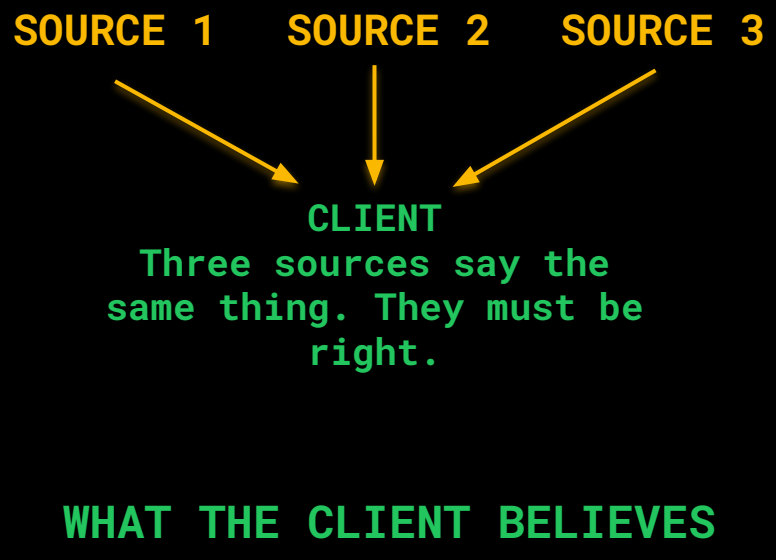
Unrestricted Peering Introduced

- Network can survive the loss of an individual source more gracefully, but at the cost of introducing a hidden risk of circular timing loops



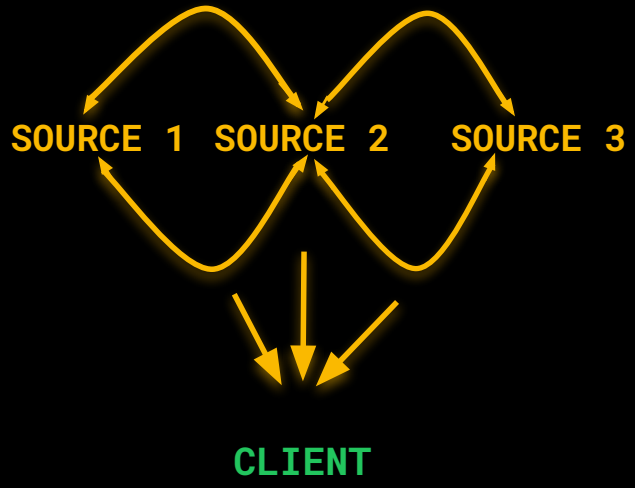
A Timing Loop?

- Circular Dependency where sources validate time against each other in a closed loop, not to an authoritative external clock.
- It gives the illusion of consensus. NTP relies on majority agreement; a loop reflects bad time back and forth, making an error look universally confirmed.
- Once an error enters the loop, it overrides NTP's built-in outlier detection because the sources no longer act independently.



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IN REALITY

Hears the same answer from three sources that should be independent.

// a known degradation of lost redundancy (...) and unknown degradation of looping *

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- TAP Report

October 2025 - things that did happen

The Complaint:

- Melbourne kept losing its only stratum 2 source in Sydney, several times a day
- Peering went looking for a replacement, sometimes a node beneath it
- Melbourne, a stratum 3 server, was reporting stratum 5

The Fix:

- A GPS card, unused in the chassis since 2020, was connected to the stratum 3 server
- Melbourne now had a source of its own that did not disappear
- The alarms stopped

By every visible measure, it worked

October 2025 - things that did not happen

1. **The cause was never established**

No root cause was found. Whatever was breaking the Sydney link was still there in July 2026, still unknown

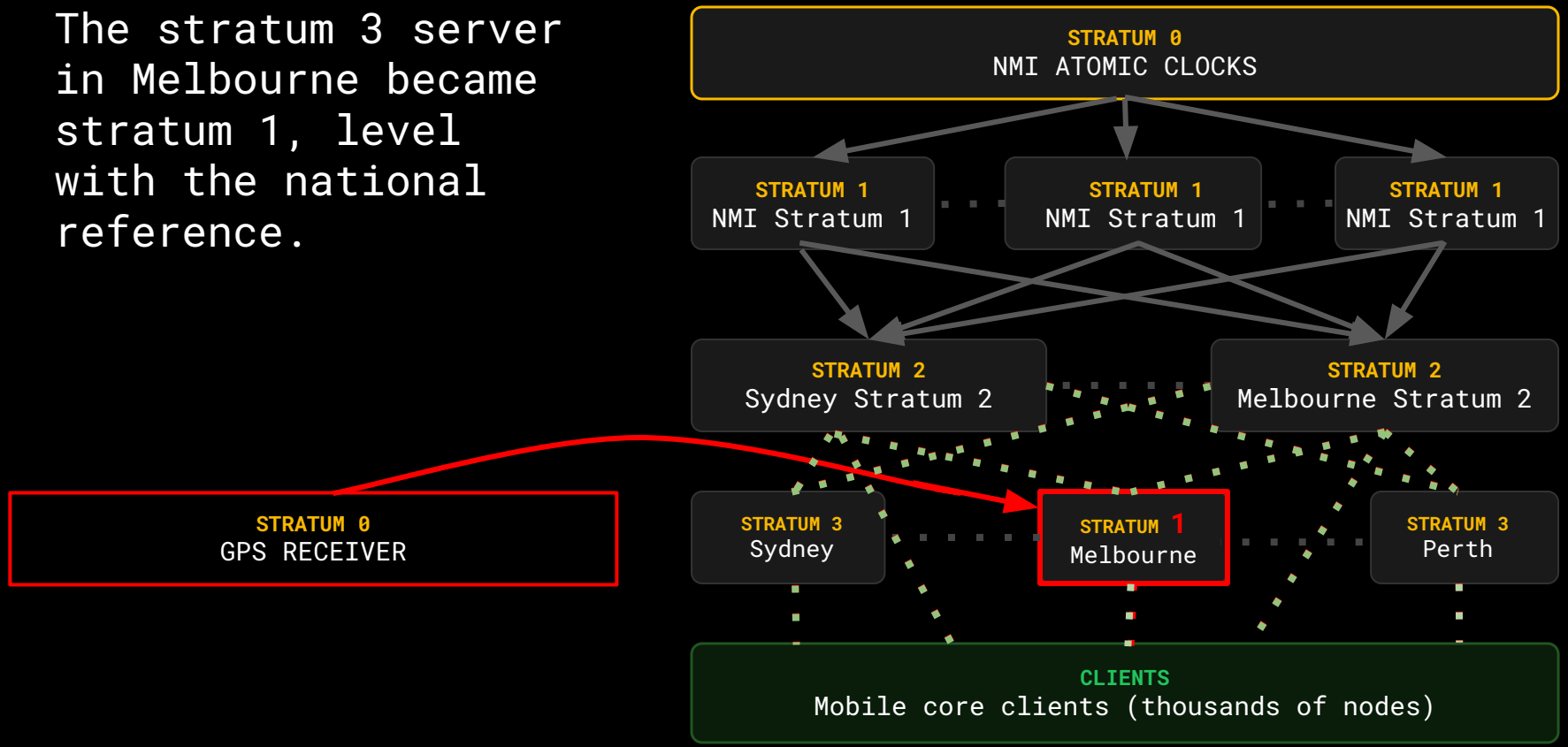
2. **Nobody registered the promotion**

A GPS card is a stratum 0 reference, the server it feeds becomes stratum 1. To NTP, Melbourne now carried the same weight as the national reference.

A workaround had quietly become the most authoritative source in the network – unreviewed, undocumented, monitored by no one.

Nothing was left of the 2010 design

The stratum 3 server in Melbourne became stratum 1, level with the national reference.



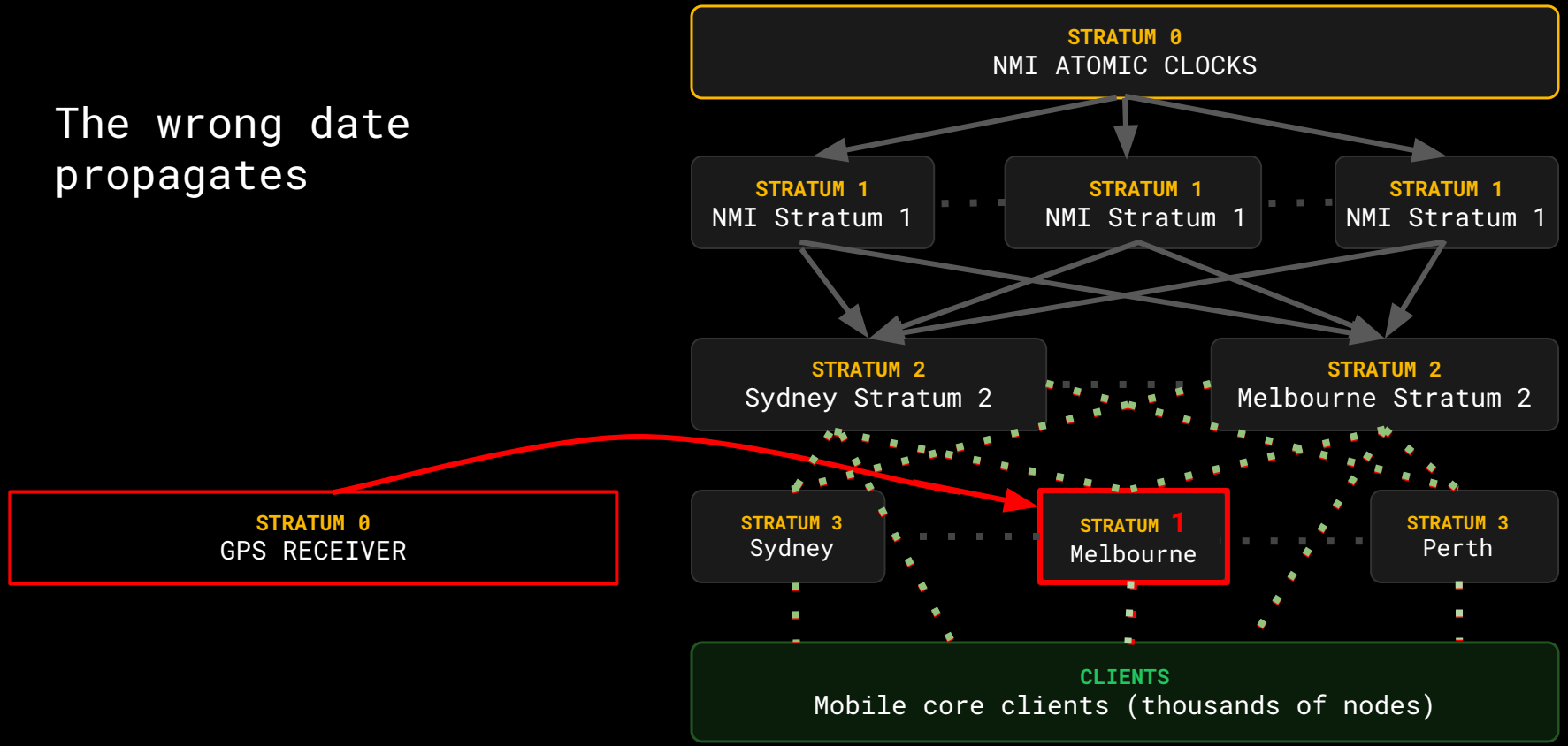
GPS and the 10 bit field

- The GPS week number is a 10 bit field
- Every 1,024 weeks, roughly 19.6 years, the counter wraps
- A running receiver keeps counting, and never has to ask which epoch it is in
- At a cold-start, the only answer lies in the firmware

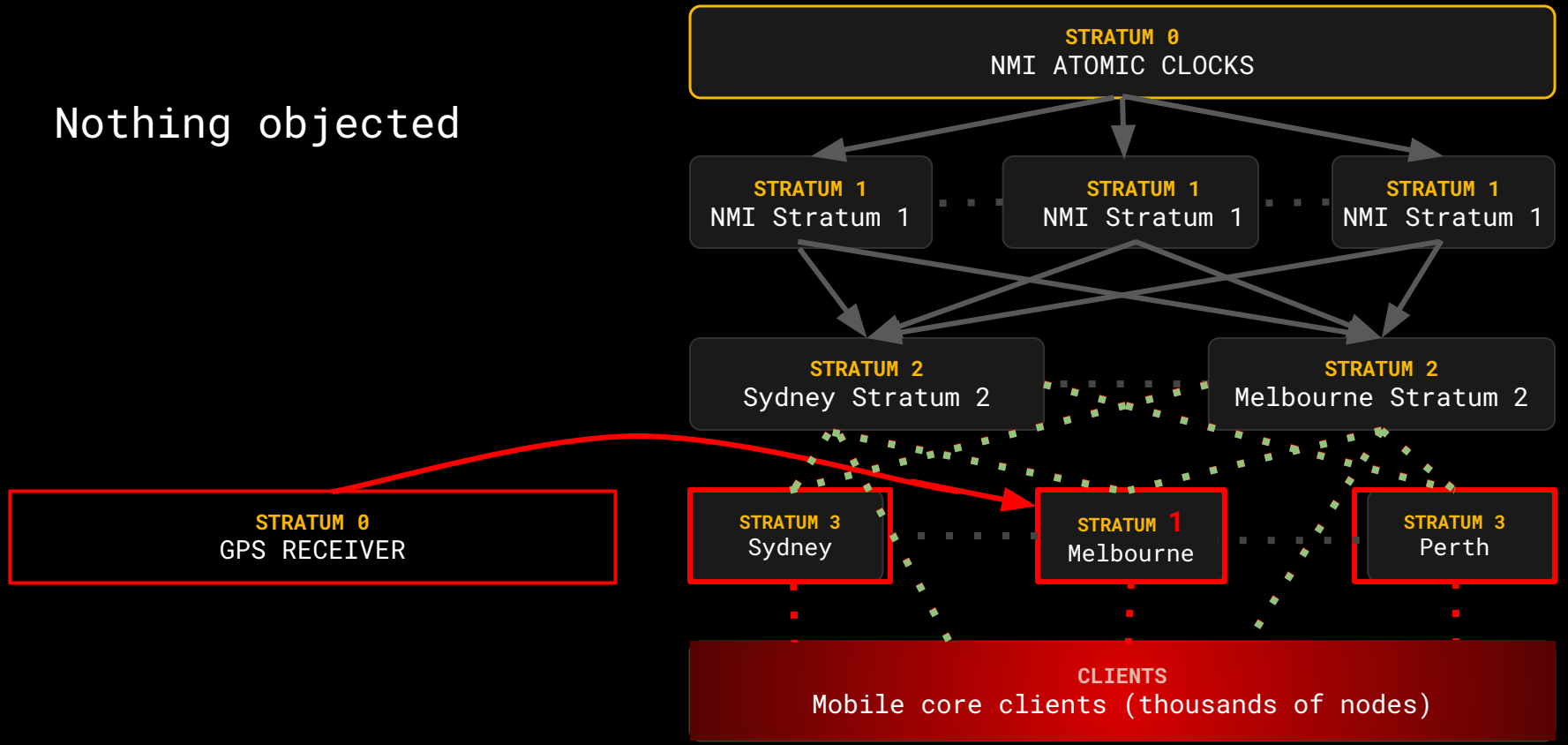
GPS and the 10 bit field

- The firmware on the Melbourne card had not been updated and predated the 2019 GPS rollover
- It was working well, until a maintenance job rebooted it
- The date came out 1,024 weeks in the past, November 2006

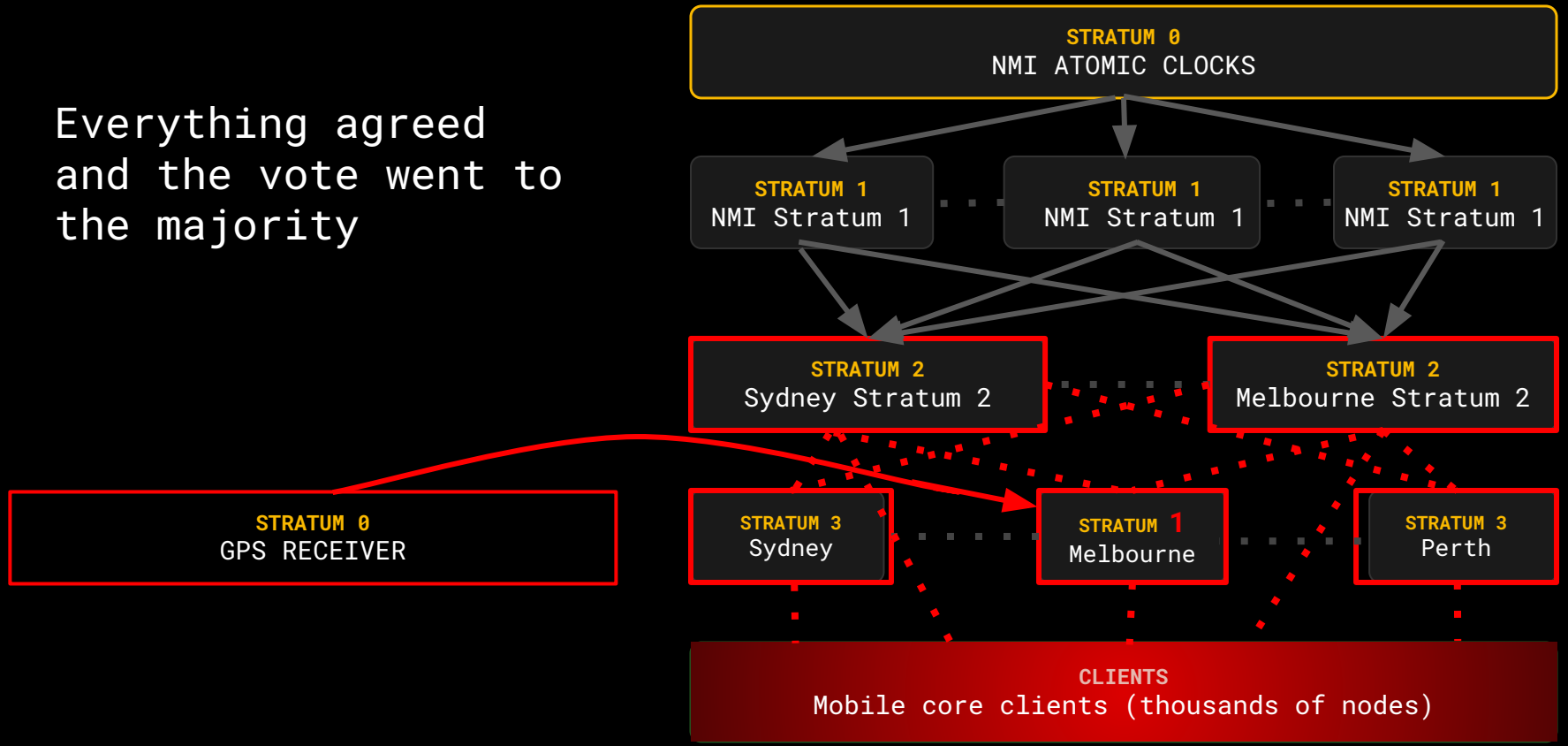
The wrong date propagates



Nothing objected

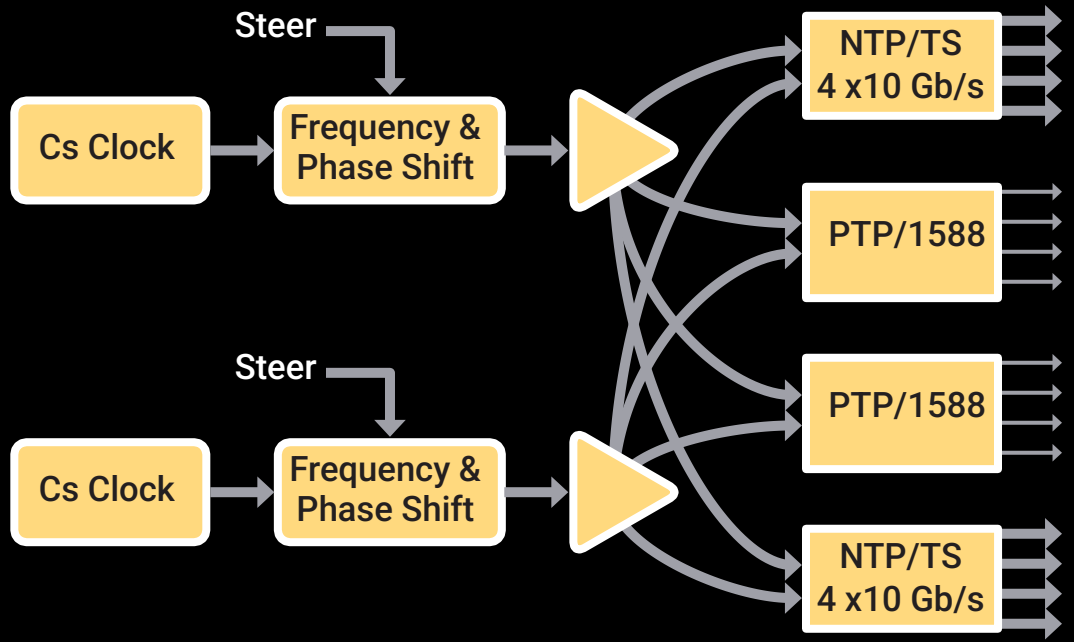


Everything agreed and the vote went to the majority



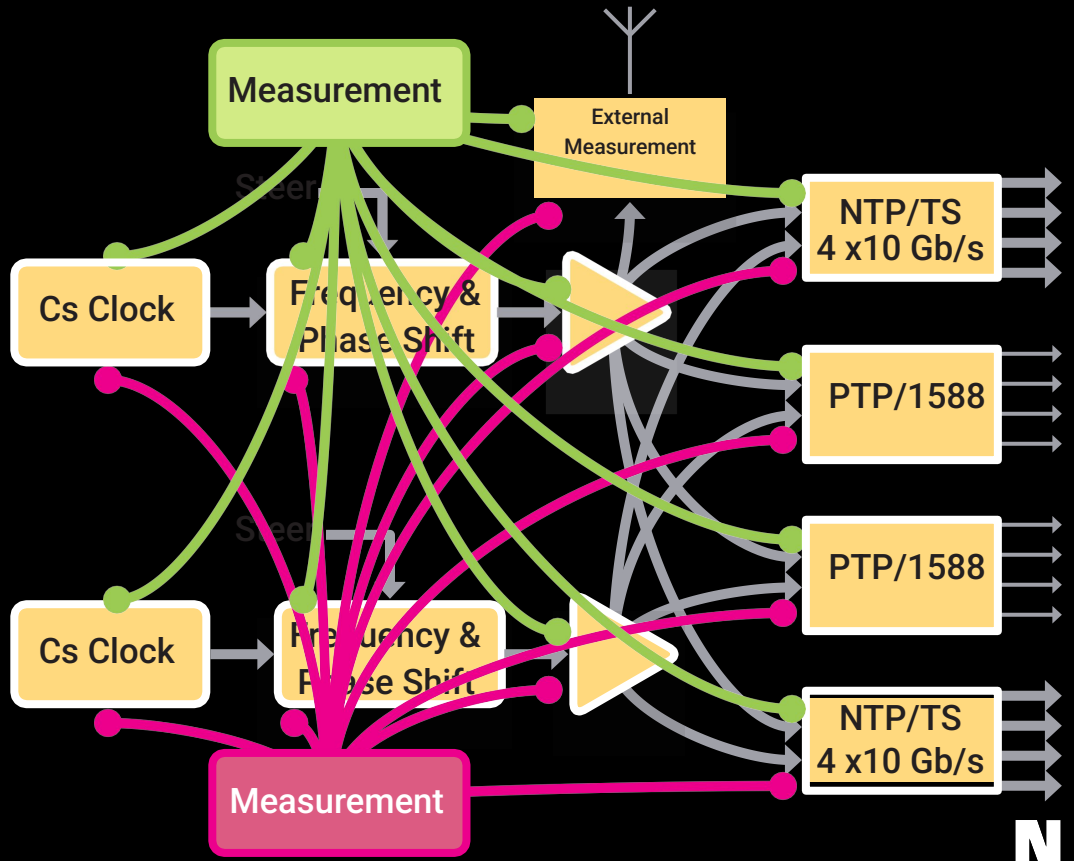
Time-node

- All equipment in the node is constantly monitored for correct time.
- A node has two independent measurement systems.



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Summary of Findings

- Unclear and insufficient NTP ownership and lack of recognition of its importance as a Sovereign Function.
- No end-to-end architecture for mobile core Timing.
- Insufficient technical expertise for NTP and the need for stronger competency and more curiosity.
- Increase attention to the operation and management process discipline in all areas. There were several instances of insufficient execution discipline for NTP including change management, configuration control and incident management including elements of attention to detail, record keeping and documentation and follow through.

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