



Quincy Data

# Quincy TSaaS: Toward a Unified Time Synchronization Architecture

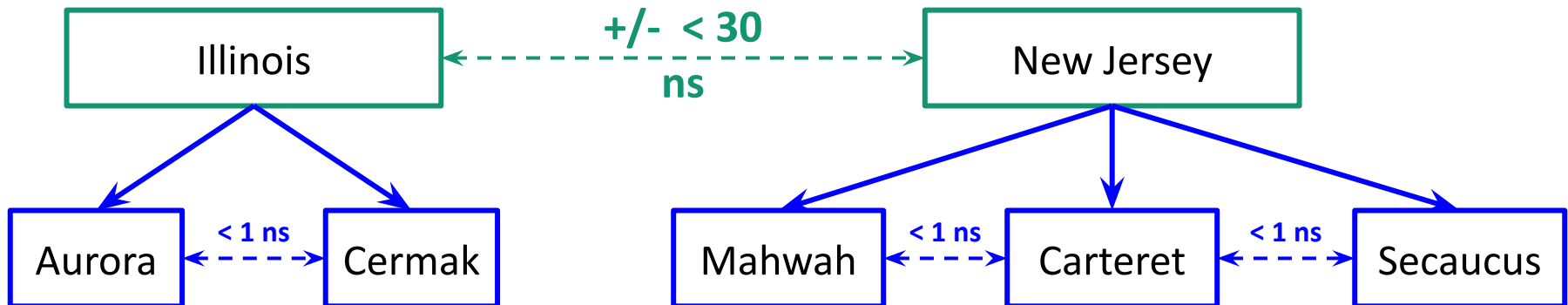
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# Single Clock Domain

A **single source of time** synchronizing clocks spanning major US Trading Venues

Motivation: high quality **internal timestamps**

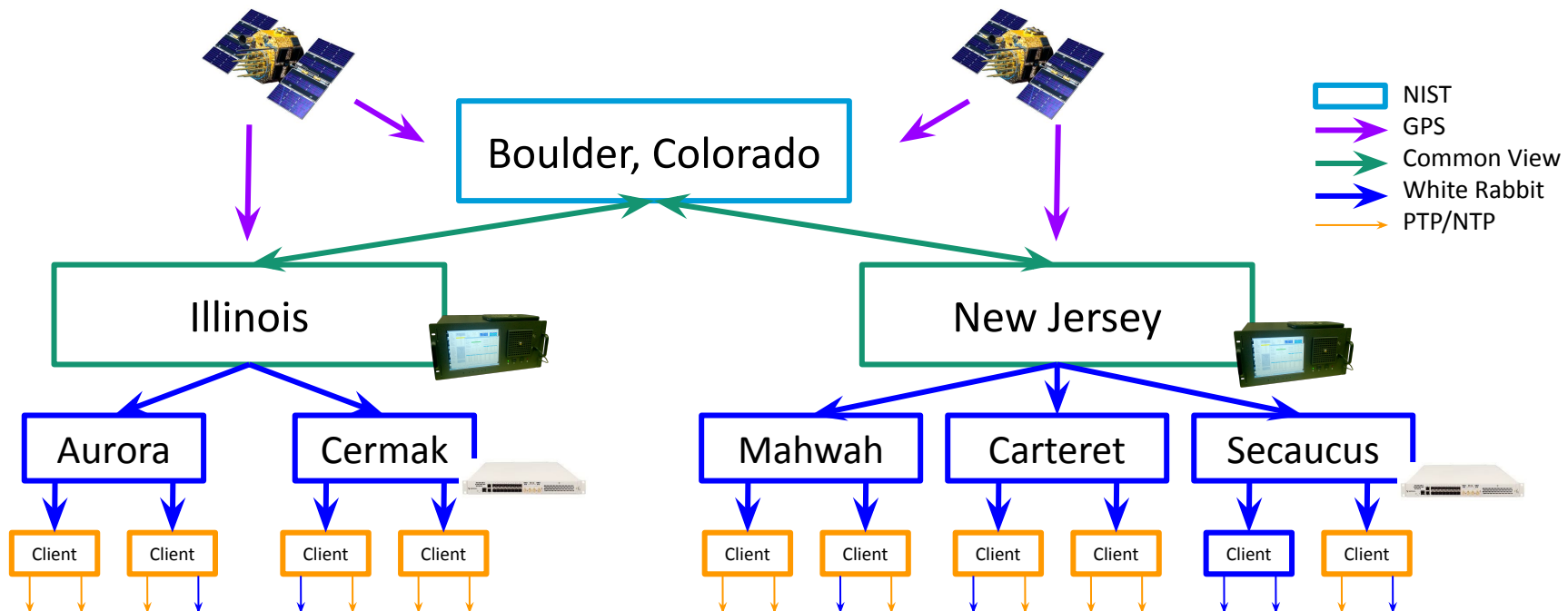
- Improving **accuracy** and **precision**
  - Increases utility and value of captures
- Initial requirements
  - Include all **major US trading venues**
  - **Subnanosecond** precision within metro
  - **Better than 30** nanosecond precision between NJ and Chicago
  - No single point of failure



# Time Transfer Techniques

- Assisted GNSS (GPS) time transfer
  - NIST Time Measurement and Analysis Service (TMAS)
  - Better than **15 ns** accuracy
  - **Traceability** to UTC(NIST)
  - Enables **transcontinental** transfer

- White Rabbit
  - **Subnanosecond** precision
  - Existing infrastructure
  - Data center transfer and, with effort, **metro**
- PPS
- PTP/NTP

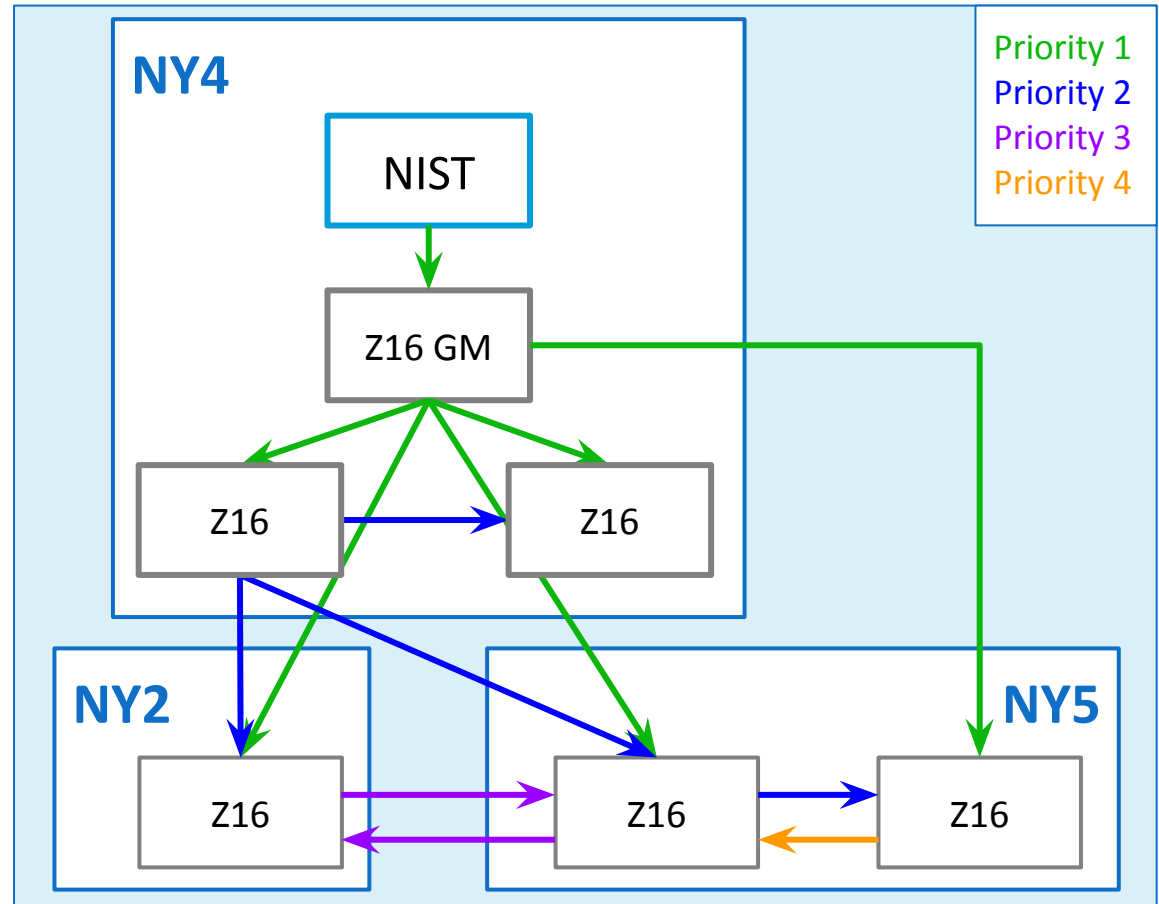


# Building a Fault Tolerant Service

- Redundant resources
  - Lots of diverse **dark fibers**
  - Multiple **NIST TMAS** reference clocks
  - Rubidium(Rb) **atomic clocks** for holdover
  - Redundant **White Rabbit** hardware
- Configuration and topology
  - No single point of failure
  - Never split **clock domains**
  - Maintain **traceability**

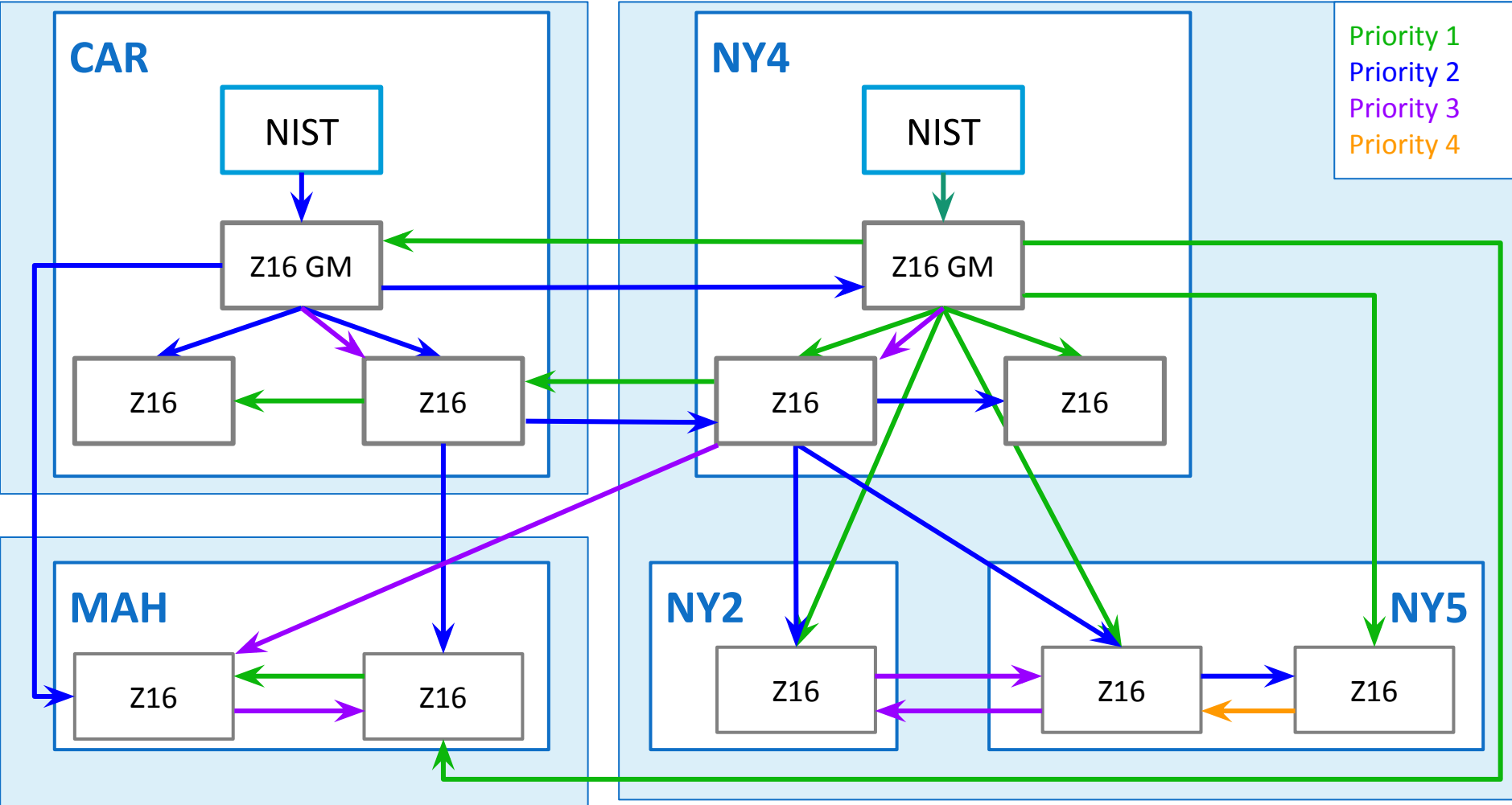
# DC/Campus TSaaS Fault Tolerance

- Safran Failover Clock Algorithm (FOCA): “Out of the box” support with minor caveats
- GNSS redundancy at metro level

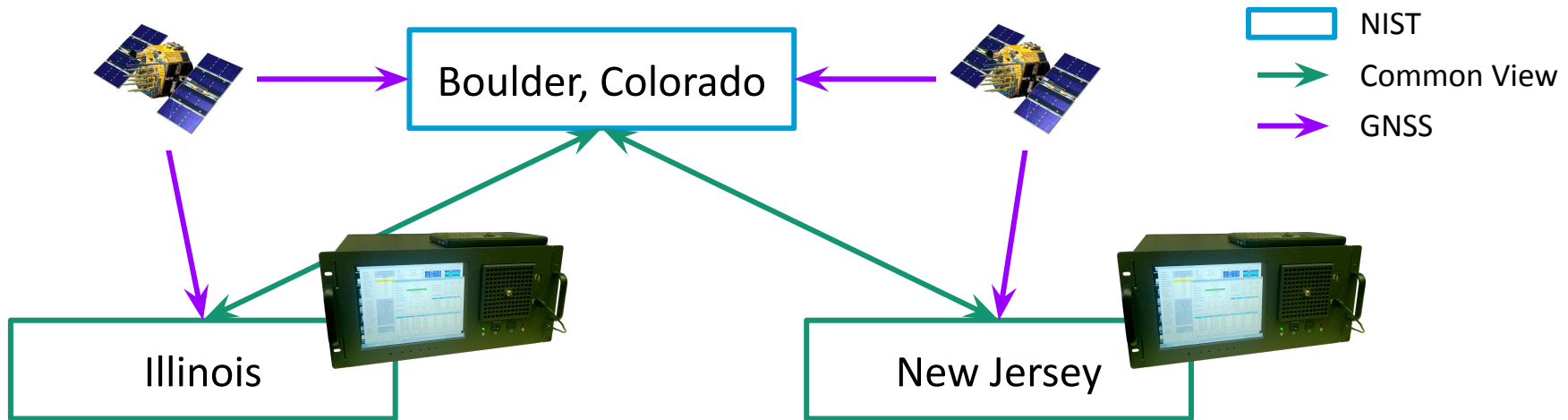


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# Metro White Rabbit Networks



# Common View



- **Dual NIST devices** in each domain with Rubidium atomic clocks for holdover
- **Common view** (CV) time transfer provides traceability to UTC(NIST)

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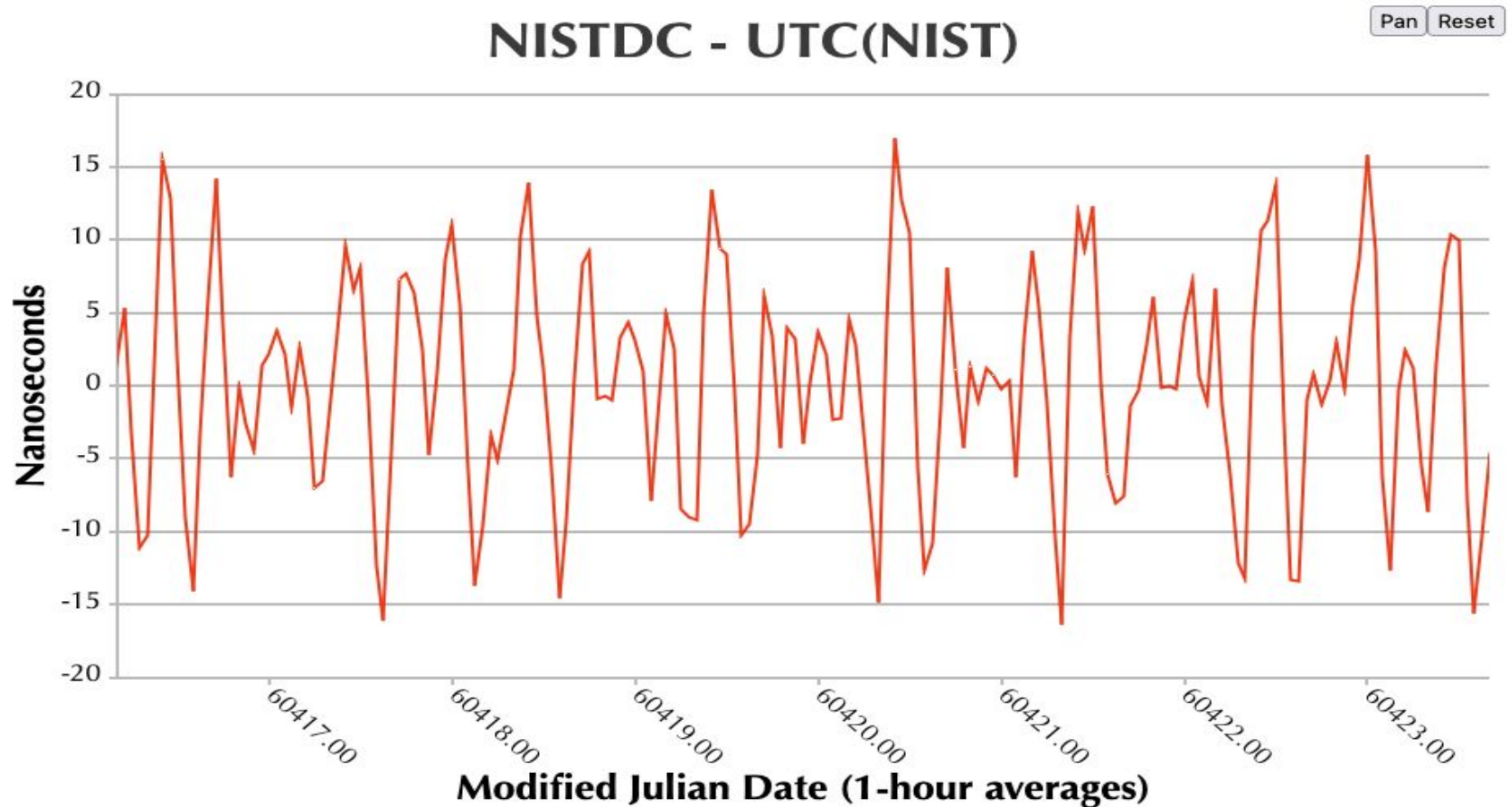
# NIST/TMAS Failure and Traceability

- Complex failure modes:
  1. **All good**: GNSS locked and CV working
  2. **No NIST**: CV failed and GNSS working
  3. **Rubidium clock holdover**: GNSS failed
- When CV fails local TMAS loses traceability
- But we maintain **synchronization** and **traceability**:
  - **Monitor the offset** between two NIST devices
  - Using **survey mode** and/or time interval counter

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# Secaucus TMAS Performance



# Quincy TSaaS: Future Directions

## Time Synchronization as a Service

- Today many firms have White Rabbit for NJ Triangle but:
  - **Difficult to build** and **maintain** a robust solution
  - Everyone has picosecond precision but **no one agrees on the time**
- Quincy TSaaS is **Unified Time**: picosecond precision with traceability UTC(NIST): we all agree on the time



# Full Picture Conclusion

- Current status
  - **New Jersey** hardware installed and **under test**
  - Redundant fiber nearly complete in New Jersey
  - Full solution available: **later this summer**
    - Subnanosecond in New Jersey and Chicago metro
    - Expect 15 nanoseconds between NJ and Chicago
- **Future directions**
  - Expand beyond North America
  - Redundant White Rabbit domains
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