

Robust Redundant Time Servers for Anti-Spoofing Protection

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Resilience Problem

- Threats, hazards, and disruptions are present across critical systems whether intentional or unintentional
 - Jamming, spoofing, man in the middle, network cyber attacks
 - Time discontinuities (leap seconds, week rollovers), source errors, user error
- Existing interference detection mechanisms are based on live data as it passes through the system
- Existing control mechanisms include intermittent system disciplining (“The Flip”) that reduce the attack surface to only during the active disciplining periods
- Only way to remove the attack surface is to completely disconnect the live input data from the output path until it can be qualified
- New patent pending concept includes intermittent disciplining with an independent cascaded disciplining stage

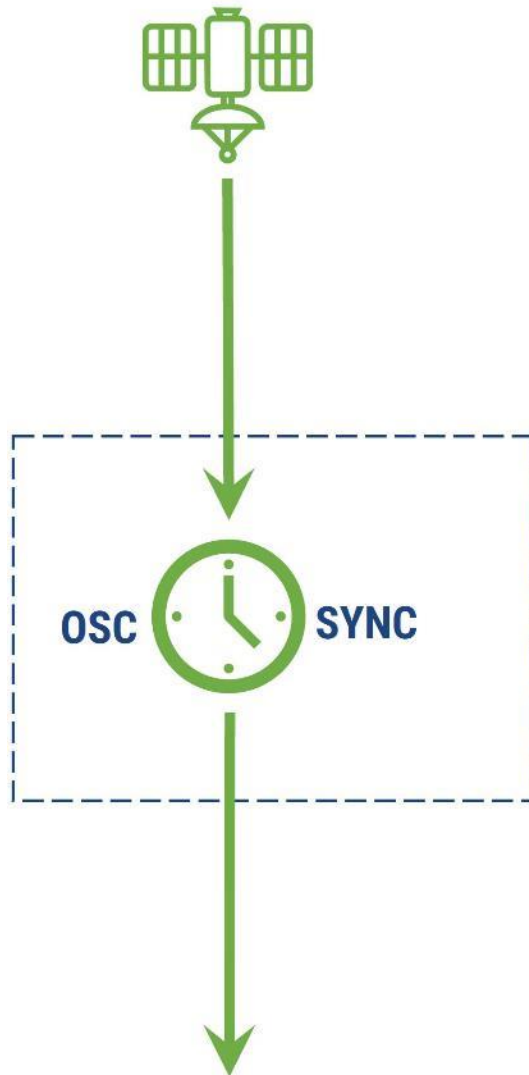
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Concept Comparison

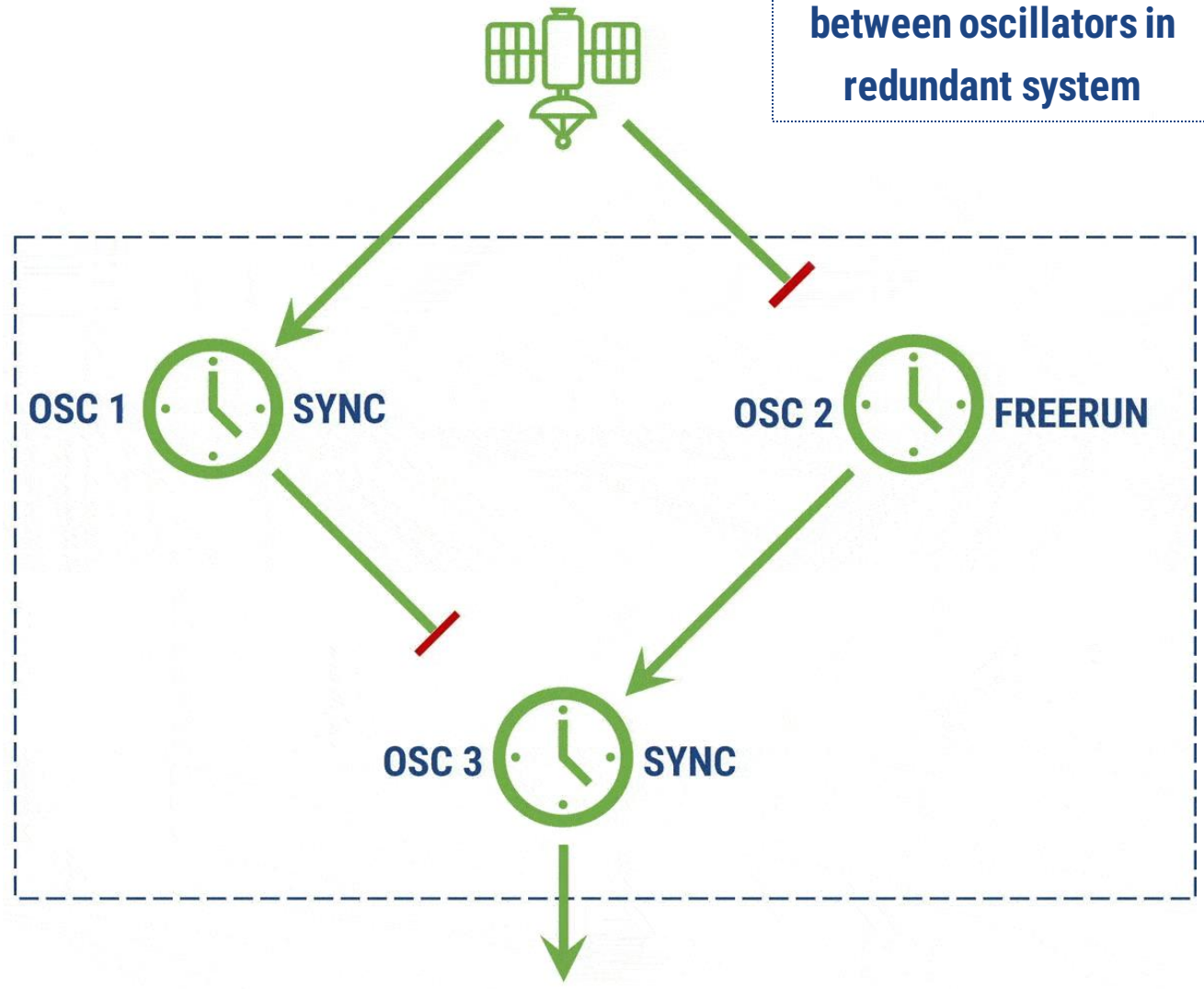
NORMAL OPERATION

DISRUPTION

RECOVERY



REDUNDANT



Synchronization rotates between oscillators in redundant system

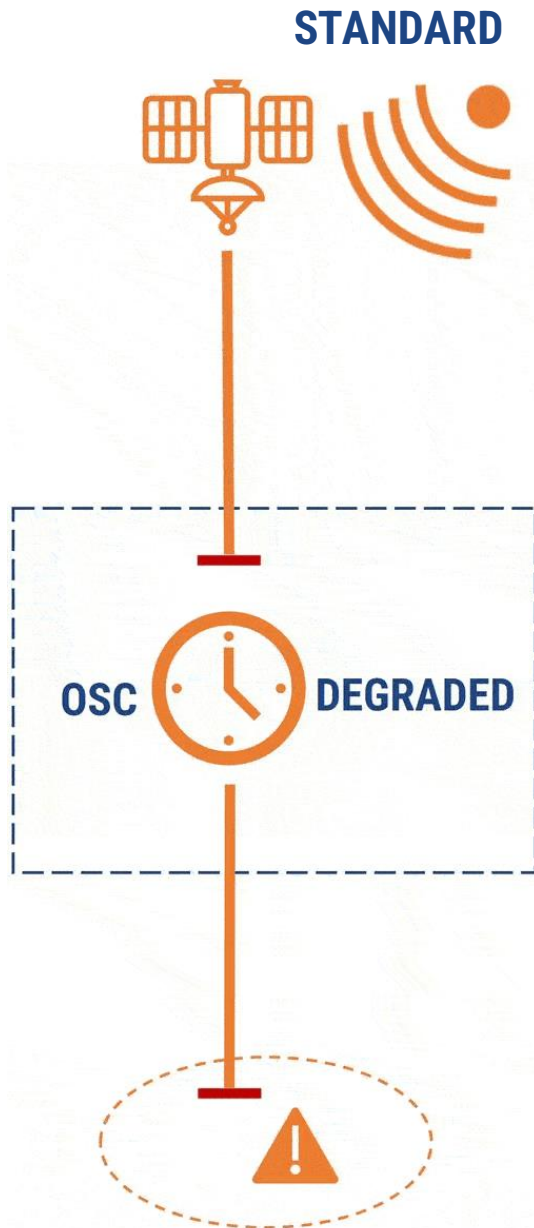
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Concept Comparison

NORMAL OPERATION

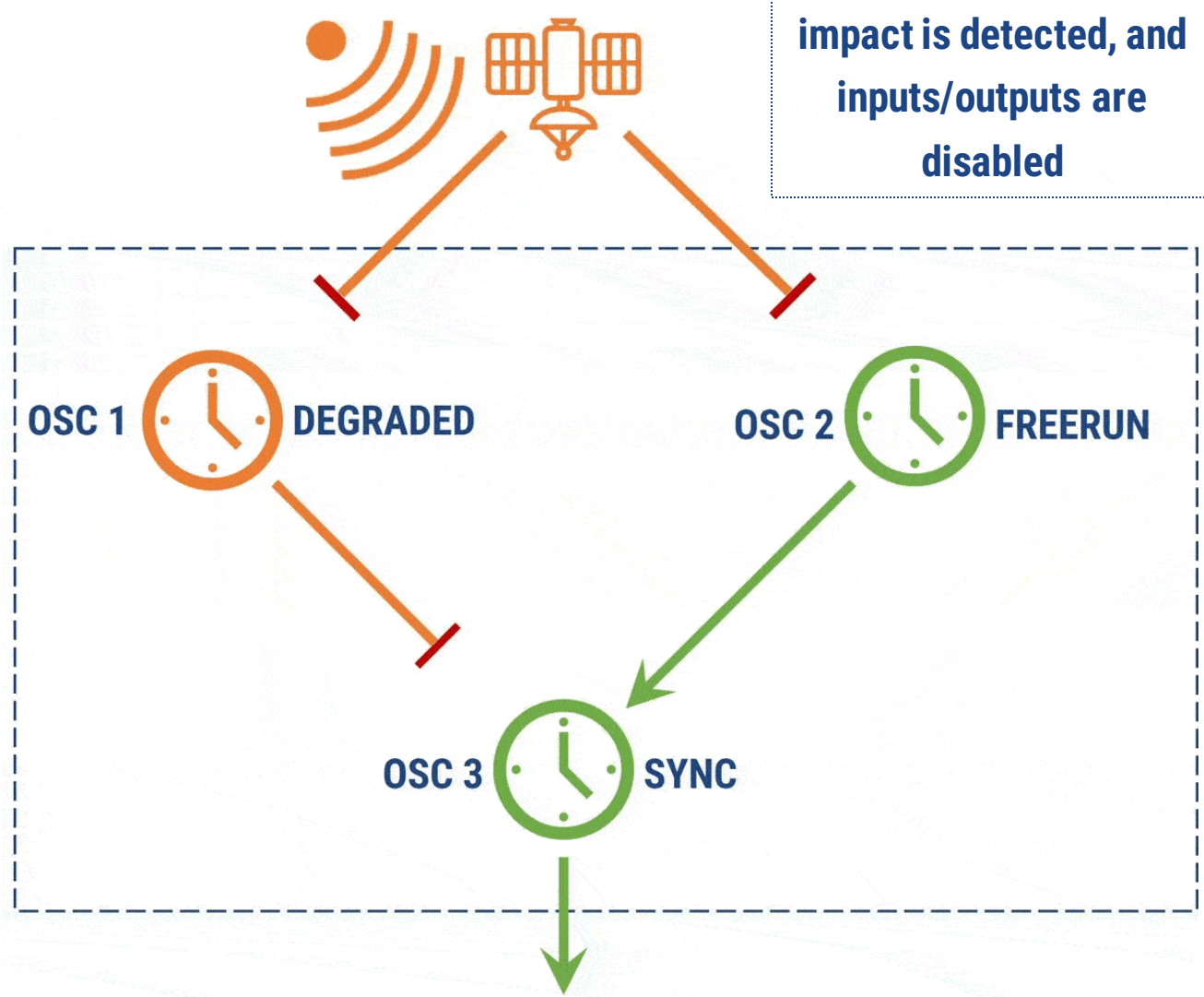
DISRUPTION

RECOVERY



REDUNDANT

Disruption starts, impact is detected, and inputs/outputs are disabled



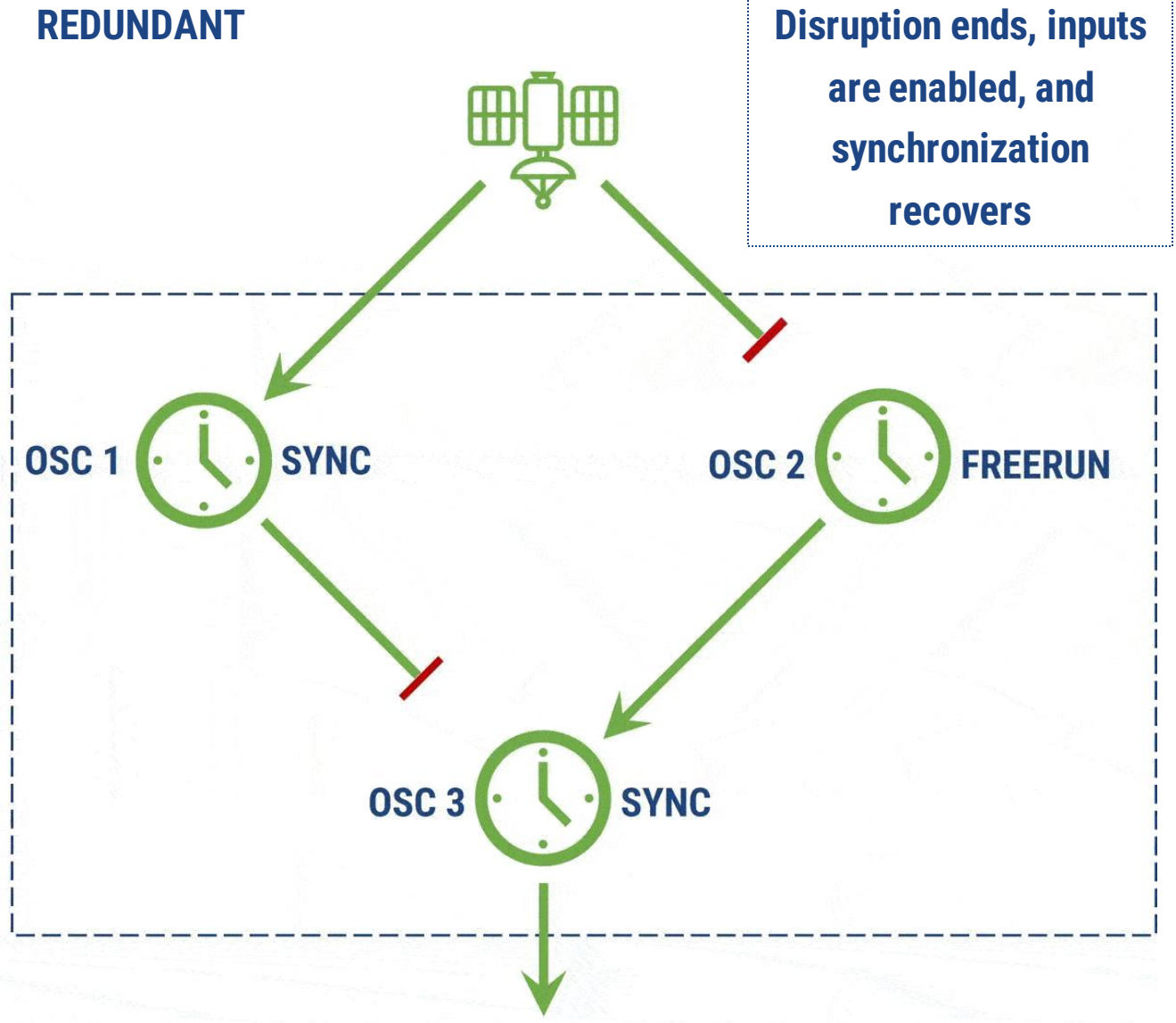
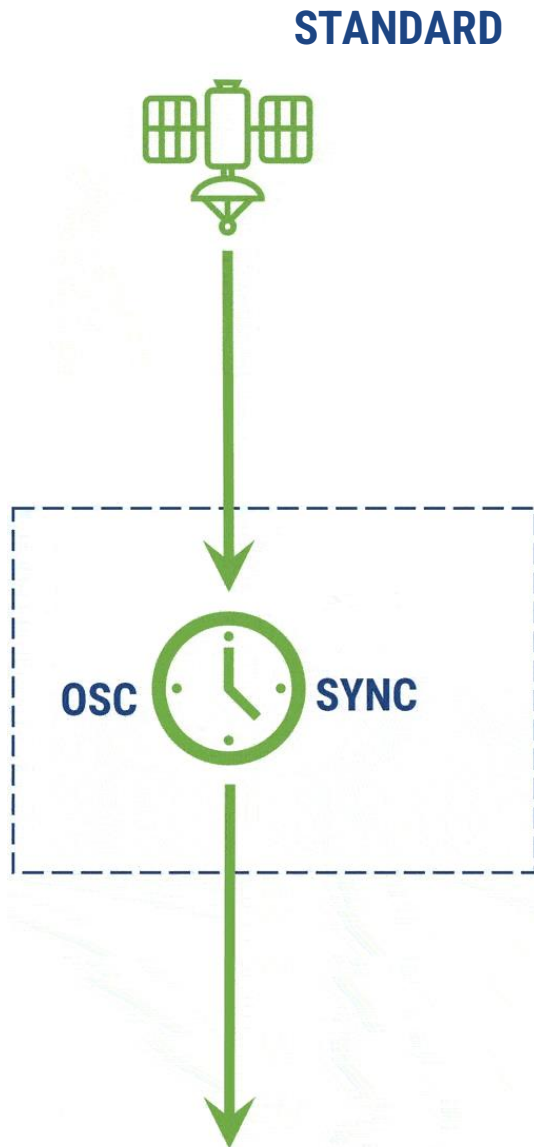
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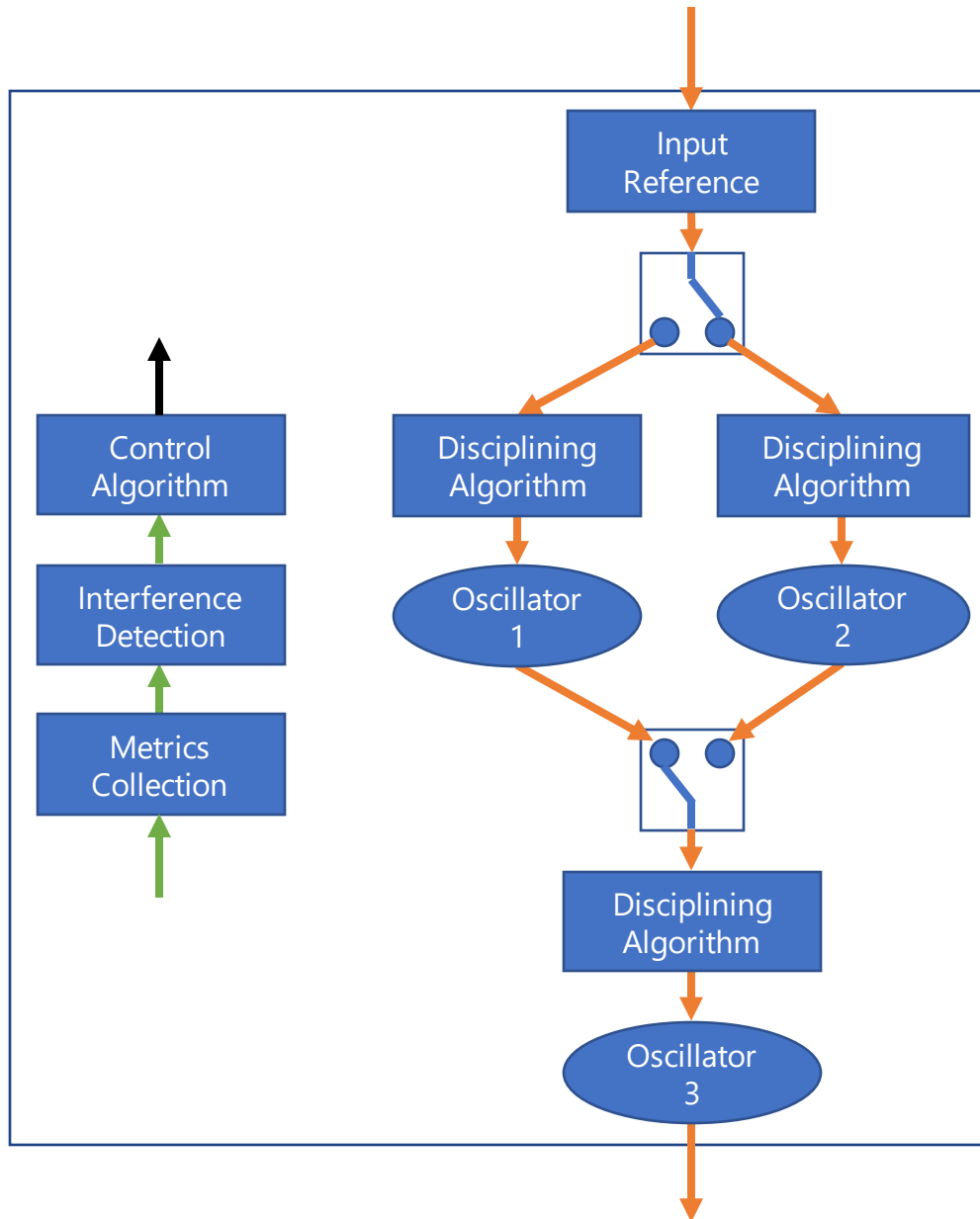


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Concept Details

REDUNDANT SERVER

DISTRIBUTED REDUNDANT
SERVER



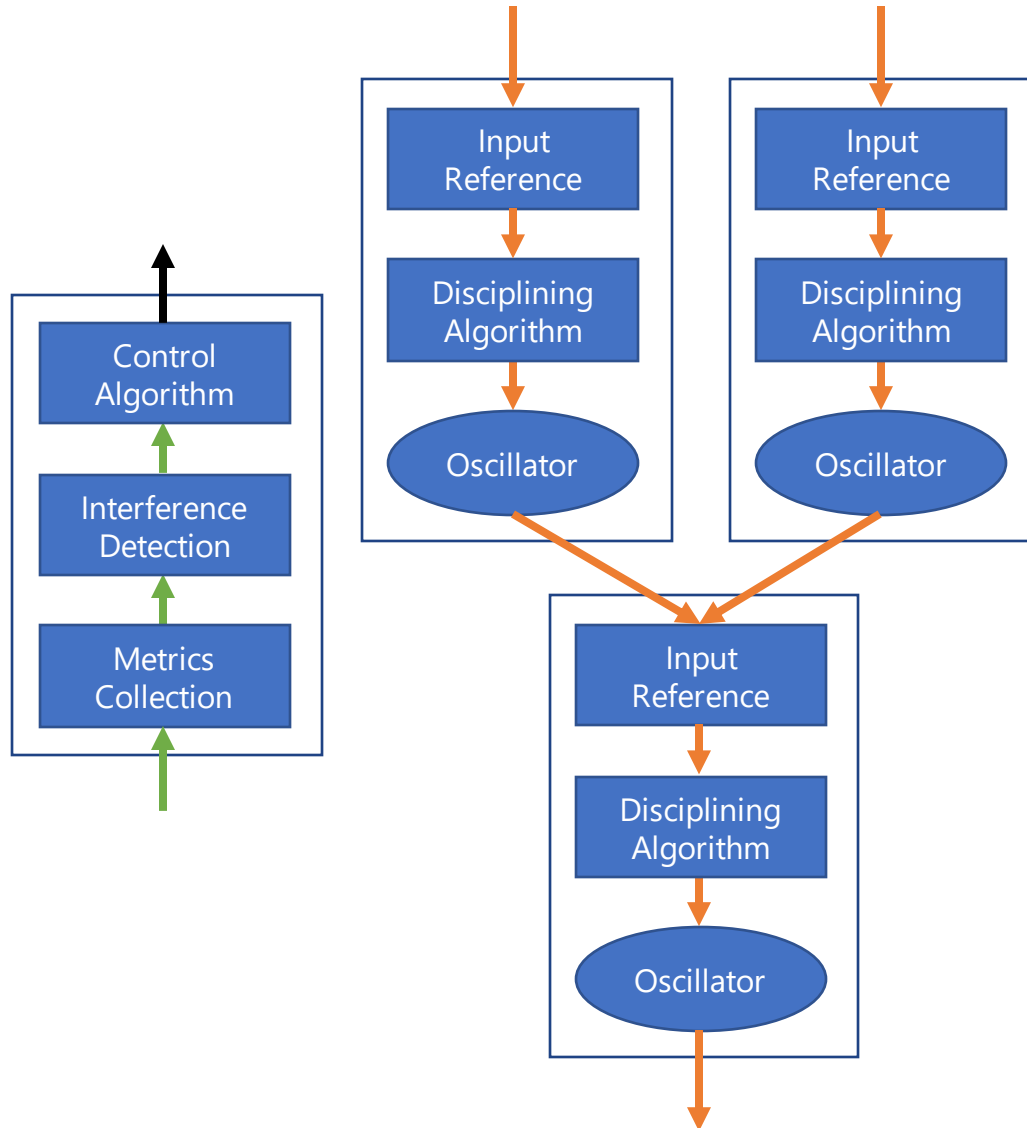
- Redundant Server with interference detection algorithms
- Multiple and cascaded disciplined oscillators
- Rotation between disciplining first stage oscillators and rotation between oscillator stages
- Free-running first stage oscillator disciplines second stage oscillator

04

Concept Details

REDUNDANT SERVER

DISTRIBUTED REDUNDANT
SERVER

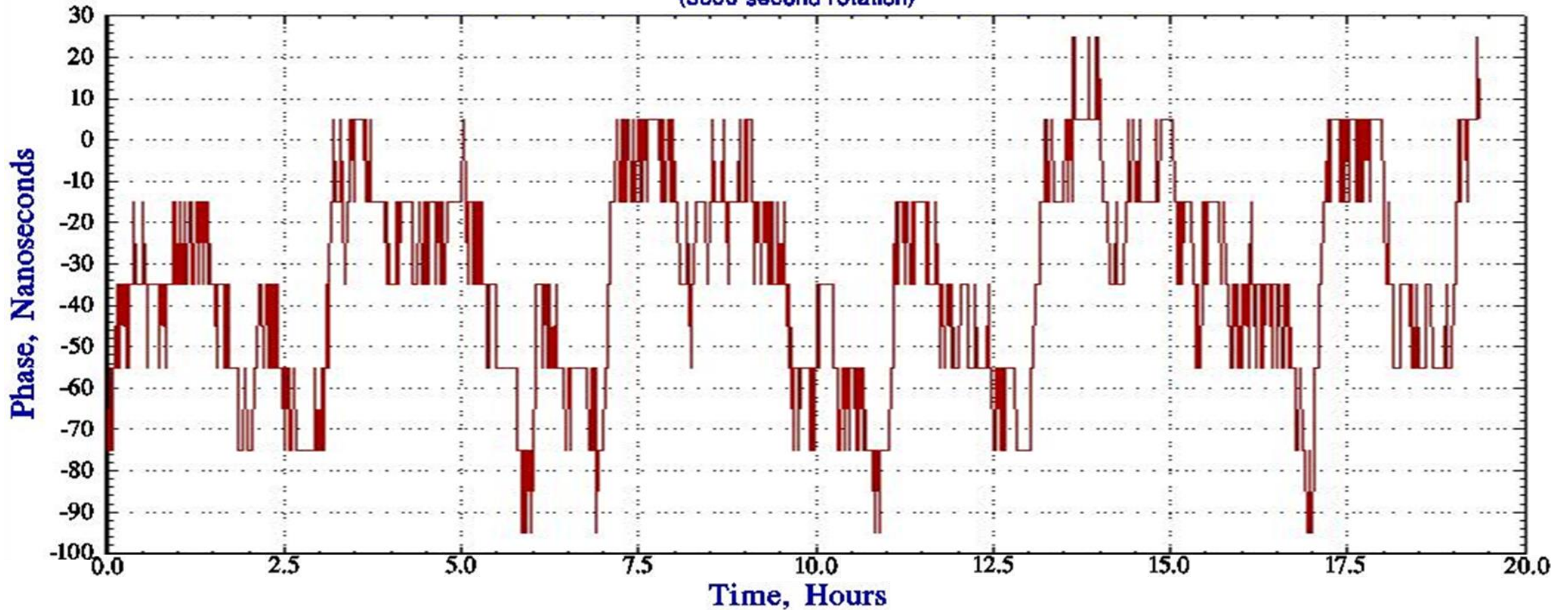


- Multiple cascaded disciplined systems
- Coordinated intermittent disciplining on first stage systems
- Free-running first stage system disciplines second stage system
- Depending on control/metrics capabilities, may be implemented with existing systems

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Sync Results

PHASE DATA
(3600 second rotation)



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For more information...

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POSITIONING | RESILIENT
NAVIGATION | TOGETHER
TIMING