

LMS  
LIQUID-MARKETS SOLUTIONS

THE POWER OF THE POSSIBLE™

The Real Numbers Don't Lie  
Presentation for STAC Fall 2021 GSL

October 25, 2021



96%

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# *Testing & Measurement For Performance Optimization*

**“If you can’t measure it, you can’t improve it.”**

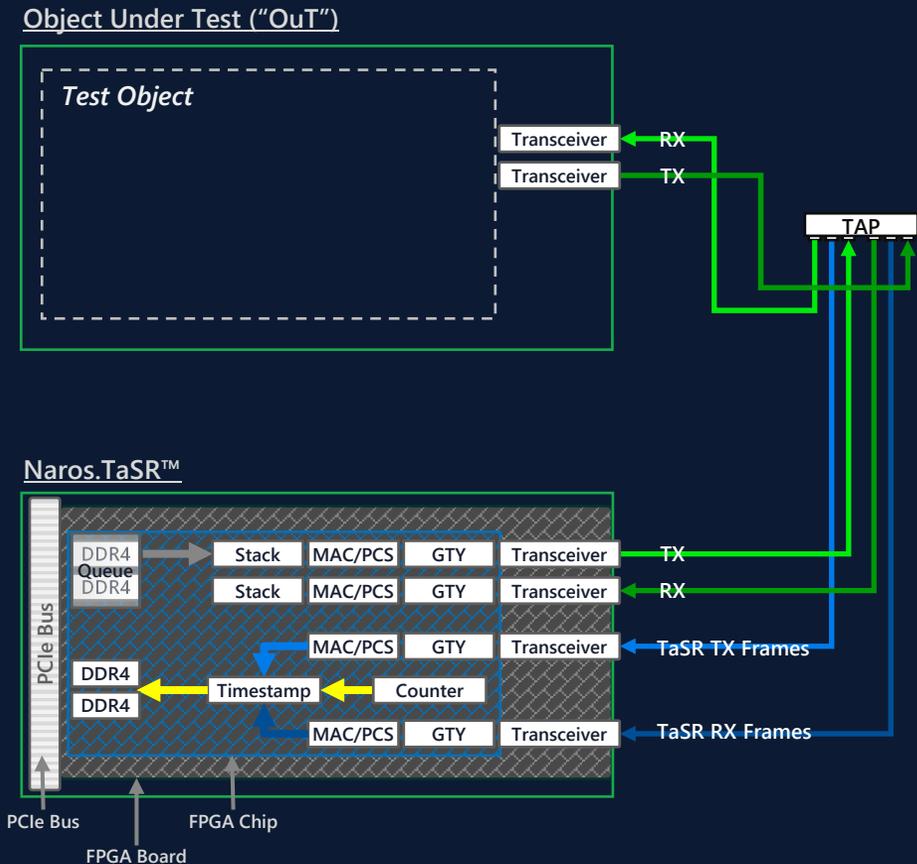
*Peter Drucker*

*If You Don’t Measure You Don’t Know. Full Stop.*



# Testing and Simulation Rig (TaSR)

## How It Works



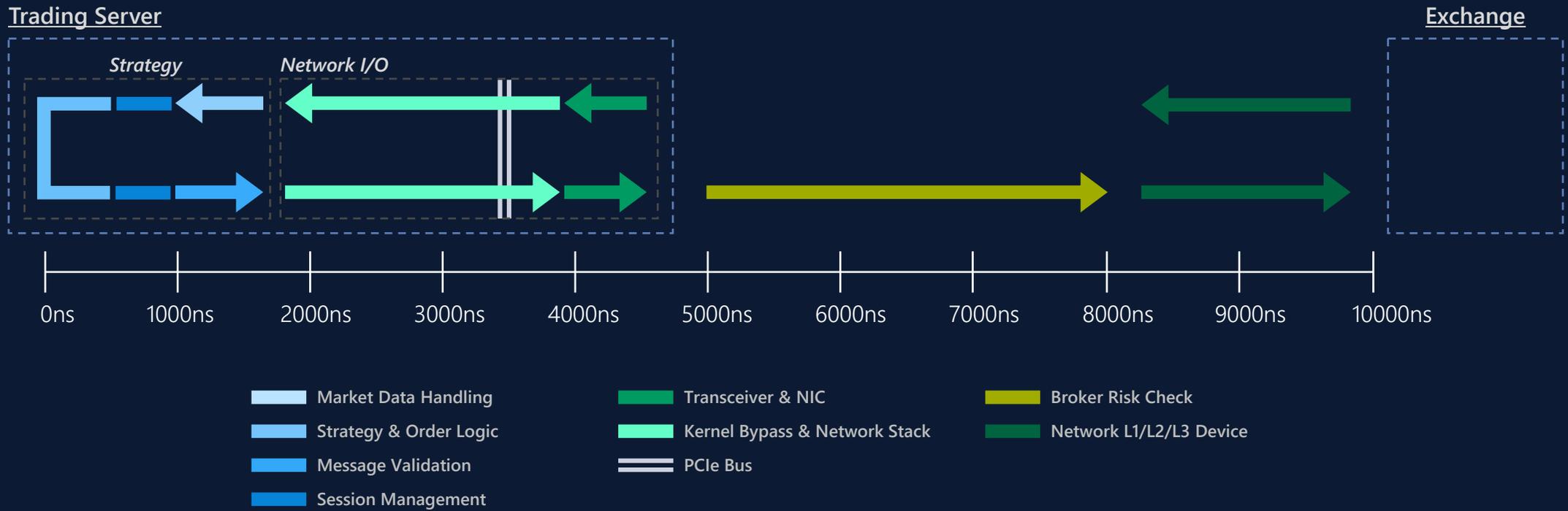
1. Test Data Staged in Queue or Dynamically Generated
2. Frames Released and Transmitted to OuT
  - a) Frames Mirrored at Splitter "A"
  - b) Mirrored Frames Received and Timestamped
3. Frames Received in OuT and Processed
4. Frames Transmitted from OuT
  - a) Frames Mirrored at Splitter "B"
  - b) Mirrored Frames Received and Timestamped
5. Calculate Latency = ("B" - "A") - Fiber Length (6m)

*TaSR Delivers Accessible, Effective, & Deterministic Nanosecond End-to-End Measurement*

# The Totality of Latency

## Components of Latency

### The Totality of Latency Exceeds 10,500ns



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## Understanding The Totality of Latency & What It Costs You



# Components of Latency – Kernel Bypass & Network Stack

## Legacy Solutions Fail When You Care

### Traditional 'Dumb' Adapters

- Software Network Stacks Increasingly Insufficient
- Market Data Routinely Bursts Beyond 2 to 3 Gbps
- Legacy Solutions Do Not Meet Latency or Throughput Needs

### Next Gen Offload/Programmable Adapters

- Global Hardware Offload Market Expanding at 23% CAGR
- Global Market Rapidly Expanding, Doubling to \$4.25B by 2024

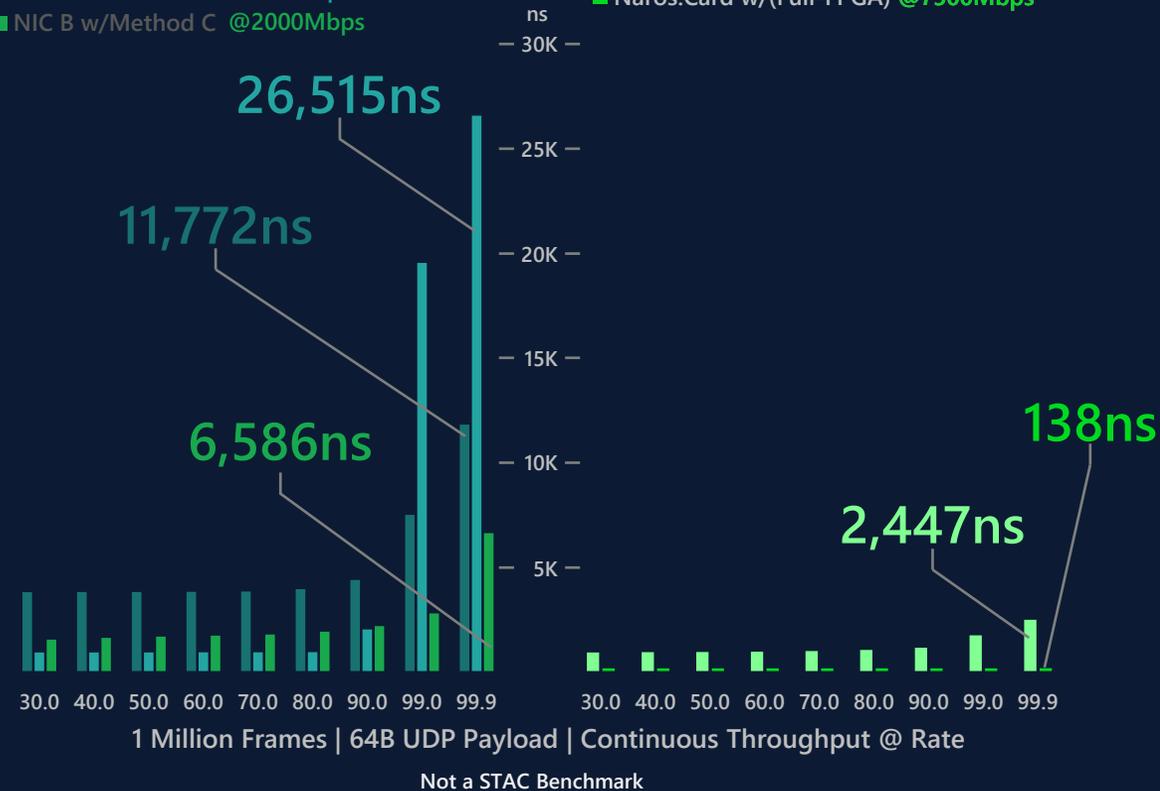
## Performance – L2 SOF I/O Latency Percentiles

### x86-64 NIC

- NIC A w/Method A @50Mbps
- NIC A w/Method B @805Mbps
- NIC B w/Method C @2000Mbps

### FPGA NAC

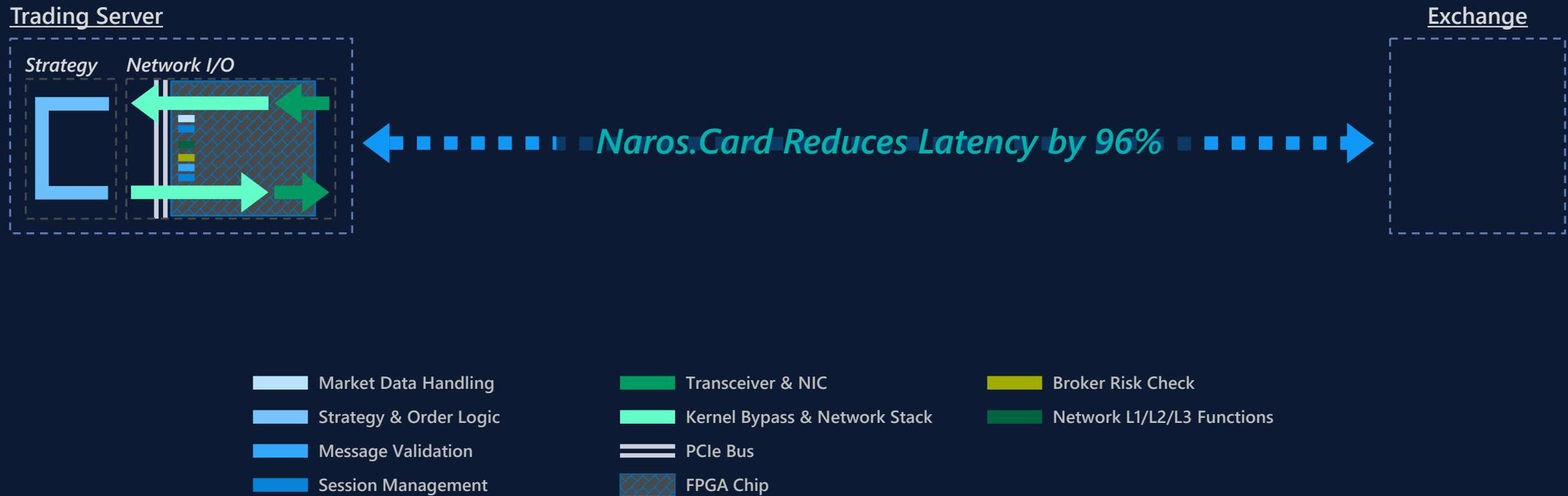
- Naros.Card w/(Hybrid-FPGA) @3000Mbps
- Naros.Card w/(Full-FPGA) @7500Mbps



**LMS's Full Hardware Network Stack Dominates Network Performance. Full Stop.**

# Naros.Card – Addressing The Totality of Latency

## Components of Latency

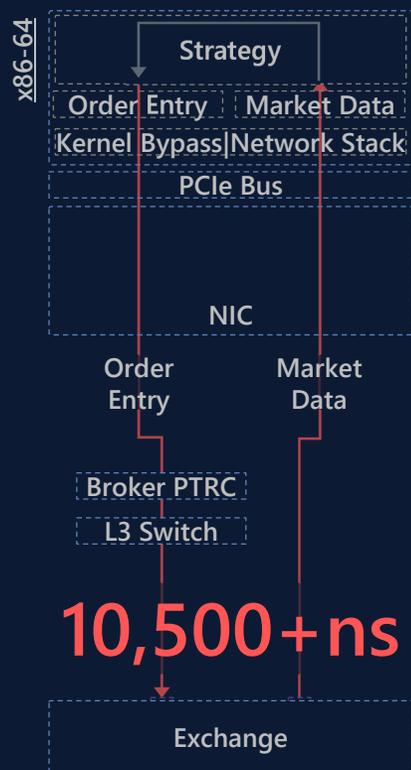


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## Understanding The Totality of Latency & What It Costs You

# Naros.Card - Resolving The Totality of Latency

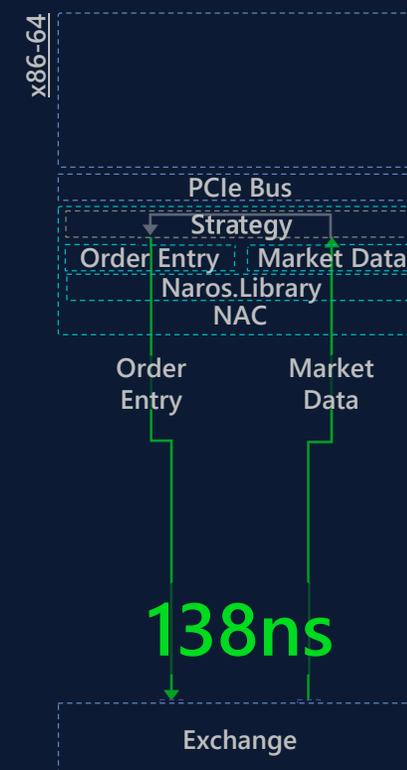
## Legacy x86-64 NIC



## Naros.Card Hybrid FPGA



## Naros.Card Full-FPGA



  End-User Function/Component  
  LMS Function/Component

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**Naros.Card – Uniquely - Delivers A Patented & Complete NAC-Based Network & Trading Stack**

 *If You Don't Measure You Don't Know. Full Stop.*

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*Measurement is Validation. Don't Assume. Know.*

## The Global Standard

Ultra-Low-Latency | Ultra-High-Capacity

Venue Access & Buy-Side/Sell-Side Connectivity

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