# HYBRID TRANSACTION/ANALYTICAL PROCESSING

Inconnouting

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#### WHO IS NEEVE RESEARCH?

- Headquartered in Silicon Valley
- Creators of the X Platform<sup>TM</sup> Memory Oriented Application Platform
- Passionate about high performance computing
- Running in production at Fortune 100-300





# What is HTAP ... What are the Challenges?

# How The X Platform tackles HTAP

# HTAP Use cases



#### WHAT IS HTAP?

Hybrid transaction/analytical processing will empower application leaders to innovate via greater situation awareness and improved business agility.

This will entail an upheaval in the established architectures, technologies and skills driven by use of in-memory computing technologies as enablers. - Gartner 2014

HTAP allows businesses to react to "business moments" ... transient opportunities and risks that exist in the now.



#### TYPES OF APPLICATIONS

- Credit Card Processors
- Personalization Engines
- Ad Exchanges
- IoT Event Processors
- Financial Trading Risk Engines



#### WHAT DO WE NEED?

#### Performance

- I00s of thousands of transactions a second
- Microseconds to low milliseconds processing times

#### Scale

- I0s of millions of records in application's working set
- Scale linearly with the business
- Reliability / Availability
  - Zero message or data loss across network, process, machine or data center failures
- Agility / Ease
  - Write pure Java business logic without concern for above, ability to evolve applications organically
- Intelligence
  - Ability to analyze working state and absorb streaming intelligence <u>quickly</u> to react to business opportunity and risk.

#### Non Functional Needs

**Business Needs** 



#### A SIMPLE ARCHITECTURE (UNTENABLE)



#### THE TRADITIONAL ARCHITECTURE (ETL)



#### **ETL FAILINGS**

#### Scalability

Update Contention in Operational Database impedes scale

#### Performance

- Database read/write round trip latency impedes ability to stream.
- Extract/Transform/Load is slow to avoid impacting operational data
  -> "business moment" is long gone by time analytics yield results.

### Agility

- Data duplication due to mismatch between operational state and data warehouse.
- ETL process is complex leading to fear about changing data warehouse schema and hampers innovation in transactional business logic.









#### ENTER HTAP DATABASES

# **HTAP DATABASES**

Use In-Memory Technologies and Multi-Version Concurrency Control to allow transaction processing and analytical Loads on the same database



#### ENTER HTAP DATABASES



#### SCALING IT OUT – MICROSERVICES

# MICROSERVICES

Decompose Applications Into Individual Services that Perform Business Functions around State Private to that Service With Inter-Service Collaborate Purely Over Messaging. Applications Can Then Scale By Partitioning of State



#### SCALING OUT - STRIPED DATA + SMART ROUTING



n-Memory Computing

#### HTAP DB ARCHITECTURE - REPORT CARD

### Scalability

- ✓ Update contention handled by microservices and data striping.
- -- Still some complexity in scaling data tier and transaction processing tier

#### Performance

- $\checkmark$  Ability to perform analytics without impacting OLTP
- Transaction Processing Performance not optimal due to remote state. Have to scale very wide to absorb analytics streams

# Agility

- ✓ Microservices allows more agile, lower risk delivery
- -- Unclear who owns database schema when database is doing double duty for analytics and transaction processing.
- -- Complexity mapping application state to database schema.



#### Throughput / Latency?







#### TAKING IT TO THE NEXT LEVEL – THE X PLATFORM

### THE X PLATFORM

The X Platform is a memory oriented platform for building *multi-agent, transactional* applications.

Collocated State + Business Logic = Full Promise of In-Memory Computing



#### THE BIG PICTURE



State as Java State in Local Memory Ultra Performance Zero Garbage Fully Fault Tolerant Zero Loss Horizontally Scalable

- ✓ Message Driven
- ✓ Stateful 100% In Memory
- ✓ Multi-Agent

Totally Available
 Horizontally Scalable
 Ultra Performant



#### EXTREMELY SIMPLE PROGRAMMING MODEL

#### MESSAGES



#### BUILD-TIME CODE GENERATION

MESSAGE HANDLERS

Scales horizontally

- ✓ Incredibly Fast
- ✓ Fault tolerant
- ✓ Zero Garbage

#### In-Memory Computing SUMMIT

@EventHandler public void onMessage(MyInboundMessage,message, MyAppState state) { long counter = state.getCounter(); counter + = message.getValue();

state.setCounter(counter);

MyOutboundMessage out = MyOutboundMessage.create(); this.messageSender.send(out);

#### STATE

. . .



src/main/models/.../messages/state.xml

#### BUILD-TIME CODE GENERATION

Built-In Schema **Evolution** 

✓ Single Thread Handler Logic **Provider Agnostic Messaging** ✓ Transparent State Replication **Exactly Once Atomic Handling** 

src/main/java/.../MyApp.java

#### HTAP WITH X – IN TRANSACTION ANALYTICS



#### X PLATFORM - RELIABILITY



#### X PLATFORM FOR HTAP- REPORT CARD

### Scalability

- ✓ Update contention handled by microservices and data striping
- $\checkmark$  Single scaling metric: state scales with application

### Performance

- $\checkmark\,$  Maximum throughput since state is local to function
- $\checkmark$  Local state allows in transaction analytics
- $\checkmark\,$  Change Data Capture allows asynchronous, optionally conflated

# Reliability / Availability

- ✓ Pipelined Replication to Hot Backup(s),
- ✓ Journaled Storage, Change Data Capture to

# Agility

- ✓ Microservices allows more agile, lower risk delivery
- ✓ Fire and Forget Messaging, Objects Transparently Persisted, Atomic
- Pure Business Logic, no infrastructure bleed







#### **REAL LIFE USE CASES**

#### MGM Resorts International

- eCommerce Engine is authored on the X Platform
  - I0 services/26 agents comprise the eCommerce service suite
  - Key metrics
    - All state, reference and transactional fully in-memory: ~ITB of in-memory state
    - Low 10s of millisecond catalogue/pricing update latency
    - Full 14 month dynamic pricing response time to website
    - Sub-second rate update to partner (wan)
- SSO storage engine authored on the X Platform
  - Authored as a distributed, persistent, partitioned hash map
    - Authored on X in 3 hours!
  - <10ms response times @ 20k updates per second</p>
    - Bottleneck in messaging bus, X has plenty of more capacity









#### FRAUD DETECTION: PERFORMANCE

**200k** Merchants **40k** Card Holders 80k Cards **Year** Card History Only 2 partitions per agent All agents running on just 2 servers 7,500 auth/sec, Full HA + X-Once **Auth Response Time = 1.2ms** 

In-Memory Computing SUMMIT

#### GETTING STARTED WITH X PLATFORM™

#### **Getting Started Guide**

https://docs.neeveresearch.com

#### **Reference Applications**

https://github.com/neeveresearch/nvx-apps

We're Listening

contact@neeveresearch.com



NEEVE RESEARCH CHALLENGES VOU TO BUILD AND DEPLOV VOUR FIRST X PLATFORM<sup>TM</sup> APPLICATION! UPON COMPLETION VOU WILL BE ENTERED IN OUR \$500 AMAZON GIFT CARD SWEEPSTAKES. THE DRAWING WILL TAKE PLACE NOVEMBER 15TH. AT 9:00AM PT.

ONCE YOU HAVE COMPLETED THE TUTORIAL, RUN THE FOLLOWING QUERY ON THE/APP'S TRANSACTION LOG: SELECT ID, ENTRYTYPE, TIMESTAMP, TRANSACTIONID,

SIMPLECLASSNAME. COUNTER FROM LOGS



# Questions

