Red Hat Summit

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Bank-in-a-box: High-performance trading systems with multi-site self-healing using Red Hat OpenShift

Anthony Warden, MD, Citi Tech Fellow,
Head of High-Performance Architectures , Citi (London)

Red Hat

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Biography

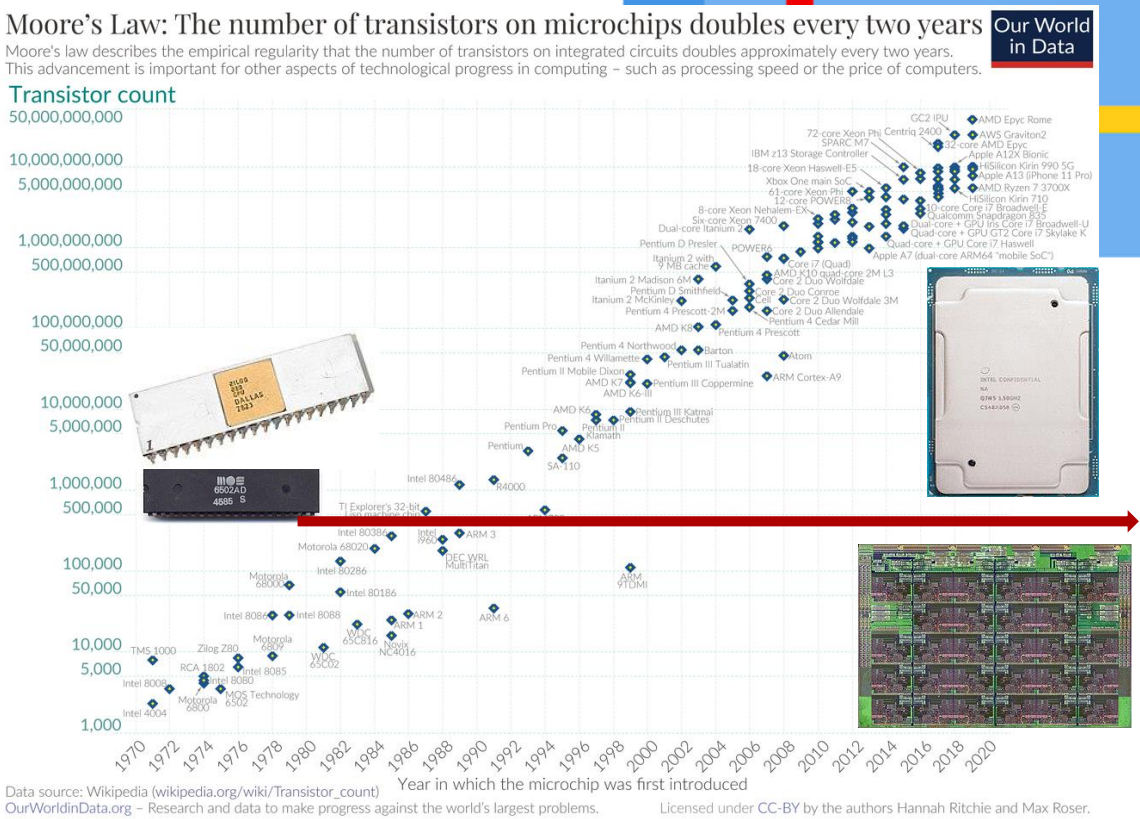
https://www.linkedin.com/in/**anthonywarden**

Anthony Warden, MD, Citi Tech Fellow, Head of High-Performance Architectures , Citi (London)

Experience -
From: Programmed on Single core, 8 Bit , 3.5Mhz, 16KB RAM in the 80's – Z80 & 6502 128K!
…

To: 64 Bit , 4GHz, 224 core, 13Tb RAM / FPGA, and Quantum…

Hobbyist…"Programmer 1" to Tech Fellow, MD
Software houses, Consulting, Lehman, Nomura, JPMorgan, Citi.



Basic, Pascal, Modula2, ML, Smalltalk, C , C++, Java, Python, Rust

COM(+), Tuxedo, CORBA, J2EE, SOA,

Docker(Swarm), **Kubernetes/OpenShift &**

(low latency)

Microservices….

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Abstract

Join this session to learn how the High Performance Architecture (HPA) team at Citigroup Global Markets is delivering the next generation of its **trading systems with multi-site self-healing** using Red Hat OpenShift. With its new bank-in-a-box HPA solution, Citigroup Global Markets can quickly and reliably develop, deploy, and manage applications across teams, projects, and IT environments. Based on Red Hat Enterprise Linux and Red Hat OpenShift, the new HPA solution integrates data, business logic, and interfaces in a single environment. Red Hat OpenShift provides automated operations, consistent experiences, and self-service provisioning to help teams work together more efficiently as they move ideas from development to production. It also minimizes risks to bank and customer information, as **transaction data travels through shared container memory rather than from server to server across the network fabric.**

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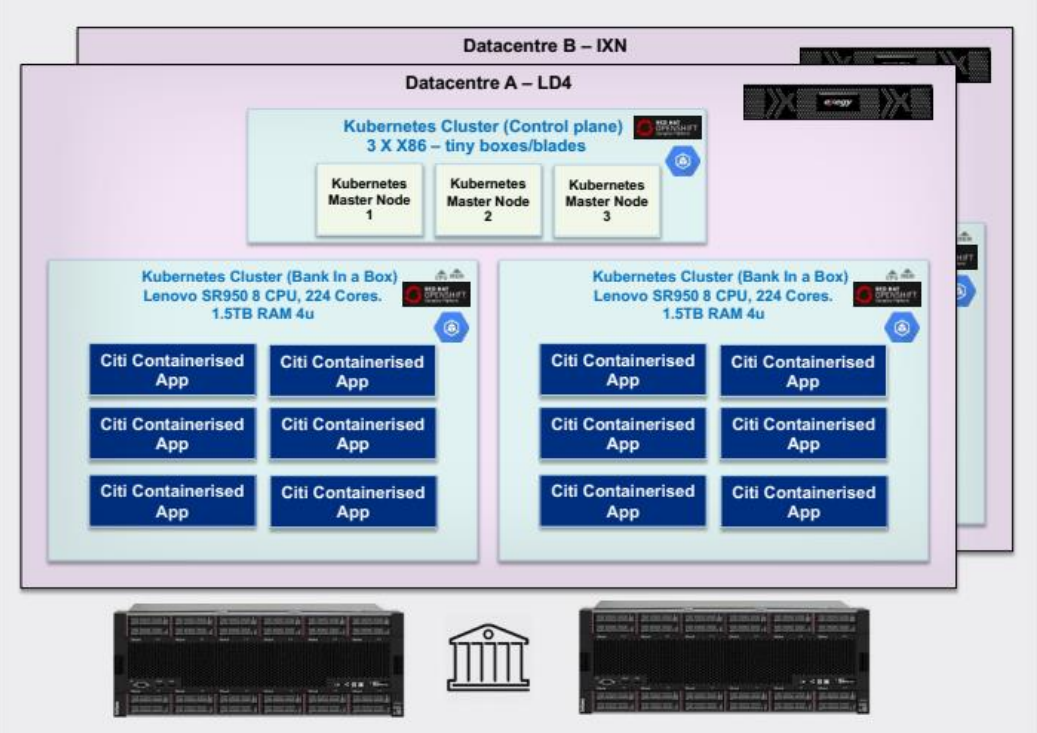
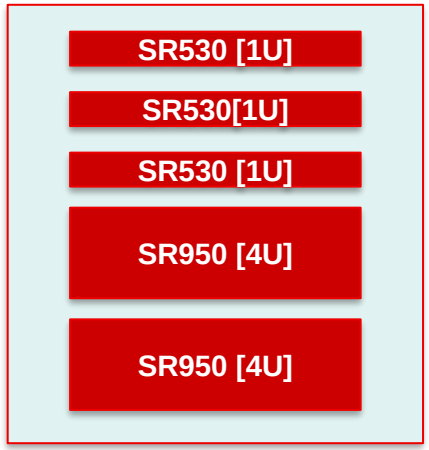
Physical deployment

No single point of failure… multi-site automated self-healing with minimal, isolated hardware

Consider failure boundaries
Degradations
Loss
Disruption



Rackspace - 11U of hosts



Chaos test…

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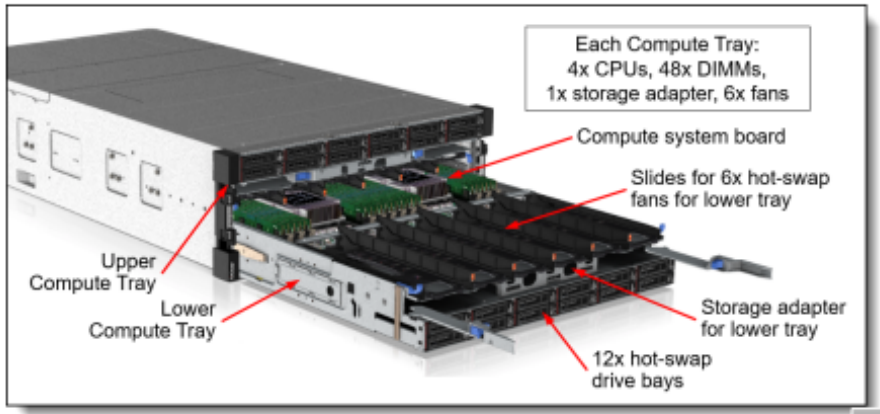
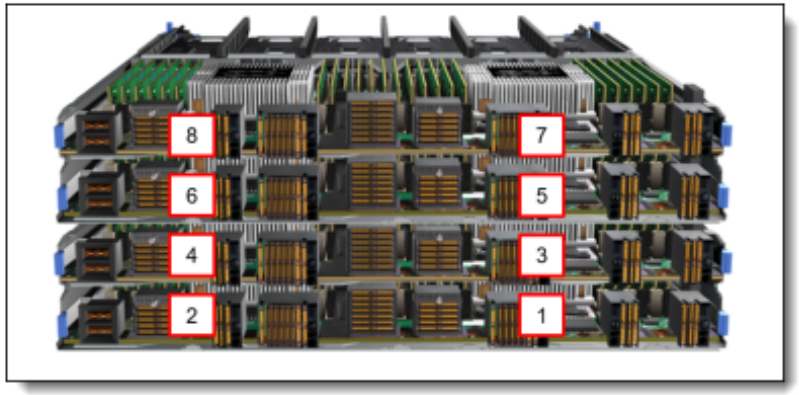
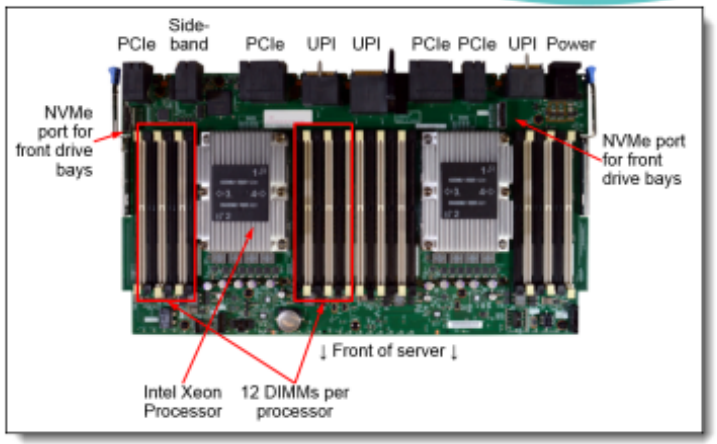
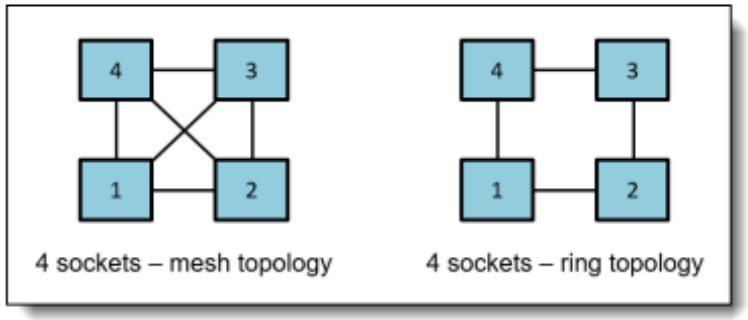
Physical deployment - diving deeper...not all cores are equal..



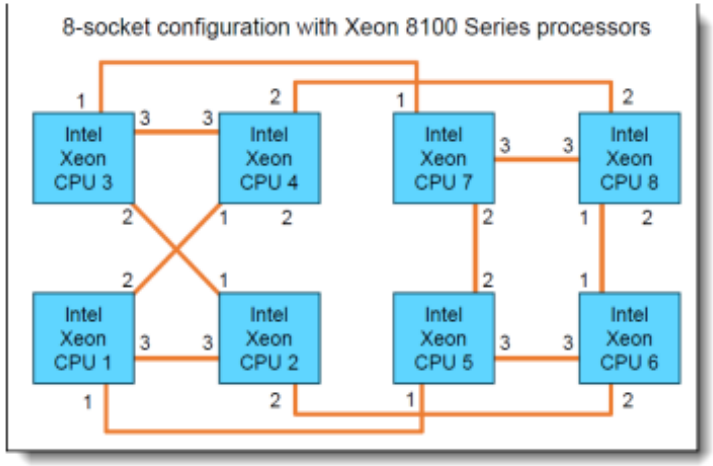




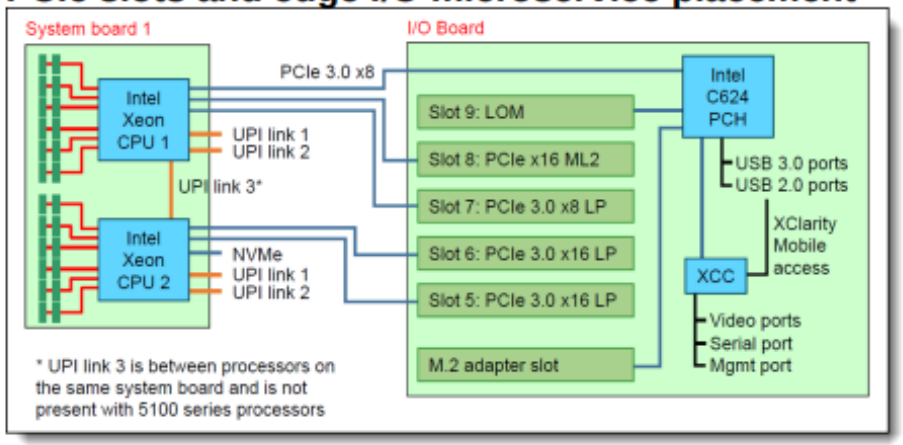
NUMA zones and microservice placement



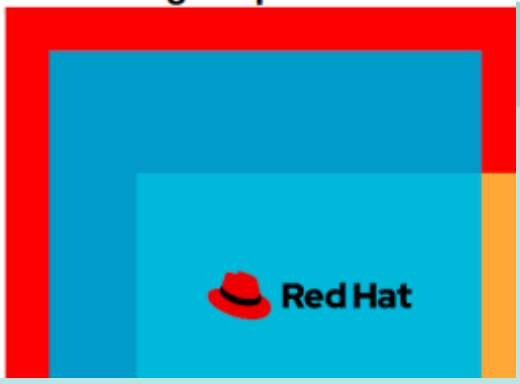
Access Level	Latency (ns)
L1 Cache	1 - 3
L2 Cache	3 - 10
L3 Cache	10 - 40
Main Memory (DRAM) - Local NUMA Zone	60 - 100
Main Memory (DRAM) - Distant NUMA Zone	100 - 300
Peer over 10GbE (Kernel Bypass)	10,000 - 30,000
Local Disk (SSD)	50,000 - 200,000



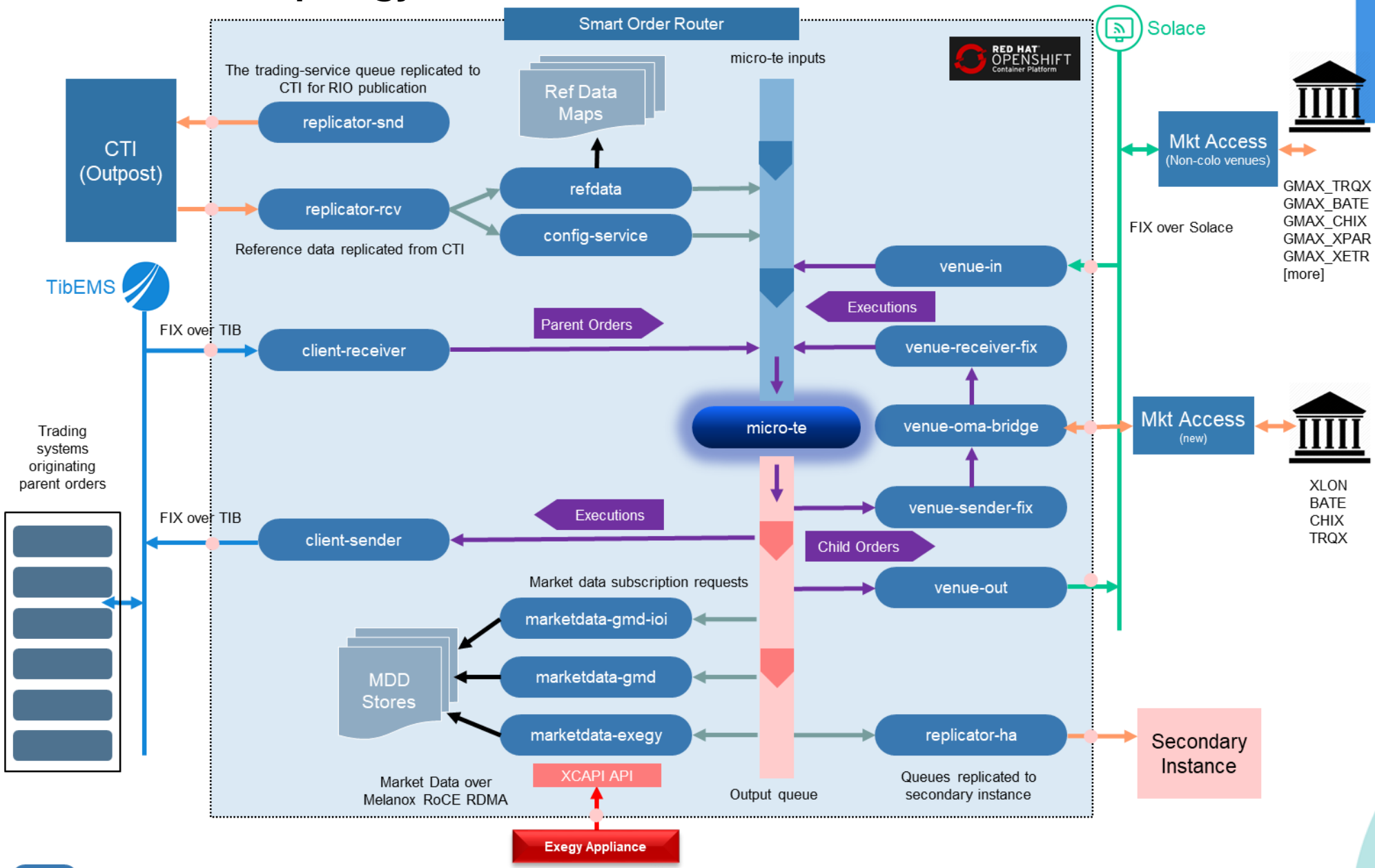
PCIe slots and edge I/O microservice placement



Fill slots with SSD's – local install.image repo..fast boot



Microservice Topology



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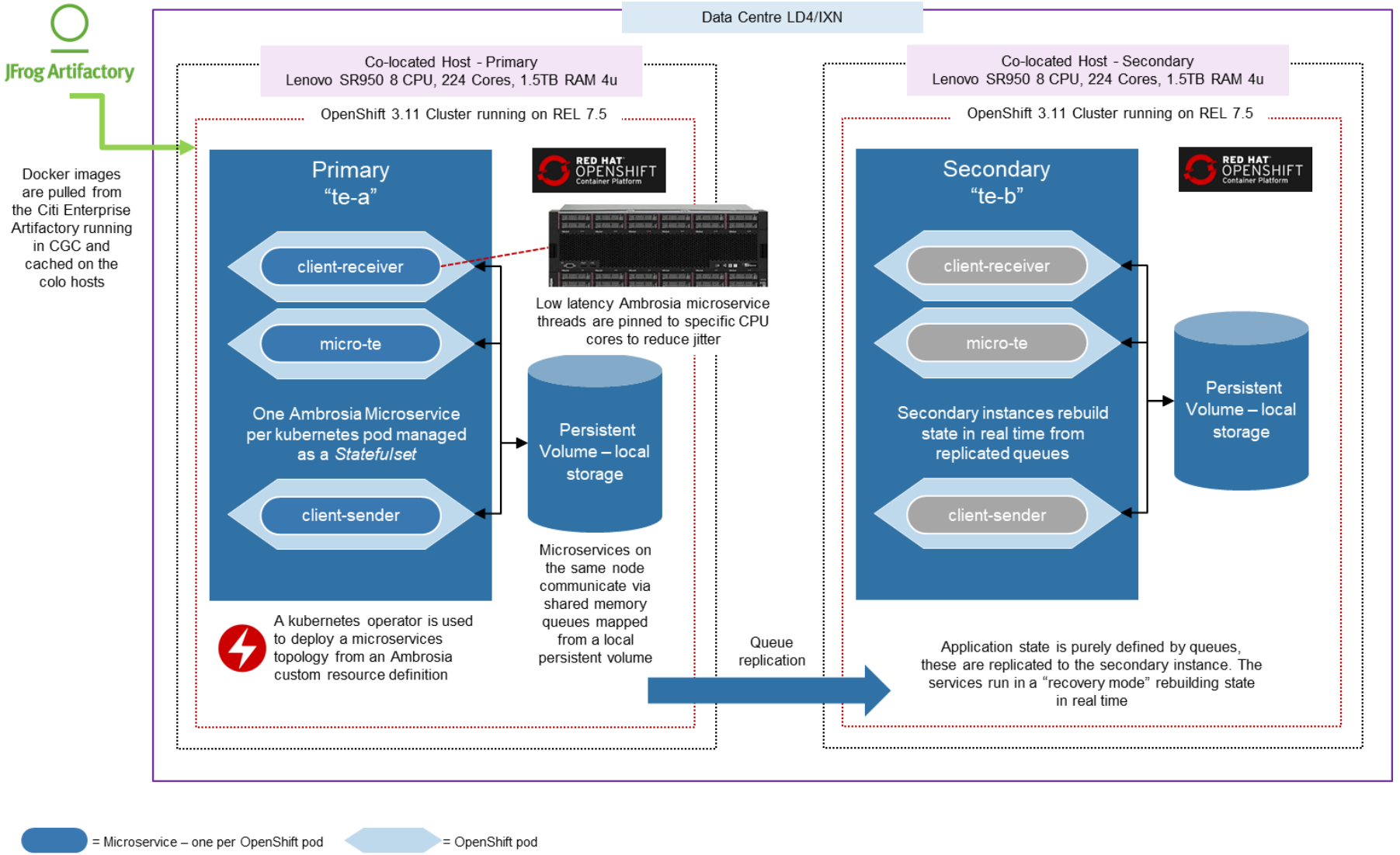
State and self-healing

Microservices as OpenShift "Statefulsets"



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Questions / Discussion..

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Thank you

LinkedIn https://www.linkedin.com/in/**anthonywarden** **<-not for messages.**

Yes for connections

Anthony.warden@citi.com

^email for business messages…

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