

Enterprise Computing and the Precision Time Protocol

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Abstract

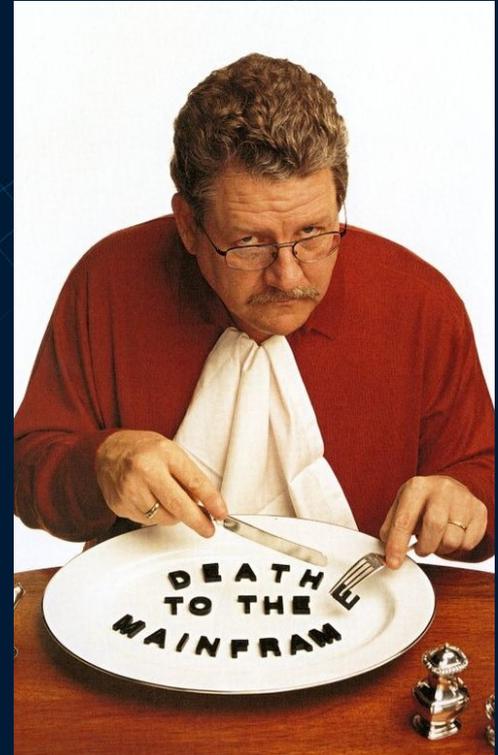
The latest generation of IBM Z Systems family of mainframes is used by over 90% of the world's 100 largest global banks as the computing platform they run their businesses on. The IBM Z also is heavily used in other financial, insurance, and retail companies worldwide to the point where it is often said that the world's economy runs on IBM mainframes. This session will discuss the time synchronization regulatory changes that led to IBM studying the IEEE 1588 Precision Time Protocol (PTP), and what IBM is doing with PTP and these enterprise computing platforms that are central to the world's financial systems.

Agenda

- Intro
- Latest financial industry time synchronization regulations
- IBM Z time synchronization today
- IBM Z time synchronization direction
- IBM LinuxONE

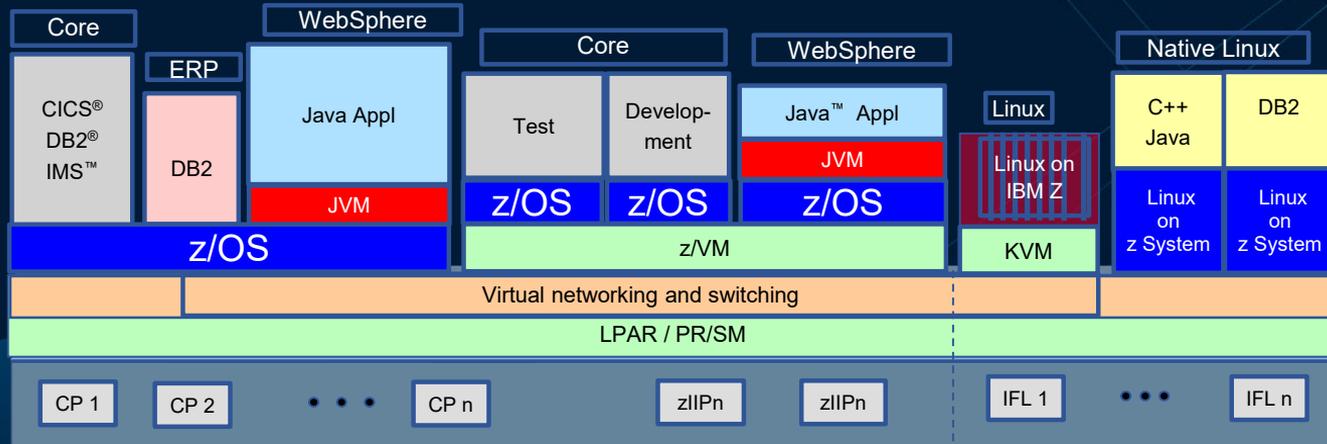
Poor Predictions in Computing History

- "I think there is a world market for maybe five computers."
-Thomas Watson, President of IBM, 1943
- "There is no reason anyone would want a computer in their home."
-Ken Olsen, Founder of Digital Equipment Corporation, 1977
- "I predict that the last mainframe will be unplugged on March 15, 1996"
-Stewart Alsop, Technology Pundit, March 1991 issue of Infoworld
- *Stewart admitted his error in 2002*



IBM Z: What is a mainframe?

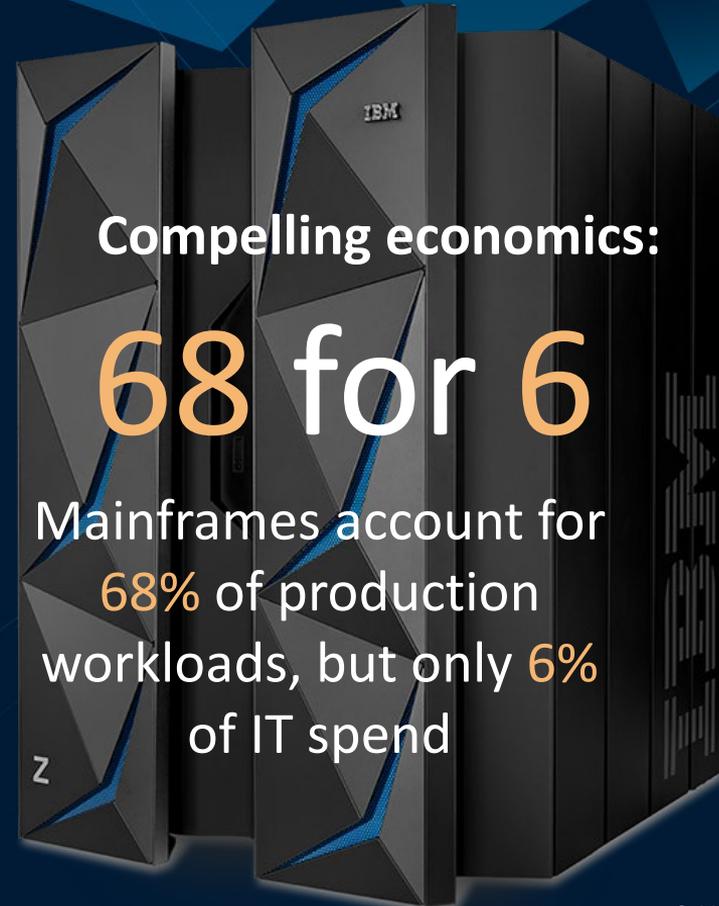
An integrated, highly scalable computer system that allows many different pieces of work to be handled at the same time, sharing the same information as needed with protection, handling very large amounts of information for many users with security, without users experiencing any failures in service



- Large scale, robust consolidation platform
- Built-in Virtualization
- 100's to 1000's of virtual servers on z/VM
- Intelligent and autonomic management of diverse workloads and system resources

Fundamental strengths of the mainframe today

- Transaction Processing
- Data Serving
- Mixed Workloads
- Operational Efficiency
- Trusted and Secure Computing
- Reliable, Available, Resilient
- Virtually Limitless Scale



World's leading businesses run on the mainframe

IBM Z



92

of the top 100
worldwide banks

Mainframes process

30 billion business transactions per day



10

out of 10 of the world's
largest insurers

Mainframes enable

\$6 trillion in card payments annually



23

of the top 25
US retailers

80 percent of the world's corporate data
resides or originates on mainframes



23

out of 25 of the world's
largest airlines

91 percent of CIOs said new customer-
facing apps are accessing the mainframe

Time Synch Regulatory Changes: Background

- Widespread proliferation and usage of electronic trading platforms with their automation
- Advent of High Frequency Trading (HFT)
- Increased the need for tighter synchronization and traceability to a common reference time scale
- All systems playing a role subject to the new rules

Government Regulations-US (FINRA)

- **Effective 2018 , requires synchronization of equipment to within 50ms of NIST(UTC)**
 - Also requires audit log capability to prove compliance
- **Consolidated Audit Trail (CAT)**
 - Requires sending of complete documentation on all orders to a central repository by 8am Eastern Time the day following a trade.
 - Requires time stamps at **ms resolution** at five places in the audit trail

Government Regulations-EU (ESMA and MiFID II)

- MiFID II requirements went into effect in January 2018
- MiFID II applies to any organization dealing in European financial instruments
- MiFID II clock synchronization requirements are more stringent than the latest U.S. requirements previously discussed
- Business clocks that provide the timestamp for any reportable event should be coordinated to UTC, using either a link to one of the laboratories maintaining a UTC(k) realization of UTC, or the time signals disseminated by GPS or other satellite system.
- Level of accuracy number typically cited: 100 microseconds divergence from UTC
 - 1 microsecond or better timestamp granularity

IBM Z Time Synchronization: Today and Future Direction



Server Time Protocol (STP) : 2006-today

- Designed to provide the capability for multiple servers to maintain time synchronization with each other and form a Coordinated Timing Network (CTN)
 - CTN: a collection of servers that are time synchronized to a time value called Coordinated Server Time (CST)
 - Single view of time with an external time reference
- Message based time synchronization protocol
 - Similar to Network Time Protocol (NTP)
 - Timekeeping information transmitted over specialized connections (coupling links)
 - Supports a multi-site timing network of up to 200 km over fiber optic cabling
- Two external Time Source options (today)
 - NTP server (100ms accuracy)
 - NTP server with Pulse Per Second (PPS) (10 us accuracy)

IBM Z 15 Announcement 12 Sept 2019

- [IBM Announcement letter](#)
- New IBM mainframe announced
- General availability (GA) 23 Sept 2019
- Formally announced our statement of direction for IEEE 1588 Precision Time Protocol (PTP)
 - The regulatory changes previously discussed were the primary driver



Statement of General Direction

- In the future IBM plans to introduce PTP as an external time source for IBM Z Server Time Protocol (PTP) for an IBM Z Coordinated Timing Network (CTN).
- The initial implementation will be for PTP connectivity via the IBM Z HMC/SE
 - [Hardware Management Console/Support Element](#)
- At that time there will be no change to the use of STP CTNs for time coordination, other than the potential to use a PTP-based external time source.

Statement of General Direction (Cont'd)

- Future implementation is planned to include full connectivity of an external PTP time source directly to the IBM Z central processing complex (CPC).
 - Reintroduces the concept of a mixed CTN
 - Support for traditional STP
 - Support for native PTP implementations
- Beyond this, the goal is to enhance the role of IBM Z machines in a PTP environment that addresses the many governmental regulations and security concerns that our clients are facing.

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On-chip compression lets you compress then encrypt everything, all on-chip, without impacting response times

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-- run a **17TB** MongoDB database instance in memory

Most highly rated Hardware Security Module: FIPS 140-2 Level 4

Secure Service Container appliances for hosting Hyper Secure Virtual Servers that protect against misuse of privileged credentials

-- up to 85 per system

Data Privacy Passports controller



A distributed ledger network is only as secure as its infrastructure



Why IBM Cloud runs IBM Blockchain Platform on LinuxONE™ and why you should, too

Firmware Tamper Protection & MFA		Detects firmware tampering Multifactor Authentication (MFA) option on consoles
Workload Isolation		Built-in virtualization provides highest level of multitenant workload isolation
Faster, safer in-core crypto acceleration		2x – 7x as fast as x86 True Random Number Generator (TRNG) is more secure than those pseudorandom number generator (PRNG) like in x86
CryptoExpress 6S		Elliptical curve, bulk encryption
Hardware Security Module (HSM)		The only FIPS 140-2 Level 4 certified HSM on the market
Secure Service Container		Prohibits access by rogue system administrators or other external threats to private data

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Additional reference
material on MiFID II
regulations

RTS-25 Article 1: Reference Time

- Business clocks that provide the timestamp for any reportable event should be coordinated to UTC, using either a link to one of the laboratories maintaining a UTC(*k*) realization of UTC, or the time signals disseminated by GPS or other satellite system.
- If using a satellite system, any offset from UTC must be accounted for and removed from the timestamp.

RTS-25 Articles 2 and 3: Level of Accuracy

- Article 2 describes the level of accuracy, i.e. the maximum divergence from UTC, that should be achieved by the operators of financial trading venues, taking into account the gateway to gateway latency of their trading systems.
- Article 3 defines the level of accuracy that apply to business clocks of members or participants of financial trading venues.
- Number used is 100 microseconds divergence from UTC
 - 1 microsecond or better timestamp granularity

RTS-25 Article 4: Compliance With Maximum Divergence Requirements

- Article 4 specifies that operators of trading venues and their members or participants shall establish a system of traceability to UTC.
 - They shall be able to demonstrate traceability to UTC by documenting the system design, functioning and specifications.
 - They shall be able to identify the exact point at which a timestamp is applied and demonstrate that the point within the system where the timestamp is applied remains consistent.
 - The traceability system should be reviewed at least once per year to ensure compliance with the regulations.
- **Single Point of Failure**
 - Requires banks to notify the government if their systems are running with a single point of failure
- MIFID II violation fines: up to 5 million Euros, or 10% of firm's turnover