zPDT & zDT Technology Presentation and Fact Finding

by

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Order of Knights of VM

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Abstract

Mainframe emulation is common today and heavily used for application development but what are the limitations and capabilities?

Learn about the different packages and options from IBM and how to use them effectively to achieve mainframe quality application development. What are some of the road bumps that you may experience with zPDT and zDT using zVSE, zVM and zOS? How to avoid the pitfalls? What can it do and what it cannot!

Introduction

Since 1952 IBM has been the leader in large scale data processing. Although the IBM 701 Data-Processing Machine was hardly a mainframe by todays standards it was the seed that led to the development of the venerable System/360 in 1964; and that was the supreme game-changer!

Since that time the technology has become more versatile, more complex, faster/better, and smaller. In 1998 IBM achieved a magnificent accomplishment with the introduction of a small (3 foot tall), office-friendly, mainframe, the Integrated Server (3006-B01). Designed as a hybrid, merging x86 technology with a S/390 CPU on an adapter card, it brought true low-cost mainframe processing to a distributed business model. The ability to develop and operate mainframe applications away from the main datacenter was a breakthrough concept easily embraced by application developers and system programmers.

What Developers Want

Every software developer, every system admin, every system programmer, every trainer have all fantasized about having their own personal mainframe under their complete and total control. They would not have to get permission to make system level changes. They would not have to coordinate IPLs or updates with other groups. The dream has always been to have your own world where you ruled with arbitrary command and control that benefits your individual purpose.

The dream is a alive and well thanks to the IBM elves in Poughkeepsie, NY. Since the turn of the century IBM has been quietly developing tools for internal use that can provide systems assurance testing of new hardware designs. These tools have evolved into the zPDT (ISV) and zDT (Commercial) product lines.
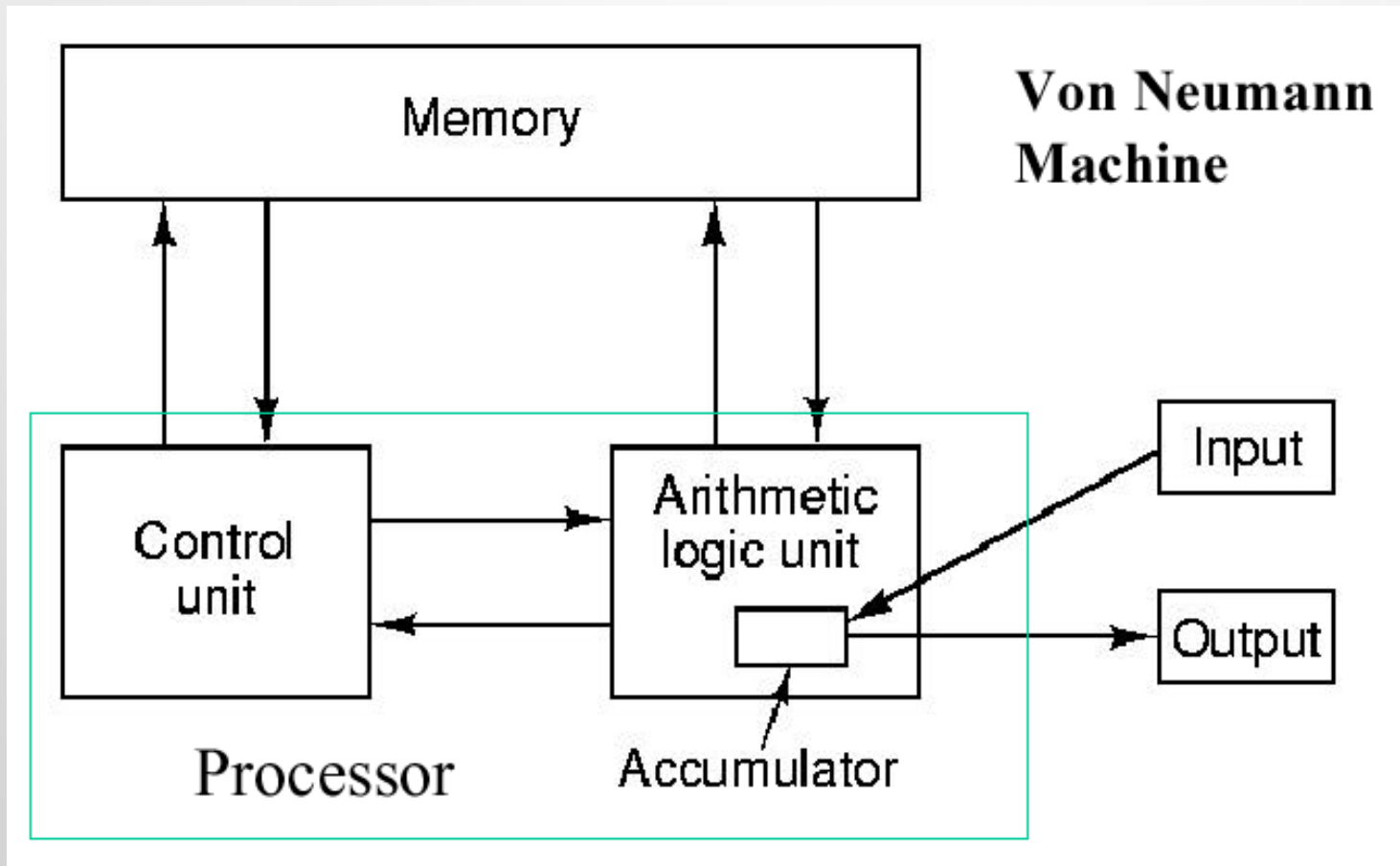
In The Beginning

Resources were limited and always physical

Classic Computer Architecture

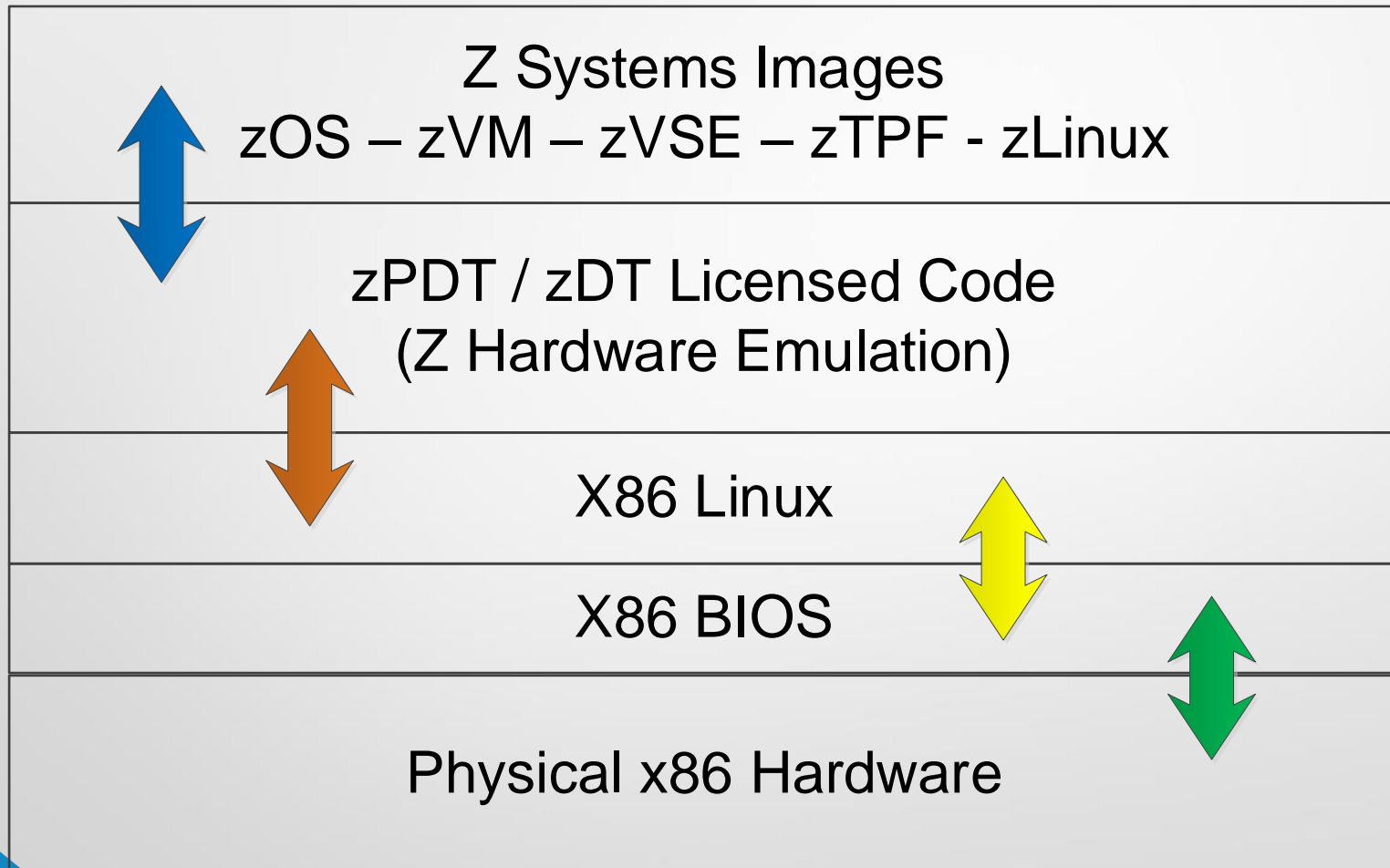All computers used for commercial processing currently adhere to specific fundamentals of von Neumann architecture.

Von Neumann Machine

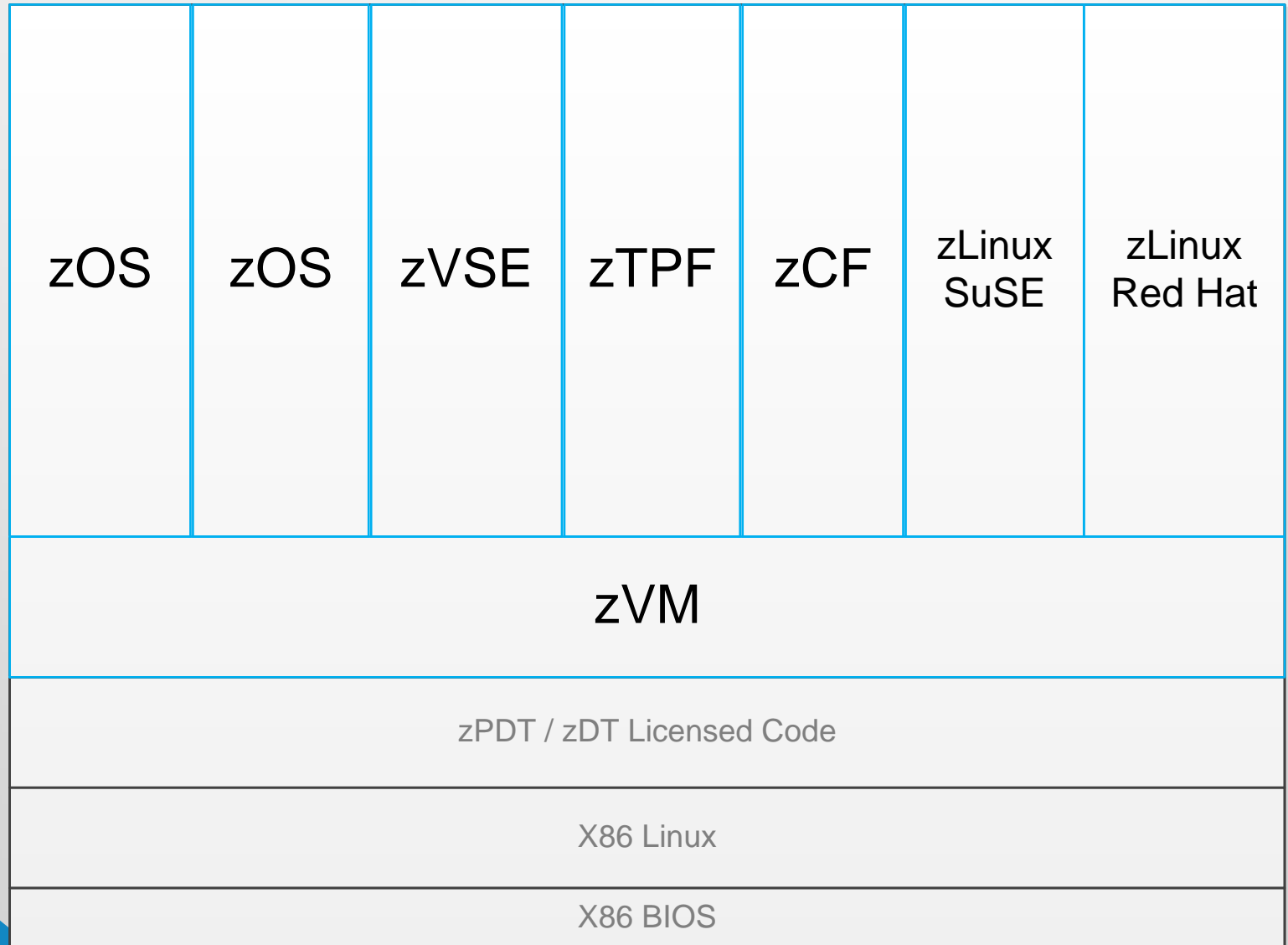# Game Changing Mainframe

CPU, Memory, Storage, I/O Devices – All Physical

z Emulation Model

Z Systems Images
zOS – zVM – zVSE – zTPF - zLinux

zPDT / zDT Licensed Code
(Z Hardware Emulation)

X86 Linux

X86 BIOS

Physical x86 Hardware

z Systems Images

zOS	zOS	zVSE	zTPF	zCF	zLinux SuSE	zLinux Red Hat

zVM

zPDT / zDT Licensed Code

X86 Linux

X86 BIOS

How it works

- **zPDT is a Linux app that executes z Systems instructions using interpretative execution with a cached JIT compiler;**

- **zPDT can be defined with 1 to 8 z Systems processors; each can be independently defined as CP, IFL, zIIP or zAAP;**

- **Each z Systems processor defined must have at least one x86 core; two processors = two cores, etc.**

- **In addition to x86 cores required by zPDT, *at least* one additional core is required for I/O processing and sys admin;**

- **zPDT Device Managers provide the integration of virtual requests with physical resources;**

z Systems Physical to Virtual

A zPDT system includes 12 *device managers*, each of which provides emulation for a related group of devices. A device manager can emulate multiple instances of its devices.

aws3274 Emulates a local, channel-attached 3274 control unit. This device manager is almost always used to provide the IBM MVS™ console, for example, and 3270 application sessions. Each terminal appears (to the z System operating system) as operating through a channel-attached non-SNA DFT IBM 3274 control unit. TN3270 sessions are used through the base Linux TCP/IP interface.

awsckd Emulates 3390 (and 3380) disk units, using a single Linux file for each 3390 or 3380 device.

awsosa Emulates an OSA-Express2 adapter, in either QDIO (OSD) or non-QDIO (OSE) mode. The hardware involved is an Ethernet adapter on the underlying PC. This device manager can support TCP/IP operation. SNA operation is not supported.6 It can also support OSA/SF usage.

awstape Emulates a 3420, 3480, 3490, or 3590 tape drive, using a Linux file in place of the tape media.

awscmd Emulates a tape drive but routes output records to the base Linux system where they are executed as commands, and returns Linux output to the emulated tape drive.

awsfba Emulates FBA devices, which are supported by IBM z/VSE® and z/VM. A Linux file is used for each emulated device. This is not the Fibre Channel (Open Systems) FBA on recent z System machines.

awsoma Emulates the Optical Media Attach interface that works with Linux files in this format. This function is read-only.

aws3215 Emulates a 3215 console device (seldom used today), using a Linux terminal window for the interface.

awsprt Emulates a 1403 or 3211 printer, using a Linux file for output. Provides emulation of a 1403-N1 or 3211 printer. FCB emulation for 3211 is provided, but UCS functions are not provided. Automatic ASCII translation (fixed translation table) is provided.

awsrdr Emulates a 2540 card reader, using Linux files as input. The 2540 card punch functions are not emulated. Both EBCDIC and ASCII data can be used.

awsscsi Uses a Linux SCSI-attached tape drive as a z System tape drive, providing a way to read/write "real" mainframe tape volumes.
.
awsctc Emulates an IBM 3088 channel-to-channel adapter by using TCP/IP as the communication mechanism. The connection can be the same zPDT instance, another instance in the same PC, or a zPDT instance in a LAN-connected machine.

Where we are with zPDT/zDT

- *z14 Architecture Support*

- *zEDC Support*

- *Crypto CCA 5.4*

- *CFCC Level 23*

- *MIDAW Support*

- *Emulated tape with tape mount CCWs implemented*

- *3390-type CKD, ECKD with EAV and FBA 9336*

- *CKD Versioning*

- *Emulated Coupling Facility using zVM*

Z14 Support

- **Support for z14 Instruction and Architecture changes:**

  - *Transactional Execution (a.k.a Transactional Memory) - Improvements*

  - *Guarded Storage Facility (a.k.a. JAVA Pauseless Garbage Collection)*

  - *New instructions for old & new workloads, e.g. - SIMD enhancements (Analytics)*

  - *DB2 (and others) Compression enhancements*

  - *Instruction Execution Protection Facility (no-execute)*

  - *Vector Packed Decimal Facility*

  - *Message Security Assist extensions*

What zPDT/zDT Will Not Do

Not all z System instructions and functions are available with zPDT. Instructions that are related to specific hardware facilities or optionally used by specialized programs might not be present. This excluded list includes these items:

- *Base Control Program internal interface (BCPii) functions*

- *List-directed IPL and Internal IPL*

- *The accelerator and PKCS#11 functions of cryptographic coprocessors*

- *Time of Day (TOD) steering*

- *IBM enterprise® Blade Center Extension (zBX) functions*

- *CPU Measurement Facility*

- *Asynchronous data movers*

- *FICON, and Transport Mode I/O*

- *Parallel Access Volumes (PAV)*

- *Logical channel subsystems*

- *IBM Hi per Sockets™ functions*

- *LPARs*

What zPDT/zDT Will Not Do

- *Flash memory;*

- *Multiple I/O paths;*

- *Multithreading (MT or symmetric MT (SMT));*

- *Customized cryptographic routines (UDX) and PKCS#11 (for Crypto Express adapter emulation) cannot be used;*

- *Various fields within the Channel Measurement Facility reports;*

- *Hardware Management Consoles (HMCs) are not available;*

- *Some CHSC commands (such as crypto adapter measurements).*

What can you do with it?

- Licensed for Z development, testing, debugging, training, demonstrations, anything but production;

- IBM ADCD subscription fee of $900 annually (per token) provides access to current zVM, zVSE, zOS, zTPF software stacks with significant middleware included (Db2, IMS, CICS, MQseries, WebSphere, etc.);

- Supports monoplex, sysplex and parallel sysplex modes of operation;

- zVM provides virtual LPAR support via guesting;

- Extensive testing has proven full Z software compatibility including ISV and third-party products.

What can it do for you?

- Each licensed CP provides approximately 150 – 200 MIPs of processing capacity;

- Normal use is 1 to 3 CPs; performance enhancement is roughly linear;

- Beyond 3 active CPs performance is nonlinear and entropy occurs quickly regardless of x86 core quantity;

- Device emulation provides a rich set of integration opportunities;

- Emulation of zIIP, zAAP, and zIFL is for compatibility testing and provide no performance enhancement; do not require license (free);

- zVM provides excellent opportunity to support multiple simultaneously operating images with centralized configuration;

- Linux for Z runs well under zVM;

- zPDT and zDT work well within cloud environments but with less performance capability compared to dedicated x86 server.

Facts and Figures

- x86 core utilization limited to one per CP plus one for I/O;

- I/O capacity is the largest bottleneck; faster is better;

- Extra cores provide no performance enhancement to zPDT or zDT, and may or may not provide Linux assistance for dispatchable UOWs;

- Virtualization of zPDT/zDT, such as with KVM, is not optimum for heavy workloads; smaller development organizations will experience good performance;

- Remember: Virtualization provides a *shared* environment across many users, so image optimization becomes very important for adequate zPDT performance;

- OSA performance requires special attention for good performance; Read the RedBook!

What not to do!

- It is not a real mainframe so don't expect mainframe performance;

- It may not be a real mainframe but it still takes mainframe skills for optimum performance with good dynamics;

- OSA performance is not like a real mainframe; needs special attention as per recommendations in the RedBook;

- Do not host additional workloads under the x86 server Linux, best results will be experienced when you treat the zPDT/zDT implementation as a dedicated appliance;

- Do not diverge from IBM recommendations for x86 Linux just because you have a favorite flavor of Linux; you will eventually have problems with problem diagnosis and support

Costs

- ISV community pricing (zPDT) is lower than commercial utilization (zDT) pricing;

- Per CP pricing is roughly $4,100 per year (zPDT) and roughly $4,700 per year (zDT) depending on license scheme selected;

- Add in the platform form-factor costs (laptop, tower, rack-mount) into the budget along with the cost for Linux and your time for build-out and configuration (usually 40 hours);

- IBM charges separately for ADCD access by ISV community, $900 per year;

- Typical DIY costs installed and ready to run, Laptop $15,000; Tower $20,000; Rack-mount $25,000.

Summary and Conclusion

The world is a better place with zVM and zPDT!

zPDT technology significantly lowers the cost for mainframe application development, testing, and training.

zPDT provides true hands-on control of your own world. Control the world; control your destiny!

Need more information?

IBM zPDT for Independent Software developers

https://www-356.ibm.com/partnerworld/wps/servlet/ContentHandler/pw_com_zpdt

IBM zDT for commercial and personal developers

http://www-03.ibm.com/software/products/en/ibm-z-systems-development-and-test-environment

ITC complete solutions for zPDT and zDT

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