Confidential Computing with Secure Execution (IBM Z)

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Cloud Development for Linux and OpenShift on IBM Z & LinuxONE
IBM Secure Execution for Linux

IBM Z & LinuxONE/s390x/“mainframe” used for Red Hat OpenShift workloads

Hardware confidential computing support since z15 (September 2019) & LinuxONE III

Necessarily based on Linux KVM virtualization

Other virtualized confidential computing technologies include IBM Power’s PEF, AMD SEV, and Intel TDX
How do you know your workload runs in a secured context?

This can be achieved through attestation and smaller encrypted key containers.

Secure Execution (like PEF) relies on a fully encrypted boot image that can house anything.

The asymmetric key is tied to the machine and can be verified through a certificate authority.

But how can the machine retrieve the private key for decryption? If the hypervisor could simply read it, you haven’t gained anything.
Enter the Ultravisor

![Diagram showing the Ultravisor concept]

- QEMU
- Guest Memory
- Secure Guest State
- UV
- KVM
- Linux
- Other Linux Processes
- HW/FW
“Classical” Secure Execution

...but what if you want containers?

initrd with key
kernel
cmdline

Linux rootfs
traditional LUKS
on trusted IBM Z hardware

genprootimg

Header with checksums

initrd with key
kernel
cmdline

Linux rootfs
Secure Execution, possibly untrusted hardware
Enter Kata Containers
“The speed of containers, the security of VMs”
How do you achieve confidential computing with Kata Containers?

Utilize hardware. Lock the agent.

As a first, basic solution, we can put anything we might want to use into a custom, encrypted image.

This image is pulled upon creating a container.

Where is the key to decrypt it?
Integrating the current Secure Execution workflow with the Attestation Agent

“Bake-in” approach
Integrate the keys to decrypt image layers

- Simple, but inflexible

“Key fetch” approach
Classical authentication

- (Somewhat) more flexible
  TLS as substitute for runtime attestation
Thank you

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