Balai Sertifikasi Elektronik

Optimizing Java Containers for Government Usecases

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Jk8s Meetup #11

Jakarta, 21 November 2019

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Nama	: Arga Dhahana Pramudianto, S.Tr.TP
NIP	: 19930714 201412 1 001
Pangkat	: Penata Muda (III/a)
Formal Role	: Sandiman Pertama pada Balai Sertifikasi Elektronik, Badan Siber dan Sandi Negara
Informal Role	: System Engineer
Almamater	: Sekolah Tinggi Sandi Negara 2015 Sanapati Cendekia (I, V, VII)
Komunitas	: Docker Indonesia, Kubernetes Indonesia, OpenStack Indonesia, openSUSE ID
Sertifikasi	: ISO27001 Lead Implementer, COA, CDCP, CCNA, CCNP, CKA
LinkedIn	: s.id/linkedin-arga

BADAN SIBER DAN SANDI NEGARA

Pusdatik

Pusops Kamsinas

Puskajibang

- Sekolah Tinggi Sandi Negara
- Pusat Pendidikan dan Pelatihan
- ID SIRTII/CC
- Balai Sertifikasi Elektronik

What do we do?

Balai Sertifikasi Elektronik

QR CODE

https://psre.rootca.or.id:/#?t=6d599d6f-bb77-46c3-a692-62e7e1091eca

PSrE

* Penyelenggara Sertifikasi Elektronik
atau
Certificate Authority

https://bsre.bssn.go.id/

Instansi yang Telah **PKS** dengan **BSrE BSSN**

Total 166

*Data 16 Oktober 2019

Pemerintah Pusat dan BUMN
35

- 33 Pemerintah Pusat
- 2 BUMN

Instansi Daerah, Universitas Pengadilan Negeri
131

- 17 Pemerintah Provinsi
- 71 Pemerintah Kabupaten
- 40 Pemerintah Kota
- 1 Universitas
- 1 Pengadilan Negeri
- 1 BUMD

BSrE Users Total Amount

*Data 3 Oktober 2019

14171

OSD LU

Instansi Pemerintah
Layanan Umum

13742

OSD PSE

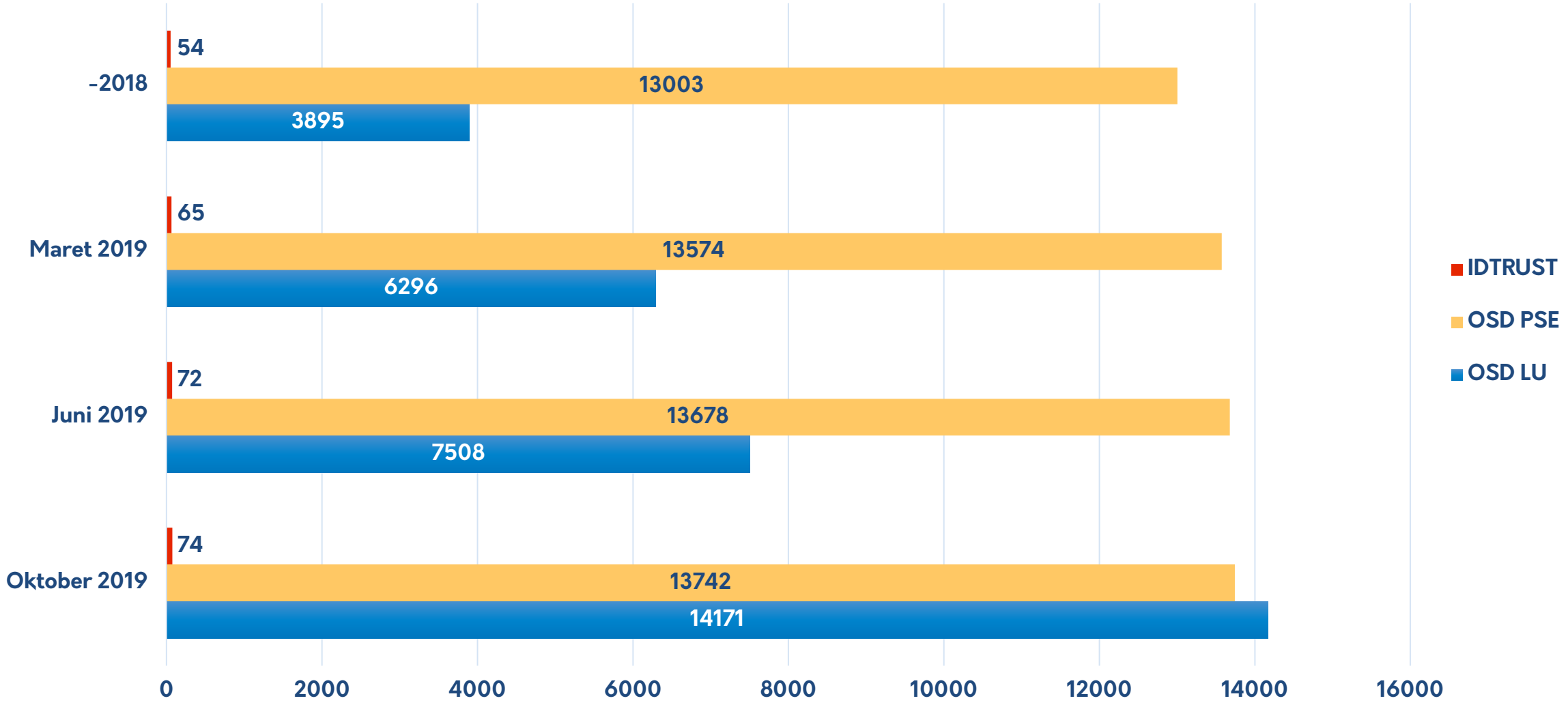
Lembaga Kebijakan
Pengadaan Barang Jasa
Pemerintah (LKPP)

74

IDTRUST

Badan Usaha Milik Negara
(BUMN)

BSrE Users Growth Last 2 Years



*Data 3 Oktober 2019

The Users Fact and Why?

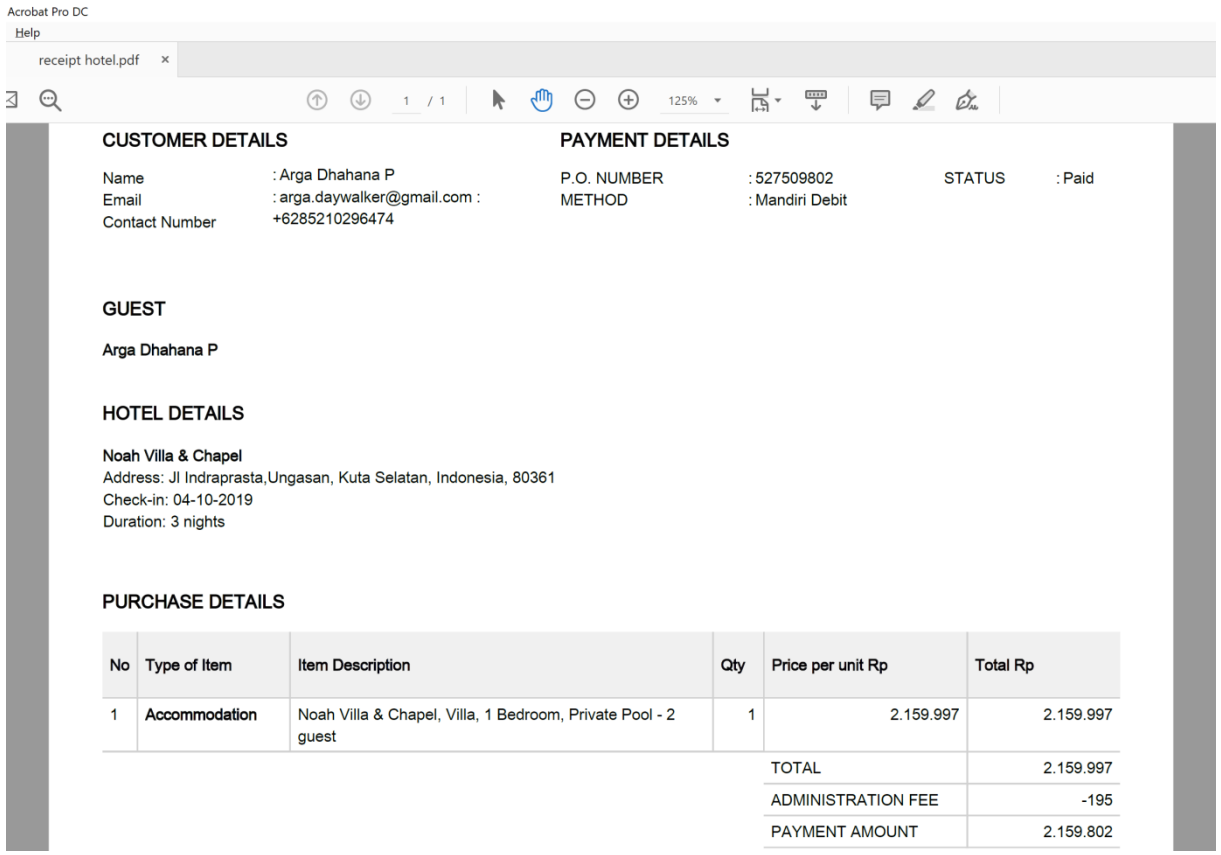
*Data 3 Oktober 2019

Proteksi Email dan Tanda Tangan Digital	1577
Tanda Tangan Digital	13947
SSL Server	61
Tanda Tangan Digital dan SSL Client	125

13.947 of 14.171 (98,4%) are digital signing service users

Anyone ever heard about digital signature?

Anyone ever heard about digital signature?



CUSTOMER DETAILS

Name : Arga Dhahana P
Email : arga.daywalker@gmail.com :
Contact Number +6285210296474

PAYMENT DETAILS

P.O. NUMBER : 527509802
METHOD : Mandiri Debit
STATUS : Paid

GUEST

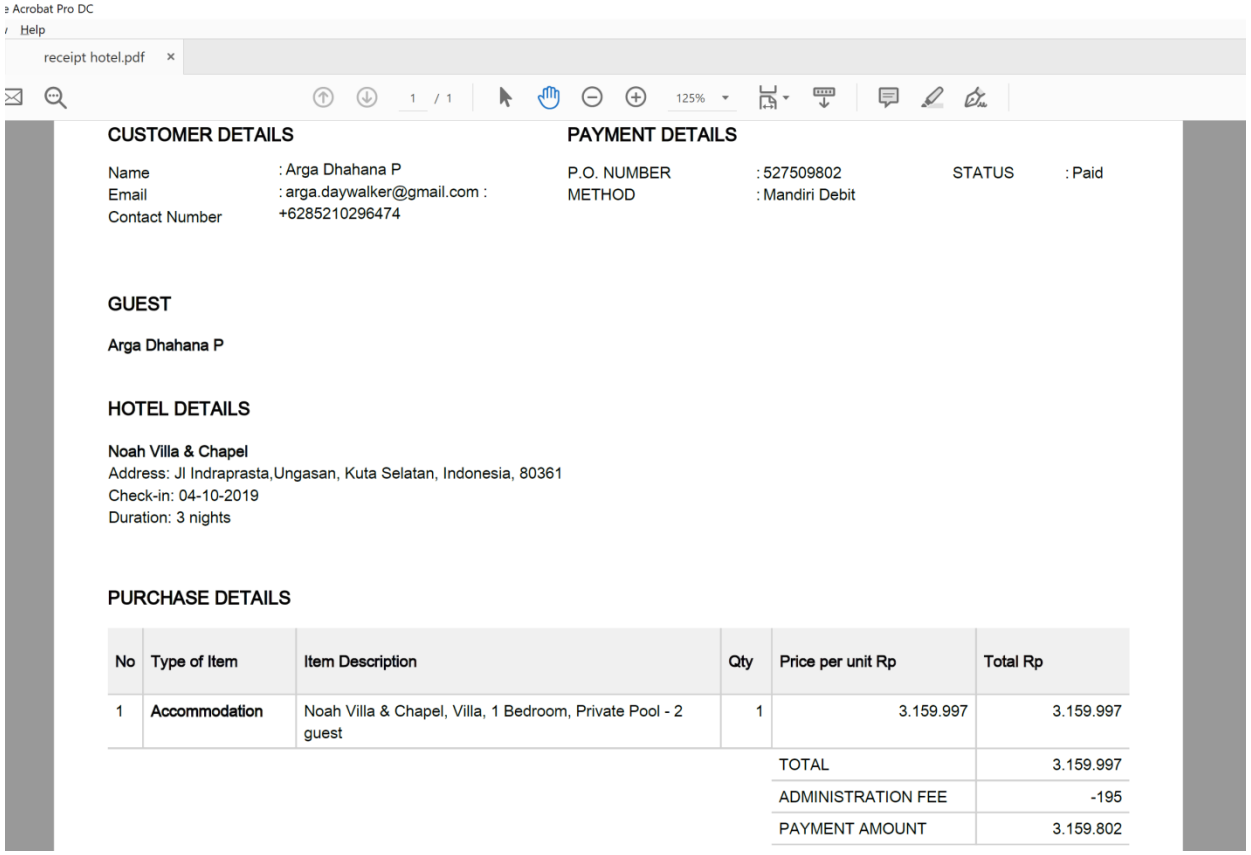
Arga Dhahana P

HOTEL DETAILS

Noah Villa & Chapel
Address: Jl Indraprasta,Ungasan, Kuta Selatan, Indonesia, 80361
Check-in: 04-10-2019
Duration: 3 nights

PURCHASE DETAILS

No	Type of Item	Item Description	Qty	Price per unit Rp	Total Rp
1	**Accommodation**	Noah Villa & Chapel, Villa, 1 Bedroom, Private Pool - 2 guest	1	2.159.997	2.159.997
				TOTAL	2.159.997
				ADMINISTRATION FEE	-195
				PAYMENT AMOUNT	2.159.802



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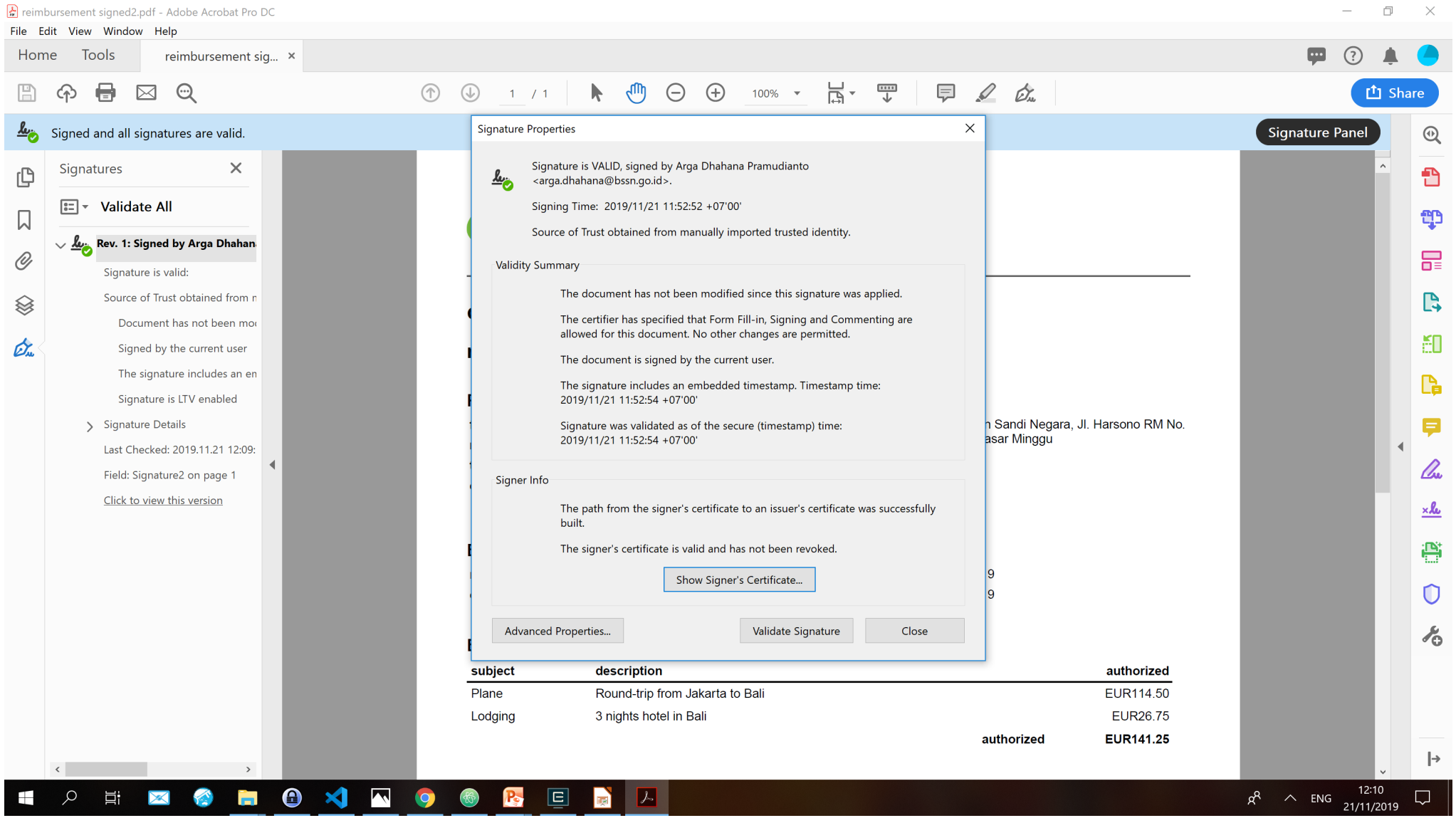
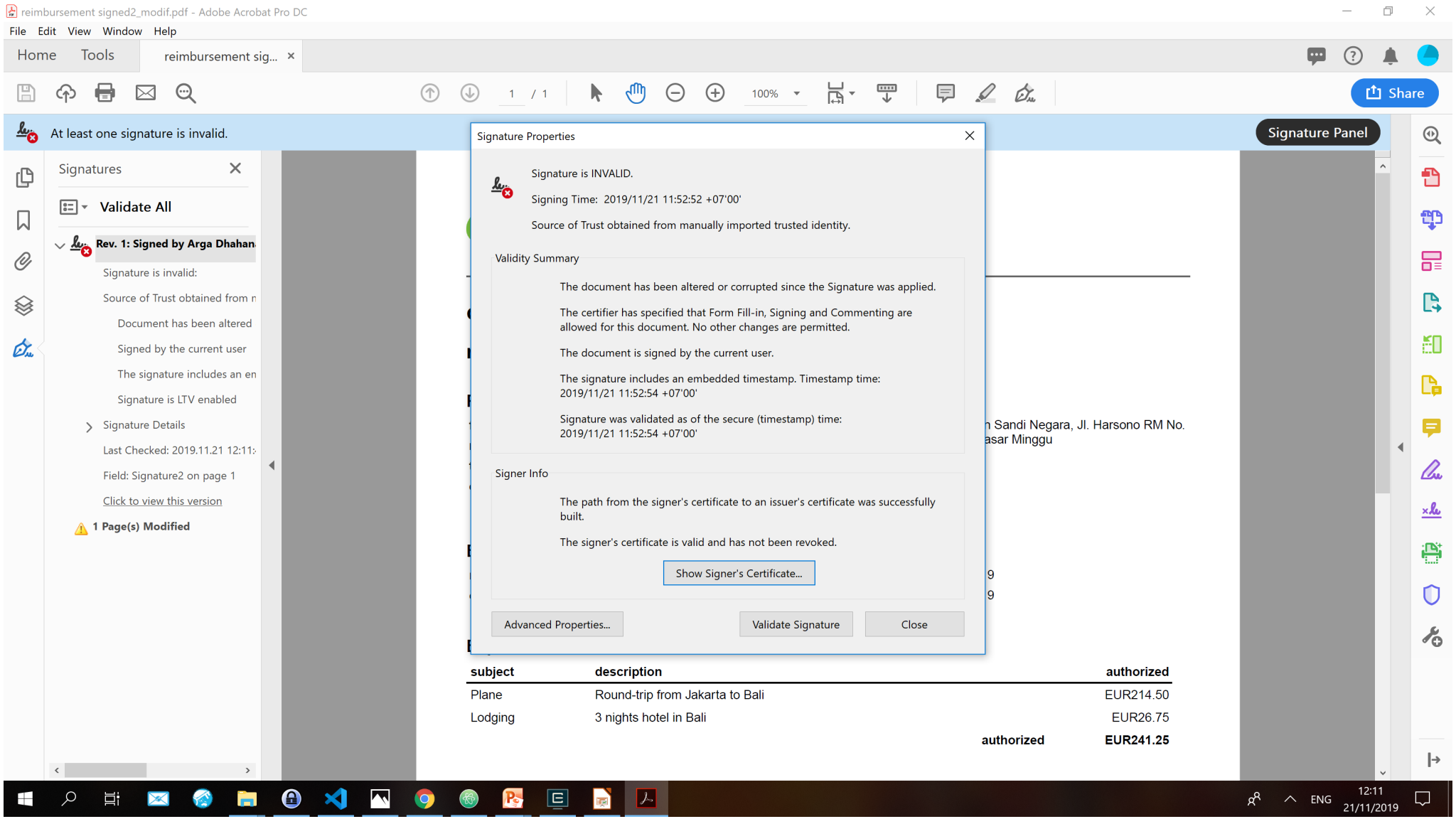


Anyone ever heard about digital signature?



Digital Signature Legal Standing in Indonesia

Undang Undang Nomor 11 Tahun 2008
Informasi dan Transaksi Elektronik

Peraturan Pemerintah Nomor 71 Tahun 2019
Penyelenggaraan Sistem dan Transaksi Elektronik

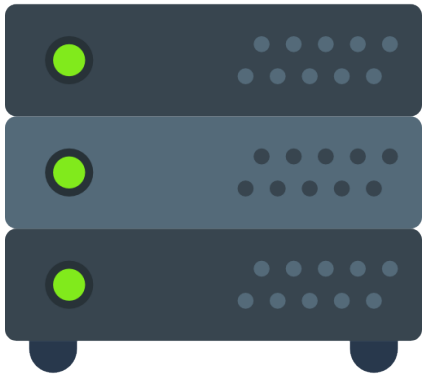
Peraturan Presiden Nomor 95 Tahun 2018
Sistem Pemerintahan Berbasis Elektronik

Major Problems

Our users are multiplying

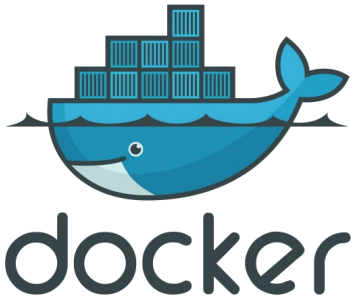
Bottleneck occurs due to overload

- There is no self-healing mechanisms
- Service can’t be scaled easily



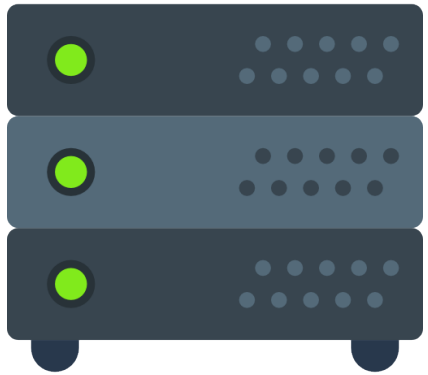
Digital Signature as a BSrE Service

kubernetes



and much more ...

Java Heap Sizing Basics in a VM



```
[root@jumphost ~]# cat /etc/redhat-release
CentOS Linux release 7.7.1908 (Core)
[root@jumphost ~]# free -m
              total        used        free      shared  buff/cache   available
Mem:           1715         246         229          16        1239        1242
Swap:          3071           1        3070
[root@jumphost ~]# java -version
openjdk version "1.8.0_232"
OpenJDK Runtime Environment (build 1.8.0_232-b09)
OpenJDK 64-Bit Server VM (build 25.232-b09, mixed mode)
```

Risks on wrong Heap Sizing:

- **Resources and money wasting**
- **Application getting killed**

Java Heap Sizing Basics in a VM

No Param Added

```
[root@jumphost ~]# java -XX:+PrintFlagsFinal -version | grep -Ei "maxheapsize|maxram"
    uintx DefaultMaxRAMFraction                     = 4                                   {product}
    uintx MaxHeapSize                              := 450887680                           {product}
 uint64_t MaxRAM                                    = 137438953472                        {pd product}
    uintx MaxRAMFraction                            = 4                                   {product}
   double MaxRAMPercentage                          = 25.000000                           {product}
openjdk version "1.8.0_232"
OpenJDK Runtime Environment (build 1.8.0_232-b09)
OpenJDK 64-Bit Server VM (build 25.232-b09, mixed mode)
```

Xmx Param Added

```
[root@jumphost ~]# java -XX:+PrintFlagsFinal -Xmx1g -version | grep -Ei "maxheapsize|maxram"
    uintx DefaultMaxRAMFraction                     = 4                                   {product}
    uintx MaxHeapSize                              := 1073741824                          {product}
 uint64_t MaxRAM                                    = 137438953472                        {pd product}
    uintx MaxRAMFraction                            = 4                                   {product}
   double MaxRAMPercentage                          = 25.000000                           {product}
openjdk version "1.8.0_232"
OpenJDK Runtime Environment (build 1.8.0_232-b09)
OpenJDK 64-Bit Server VM (build 25.232-b09, mixed mode)
```

Java Heap Sizing Basics in a VM

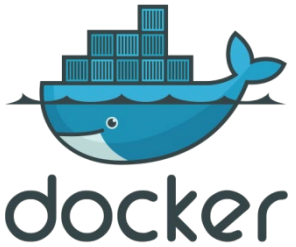
MaxRAM Param Added

```
[root@jumphost ~]# java -XX:+PrintFlagsFinal -XX:MaxRAM=1g -version | grep -Ei "maxheapsize|maxram"
    uintx DefaultMaxRAMFraction                     = 4                                   {product}
    uintx MaxHeapSize                              := 268435456                           {product}
 uint64_t MaxRAM                                   := 1073741824                          {pd product}
    uintx MaxRAMFraction                            = 4                                   {product}
   double MaxRAMPercentage                          = 25.000000                           {product}
openjdk version "1.8.0_232"
OpenJDK Runtime Environment (build 1.8.0_232-b09)
OpenJDK 64-Bit Server VM (build 25.232-b09, mixed mode)
```

MaxRAM & MaxRAMFraction Param Added

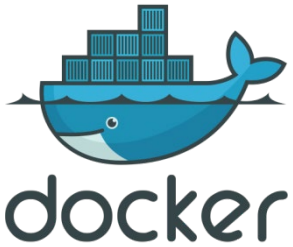
```
[root@jumphost ~]# java -XX:+PrintFlagsFinal -XX:MaxRAM=1g -XX:MaxRAMFraction=2 \
> -version | grep -Ei "maxheapsize|maxram"
    uintx DefaultMaxRAMFraction                     = 4                                   {product}
    uintx MaxHeapSize                              := 536870912                           {product}
 uint64_t MaxRAM                                   := 1073741824                          {pd product}
    uintx MaxRAMFraction                           := 2                                   {product}
   double MaxRAMPercentage                          = 50.000000                           {product}
openjdk version "1.8.0_232"
OpenJDK Runtime Environment (build 1.8.0_232-b09)
OpenJDK 64-Bit Server VM (build 25.232-b09, mixed mode)
```

Java Heap Sizing in a Containers



```
[root@jumphost ~]# free -m
              total        used        free      shared  buff/cache   available
Mem:           1715         246         226          16        1242        1241
Swap:          3071           1        3070
[root@jumphost ~]# docker run --rm -m 1g alpine free -m
              total        used        free      shared  buff/cache   available
Mem:           1715         339         175           0        1199        1191
Swap:          3071           1        3070
[root@jumphost ~]# docker run --rm alpine cat /sys/fs/cgroup/memory/memory.limit_in_bytes
9223372036854771712
[root@jumphost ~]# docker run --rm -m 1g alpine cat /sys/fs/cgroup/memory/memory.limit_in_bytes
1073741824
```

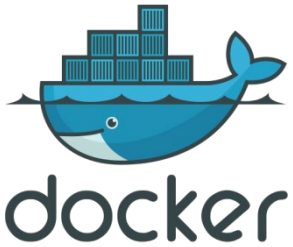
Java Heap Sizing in a Containers



- We need to make the CGroup memory limits visible to it
- Param -XX:+UseCGroupMemoryLimitForHeap was introduced on Java 9, backported to Java 8u131

```
[root@jumphost ~]# docker run --rm -m 1g openjdk:8-jdk-alpine cat /sys/fs/cgroup/memory/memory.limit_in_bytes
1073741824
[root@jumphost ~]# docker run --rm -m 1g openjdk:8-jdk-alpine sh -c "java -XX:+PrintFlagsFinal \
> -XX:+UnlockExperimentalVMOptions -XX:+UseCGroupMemoryLimitForHeap -version | grep -Ei 'maxheapsize|maxram'"
    uintx DefaultMaxRAMFraction                     = 4                                    {product}
openjdk version "1.8.0_212"
OpenJDK Runtime Environment (IcedTea 3.12.0) (Alpine 8.212.04-r0)
OpenJDK 64-Bit Server VM (build 25.212-b04, mixed mode)
    uintx MaxHeapSize                              := 268435456                            {product}
 uint64_t MaxRAM                                    = 137438953472                         {pd product}
    uintx MaxRAMFraction                            = 4                                    {product}
   double MaxRAMPercentage                          = 25.000000                            {product}
```

Java Heap Sizing in a Containers

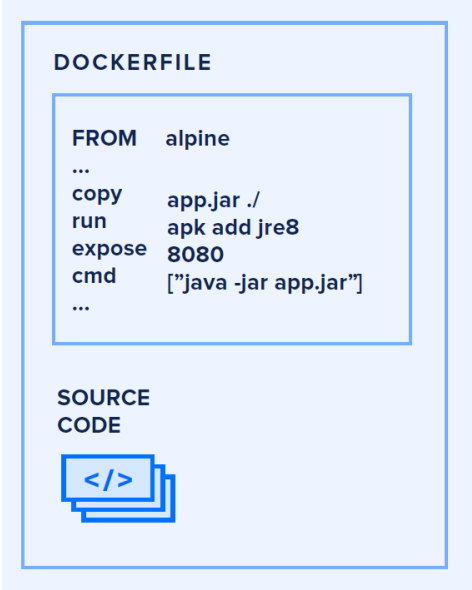


- Param -XX:+UseCGroupMemoryLimitForHeap and -XX:{Min|Max}RAMFraction were deprecated
- Param -XX:+UseContainerSupport and -XX:MaxRAMPercentage was introduced on Java 10, backported to Java 8u191

```
[root@jumphost ~]# docker run --rm -m 1g openjdk:8-jdk-alpine sh -c "java -XX:+PrintFlagsFinal \
-version | grep UseContainerSupport"
     bool UseContainerSupport                      = true                                 {product}
openjdk version "1.8.0_212"
OpenJDK Runtime Environment (IcedTea 3.12.0) (Alpine 8.212.04-r0)
OpenJDK 64-Bit Server VM (build 25.212-b04, mixed mode)
[root@jumphost ~]# docker run --rm -m 1g openjdk:8-jdk-alpine sh -c "java -XX:+PrintFlagsFinal \
-version | grep MaxHeapSize"
    uintx MaxHeapSize                              := 268435456                           {product}
openjdk version "1.8.0_212"
OpenJDK Runtime Environment (IcedTea 3.12.0) (Alpine 8.212.04-r0)
OpenJDK 64-Bit Server VM (build 25.212-b04, mixed mode)
```

Java Containers Recommendation

- Find the most suitable Java framework for your own usecase (e.g. SpringBoot, Play, etc)
- Update to latest Java 8 (8u232) or Java 10+
- Lightweight containers oriented, don't waste your resources
- Utilize resource request and resource limit on Kubernetes deployment, combine with JAVA_OPTS = -XX:+UseContainerSupport and -XX:MaxRAMPercentage=75.0




```
[root@jumphost ~]# docker run --rm -m 1g openjdk:8-jdk-alpine sh -c "java -XX:+PrintFlagsFinal \
-XX:MaxRAMPercentage=75.0 -version | grep MaxHeapSize"
    uintx MaxHeapSize                              := 805306368                           {product}
openjdk version "1.8.0_212"
OpenJDK Runtime Environment (IcedTea 3.12.0) (Alpine 8.212.04-r0)
OpenJDK 64-Bit Server VM (build 25.212-b04, mixed mode)
```

Balai Sertifikasi Elektronik

"Build Trust In Electronic Transactions"

Alamat : Jl. Harsono RM No. 70, Ragunan, Jaksel
Telp : 08119006400
Email : info.bsre@bssn.go.id

Terima Kasih

Badan Siber dan Sandi Negara