

PKI Services: The Best Kept Secret in z/OS

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Agenda

- Introduction to PKI Services
- Savings reported by a PKI Services customer – 66 millions

Introduction to PKI Services

Do you need digital certificates?

- To secure your servers, routers
- To authenticate your business partners, customers, employees

Where/How do you get them?

- Buy them from a well-known Certificate Authority (CA) like VeriSign
- Generate them using program from Windows, free software like openssl
- Generate them using z/OS RACF's RACDCERT command

Have you heard of z/OS PKI Services?

- No
- Yes, but z/OS products are not cheap...
- Yes, but I am happy with what I use now...

z/OS PKI Services

- Not a priced product. Licensed with z/OS
 - not getting enough marketing focus
 - not sure if IBM will continue the investment in this 'free' component
- A component on z/OS since V1R3, V1R13 was available last year
- *Closely tied to RACF
 - The CA cert must be installed in RACF's key ring
 - Authority checking goes through RACF's callable service (*Or other comparable security products)

z/OS PKI Services Overview

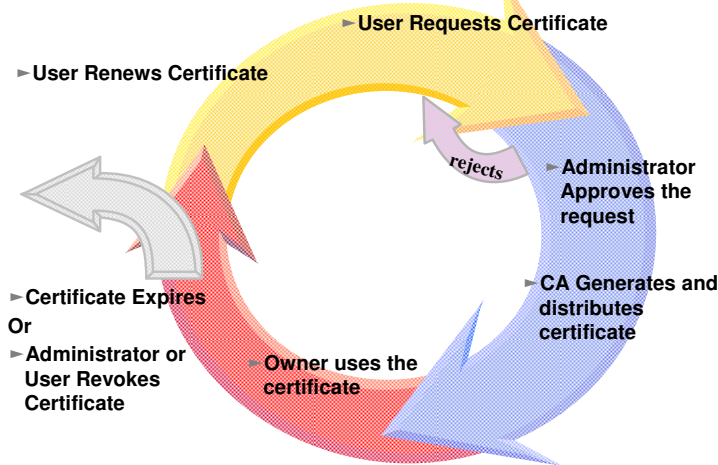
– Provide more functions than RACDCERT

- Full certificate life cycle management: request, create, renew, revoke
- Generation and administration of certificates via customizable web pages
- Support automatic or administrator approval process
- Certificates can be picked up from the requestor's machine
- Support multiple revocation checking mechanisms
 - Certificate Revocation List (CRL)
 - Online Certificate Status Protocol (OCSP)
- Certificates and CRLs can be posted to LDAP and/or stored in an HFS file
- Support Simple Certificate Enrollment Protocol (SCEP) to enable routers to request/renew certificates automatically

z/OS PKI Services Overview (contd)

- Provides email notification
 - to notify end user for completed certificate request and expiration warnings
 - to notify administrator for pending requests
 - to send the automatic renewed certificate
- Provides Trust Policy Plug-in for certificate validation

Certificate Life Cycle – This is why you need PKI Services



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Other benefits of using PKI Services

- An alternative to purchasing third party certificates
 - Cost efficient for banks, government agencies to host Digital Certificate management
- Provide options for requestor to generate his own key pair or request the PKI CA to generate it
- IdenTrust™ compliant
 - ensures adherence to a common standard to provide a solid foundation for trust between financial institutions and their customers
- Relatively low MIPS to drive thousands of certificates
- Leverage existing z/OS skills and resources
- Run in separate z/OS partitions (integrity of zSeries® LPARs)
- Scalable (Sysplex exploitation)
- Secure the CA private key with zSeries cryptography



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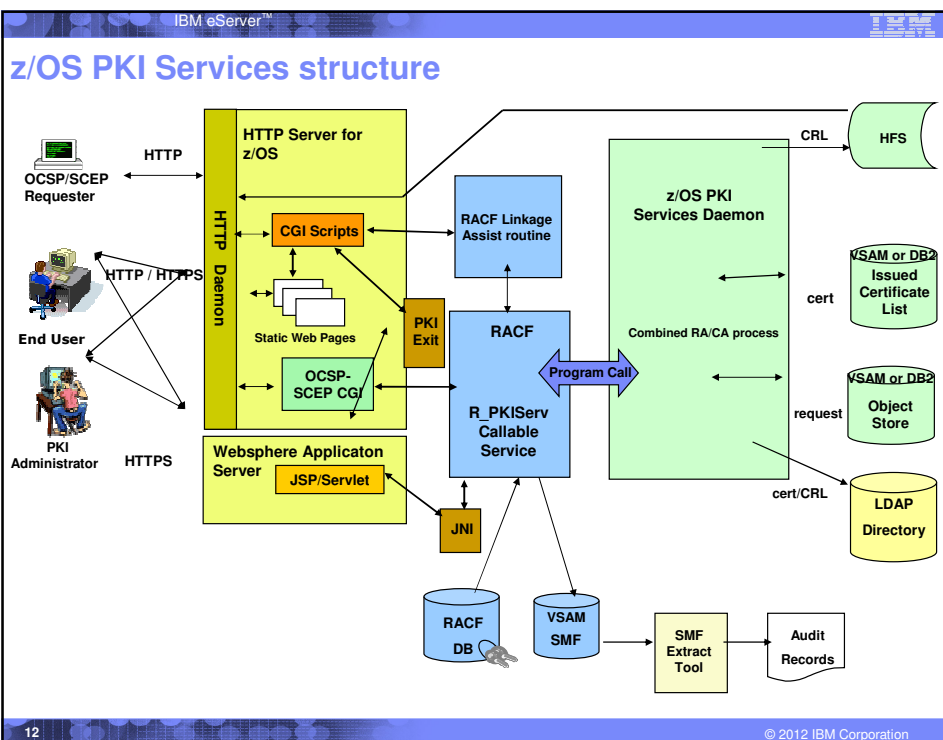
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Major Prerequisite Products

- **RACF (or equivalent)**
 - For storing PKI CA certificate
 - For authorization
- **IBM z/OS HTTP Server / Websphere Application Server**
 - For web page interface
- **LDAP Directory (z/OS or other platforms)**
 - For publishing issued certificates and CRLs
 - For email notification
- **ICSF (optional)**
 - For more secure CA private key
 - For PKI CA to generate key pair
- **z/OS Communications Server (optional)**
 - For email notification
- **DB2 (optional)**
 - An alternative for PKI backend VSAM stores

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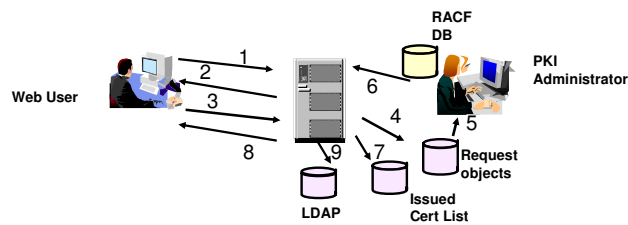


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z/OS PKI Services Process Flow – a simplified sample view

1. User contacts PKI Services to request for certificate
2. CGI/JSP constructs a web page for user to input information
3. CGI/JSP packages all the info and send to the callable service
4. Callable service calls the daemon to generate the request object and put it in the Request objects DB
5. Administrator approves the request through the administrator web page
6. CGI/JSP calls callable service which in turn calls the daemon to create the certificate, sign with the CA key in the RACF DB
7. Certificate is placed in the Issued Cert List DB
8. Certificate is sent to the user
9. Certificate is posted to LDAP



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Customization

- **Configuration file** - pkiserv.conf (used by the PKI Services daemon)
 - Contains mainly setup information for PKI Services
 - May contain certificate information applies to all types of certificates that PKI Services creates
- **Template file** - pkiserv.tmpl (used by the PKI Services CGIs), pkitmpl.xml (used by PKI Services JSPs)
 - Provides different types of certificate template
 - Browser certificate – key generated by browser
 - Server certificate – key generated by server
 - Key certificate – key generated by PKI CA
 - Each template contains certificate information that is specific to a certain type of certificate
 - S/MIME, IPSEC, SSL, CA, Windows Logon...

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Continuous enhancements (1 of 3)

V1R11:

- Support long Subject Distinguished Name up to 1024 characters (PTF UA52092)
- Provide option for the user to request PKI CA to generate the key pair
- Provide support for key recovery for those generated by the PKI CA
- Support SHA256 in the signing algorithm
- Implement the web pages with XML and JSPs to facilitate the integration with PKI Services from other applications

Continuous enhancements (2 of 3)

V1R12

- Support Elliptic Cryptographic Curve (ECC) keys, in addition to RSA and DSA keys
- Support Certificate Management Protocol (CMP) clients to communicate with PKI Services
- Provide automatic detection and correction on the potential problem causing by the used serial number
- Provide utilities to post certificates and Certificate Revocation List (CRL) on demand.
- Provide configurable time switches for the housekeeping tasks
- Support the creation of custom extensions to certificate
- Support the creation of Subject Alternate Name that contains multiple instances of each of the General Name forms
- Support the creation of certificates with expiration dates in the far future

Continuous enhancements (3 of 3)

V1R13

- Hardware Elliptic Curve Cryptography (ECC) support - PKI Services can use a hardware ECC certificate as its CA certificate.
- Optional Use of DB2 for ObjectStore and Issued Certificate List backends - Allow PKI customers who needs a large number of certificates to make use of the scalability and flexibility of DB2. Utilities to migrate existing PKI data from VSAM to DB2 are provided.
- Enable the Mozilla base browsers on both the Windows and Linux platform to use the smart card to generate certificates. Support PKI web pages to run on Internet Explorer version 8.
- Support large Certificate Revocation Lists (CRLs) for customers whose applications only support a small number of CRL distribution points.

Using RACF or PKI Services as a CA?

Use RACDCERT if	Use PKI Services if
Just need to generate a handful of certificates	Need to generate a large number of certificates
You can manually keep track of the expiration dates of the certs	You want to get notification on the expiration dates of the certs
You want to manually send the certs to the other parties	You want the other parties to retrieve the certs themselves
You don't care if the certs are revoked	You want the certs to be checked for revocation status
You just need basic extensions in the certs	You want more supported extensions in the certs



Note: PKI Services does not have any function to manage the key ring. Ring management is provided by RACF.

An user experience - saves millions by using z/OS PKI Services

Data is provided by Vicente Ranieri Junior who works with Banco do Brasil in deploying PKI Services

Banco do Brasil

- Owned by the Brazilian government
- The largest bank in Brazil
- Over 200 years old
- It maintains 4,000 banking locations throughout the country and more than a hundred international branches in 23 countries
- It has more than 40,000 ATM machines - the largest number of ATM machines in the financial market
- 87,000 Employees
- More than 30,000,000 customers
- Currently, Banco do Brasil is among the 3 largest IBM zSeries customers worldwide



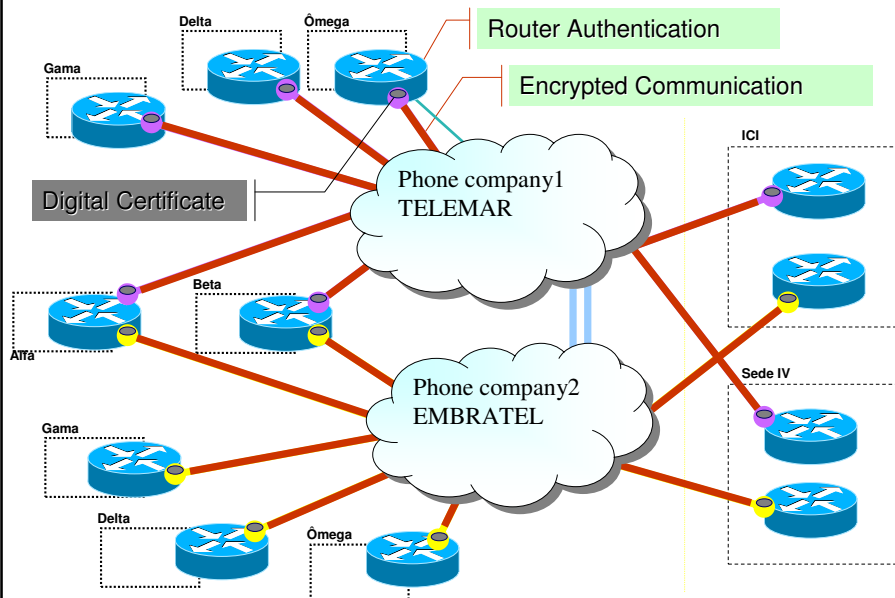
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Banco do Brasil Problem

- In 2003, following a market trend, Banco do Brasil outsourced its network to two telephone companies in Brazil
- Banco do Brasil lost the control over the path security where their critical data are flowing
- In order to enhance the network security, the telephone companies had to establish a VPN tunnel for each router pair in the network providing privacy and authentication



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Number of Certificates needed at Banco do Brasil

■ For Equipments and Applications – routers, internet banking

- 2007 : 14,000 digital certificates
- Near Future: 66,000 digital certificates

■ For People – employees, bank lawyers

- 2007 : 2,000 digital certificates
- Near Future: 80,000 digital certificates

The increase in projection number for certificates is due the 'extended services network' in which pharmacies, lottery booths need to be authenticated via certificates to perform small banking services.

Let's look at the YEARLY cost

Cost of certs for Equipment and Applications					
First Year			Projected		
Qty	Price per Cert	Total	Qty.	Price per Cert	Total
14,000	995.00	13,930,000.00	66,000	995.00	65,670,000.00



Cost of certs for People					
First Year			Projected		
Qty	Price per Cert	Total	Qty.	Price per Cert	Total
2,000	* 13.00	26,000.00	80,000	* 13.00	1,040,000.00



* Special Price from Brazilian Government Agency CA

Solutions considered

- **OpenCA**
 - Pros : Free
 - Cons: No support
- **Windows Server Certificate Services**
 - Pros : Support available
 - Cons: Scalability issue
- **z/OS PKI Services**
 - Pros : Free, scalable, support available
 - Cons: Some required certificate fields and protocol not supported yet

Banco do Brasil Solution

- **Banco do Brasil submitted requirements to IBM to enhance PKI Services**
- **After knowing that the requirements were in plan, Banco do Brasil decided to start exploiting z/OS PKI Services to issue its VPN digital certificates**

Banco do Brasil Solution

VPN Tunnel



- In Brazil, there are 2 ways to be a certified CA
 - get a certification from the PKI Brazil government department which requires the PKI application runs alone on a separate machine (the bank is working on getting the acceptance that LPAR isolation is as good as a stand alone machine)
 - the issuer and the requester sign an agreement
- Banco do Brasil signed an agreement with the telephone companies

Banco do Brasil Solution

VPN Tunnel



- Banco do Brasil network had its security dramatically improved with almost no additional cost (z/OS is their prime operating system and RACF was already deployed)
- In a week's time, PKI Services was set up and running in the test system
- Low consumption of MIPS to run PKI Services
- There are no extra head counts to run PKI Services
- The customer cost was only related to customize z/OS PKI Services pages to meet their requirements

IBM eServer™

PKI Services Certificate Generation Application

[Install our CA certificate into your browser](#) **Shipped sample**

Choose one of the following:

- **Request a new certificate using a model**

Select the certificate template to use as a model: 1-Year PKI SSL Browser Certificate

Request Certificate
- **Pick up a previously requested certificate**

Enter the assigned transaction ID: _____

Select the certificate return type: PKI Browser Certificate

Pick up Certificate
- **Renew or revoke a previously issued browser certificate**

Renew or Revoke Certificate
- **Administrators click here**

Go to Administration Page

[email: webmaster@your-company.com](mailto:webmaster@your-company.com)

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IBM eServer™

ICP BB INTERMEDIARIA 02 - Microsoft Internet Explorer fornecido por Banco do Brasil

Arquivo Editar Exibir Favoritos Ferramentas Ajuda

Endereço: <https://acnt02lab.bb.com.br/PKIServ/public-cgi/caman.nexo?>

Autoridade Certificadora Intermediária 02 LAB

PKI Services - GERAÇÃO DE CERTIFICADOS

[Baixar o certificado de nossa AC RAIZ](#)
[Baixar o certificado de nossa AC INTERMEDIARIA 01](#)
[Baixar o certificado de nossa AC INTERMEDIARIA 02](#)
[Baixar "Termo de Compromisso para Acesso Remoto"](#)

After customization

Escolha uma opção:

- **Solicitar um novo certificado utilizando um modelo**

Selecione o tipo de certificado desejado: 1-ANO CONTINGENCIA SSL BROWSER

Solicitar Certificado
- **Receber certificado solicitado**

Informe o ID da transação: _____

Selecione o tipo de certificado: CERTIFICADO PKCS10

Receber Certificado

Intranet local

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Shipped sample

Retrieve Your 1-Year PKI SSL Browser Certificate

Please bookmark this page

Since your certificate may not have been issued yet, we recommend that you create a bookmark to this location so that when you return to this bookmark, the browser will display your transaction ID. This is the easiest way to check your status.

Enter the assigned transaction ID

If you specified a pass phrase when submitting the certificate request, type it here, exactly as you typed it on the request form

To check that your certificate installed properly, follow the procedure below:

Netscape V6 - Click Edit->Preferences, then Privacy and Security-> Certificates. Click the Manage Certificates button to start the Certificate Manager. Your new certificate should appear in the Your Certificates list. Select it then click View to see more information.

Netscape V4 - Click the Security button, then Certificates-> Yours. Your certificate should appear in the list. Select it then click Verify.

Internet Explorer V5 - Click Tools->Internet Options, then Content, Certificates. Your certificate should appear in the Personal list. Click Advanced to see additional information.

[email: webmaster@your-company.com](mailto:webmaster@your-company.com)

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After customization

Autoridade Certificadora Intermediária 02 LAB

Receber Certificado do tipo: 1-ANO CONTINGENCIA SSL BROWSER

Sugestão: Caso seu Certificado ainda não esteja disponível, acrescente esta página aos seus "Favoritos". Com isto, na próxima verificação, o browser irá mostrar automaticamente o ID da transação, facilitando verificar o status e a recepção de seu certificado.

Informe o ID da transação

Digite a senha informada quando da solicitação do Certificado

Atenção usuários dos navegadores Firefox, Mozilla e Netscape: Após clicar no botão acima, estes navegadores não retornam mensagem informando que o certificado foi instalado com sucesso.

Para verificar se seu certificado está corretamente instalado siga os procedimentos abaixo:

Firefox 1.5 - Clique Ferramentas -> Opções -> Avançado -> Seguirança -> Certificados -> Seus certificados -> Dê um duplo clique em seu certificado para para obter informações mais detalhadas sobre o mesmo.

Internet Explorer V5 - Clique em Ferramentas -> Opções da Internet -> Conteúdo -> Certificados -> Dê um duplo clique em seu certificado para obter informações mais detalhadas sobre o mesmo.

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Banco do Brasil Solution

- Both telephone companies that outsourced Banco do Brasil network request and receive the VPN digital certificates through PKI Services web interface
- The phone companies send the serial numbers of the routers that need certificates to a manager
- They then use the RACF IDs in the Bank's system to request certificates for the routers
- The administrator checks if there's an email from the manager on the routers before the requests are approved
- The certificates are issued with 1 to 2 years' validity period

Performance



- 19.2 certificates created per second
- With 1+ million certificates created, queries with a requestor value specified as criteria returned in less than 1 second.
- With 1+ million certificates created and 5% revoked, CRL refreshing in LDAP (using 3055 CRL distribution points) took an average 3 minutes.
- Measured in a z900 model 2064-104 with hardware encryption and VSAM buffering

Summary

- **z/OS PKI Services is a complete Certification Authority package running under z/OS.**
- **It provides full certificate life cycle management**
- **No cost per issued digital certificate**
- **It is a very Secure, Scalable and Available PKI solution**
- **Banco do Brasil is an IBM customer reference**



References

- **PKI Services web site:**
<http://www.ibm.com/servers/eserver/zseries/zos/pki>
- **IBM Redbooks**
 - System z Cryptographic Services and z/OS PKI Services
 - Implementing PKI Services on z/OS
- **Cryptographic Server Manual**
Cryptographic Services PKI Services Guide and Reference
- **RFCs**
 - RFC2459 - Internet X.509 Public Key Infrastructure Certificate and CRL Profile
 - RFC5280 - Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile

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