Grid computing, 基本的な環境 , LOCALGROUPDISK 等

ATLAS ソフトウェア講習会 2016

河村 元
II.Physikalisches Institut, Universität Göttingen

Overview

- Your Grid environments
  - Lxplus at CERN
  - VMs at Heidelberg
  - Grid UI with Docker in your Linux Box
- Introduction to Grid computing
  - Concepts
  - Certificate Authorities and VOMS
  - Setup CVMFS
  - Grid user interface (CLI) and CVMFS
  - ATLAS Grid computing & WLCG Resources
  - ATLAS Resources
- Links ad references

Your Grid environments

Lxplus at CERN

- lxplus

```
## If you have a CERN account
ssh -Y YOUR_CERN_ACCOUNT@lxplus.cern.ch
```

- 東大 UI
  - https://naf-wiki.desy.de/Main_Page

```
## If you have a NAF account
ssh -Y schoolNN@nafhh-atlasMM.desy.de
```

Grid UI with Docker in your Linux Box - 1

- In RedHat Enterprise 6 (CentOS, Scientific Linux)

Installing Docker (as root)
yum install docker-io

You many need a permission (as root)
chown root:dockerroot /var/run/docker.sock
service docker start

Check you are in docker group
uid=500(gen) gid=500(gen) groups=500(gen),489(dockerroot)

Make your Docker file
cat Dockerfile
FROM binet/cvmfs-atlas

Replace user, group, uid, gid by your user in a local PC
RUN export uid=500 gid=500 user=atlas001 group=atlas001 && groupadd $group -g $gid && useradd $user -u $uid -g $gid -d /home/$user -s /bin/bash
USER atlas001
ENV HOME /home/atlas001

Building Docker container using CVMFS and ATLAS environments
docker build -t atlas-ui .

Running Docker container
docker run -it -w /home/atlas001 -v $HOME:/home/atlas001 -v /tmp:/tmp atlas-ui /bin/bash

概念 - 1

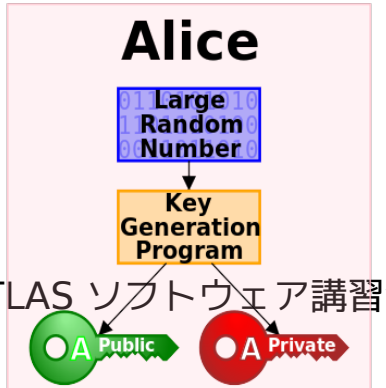
- 物理学では普通使わないテクニカルな用語。ただし覚えておくとたまに役に立つ。
  - User certificate, proxy certificate, CA, Virtual Organization (VO), VOMS, authentication, authorization, Computing Element, Storage Element, Worker nodes, Workload Management System, data management system, Job, data replica, information provider, site

概念 - 2

- Grid はどのように動くのか？
  - 基本
    - PKI（公開鍵認証インフラ）によるセキュリティ基盤
    - 同時に多人数のユーザーが利用
    - ユーザーの所属、実験等の識別
    - 計算資源のコントロール
    - ディスク資源やデータレプリケーションのコントロール
    - 世界中に分散した計算機の管理
    - ローカルな計算機のインターフェース
    - （例えば DNS のような） Tree 型の情報、計算資源検索
    - 末端ユーザーのためのツール（ UI ）

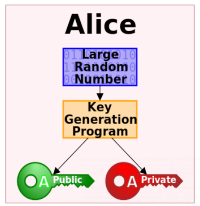
概念 - 4

- User certificate, proxy certificate, CA, Virtual Organization (VO), VOMS, authentication, authorization
  - 証明書と認証メカニズム
    - ユーザー証明書の発行
      - ２つの巨大素数 → p and q
      - 巨大な積 N = pq
      - 秘密鍵 (SK) に p + q を保存、 N は公開鍵 (PK) として使用

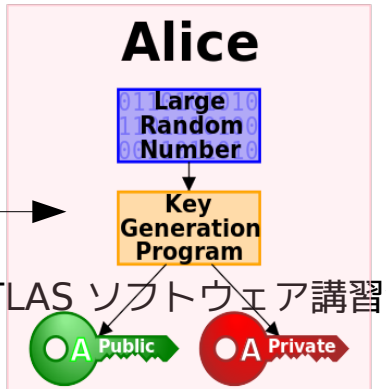


概念 - 4

- User certificate, proxy certificate, CA, Virtual Organization (VO), VOMS, authentication, authorization
  - 証明書と認証メカニズム
    - ユーザー証明書は CA によって署名される。
      - 署名 (S) はユーザー秘密鍵と公開鍵と文字列 X からタグ (T) 返す
      - 検証 (V) はユーザー公開鍵と X と T から 1/0 を返す。

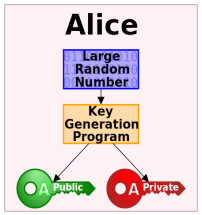


署名と検証



概念 - 5

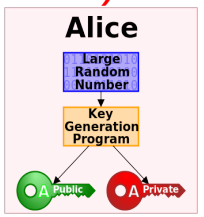
- 新しい一時証明書の発行 = プロキシ証明書



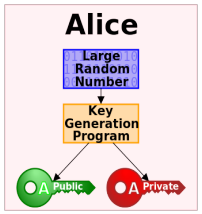
CA1

検証可能

プロキシ証明書
(限定的)

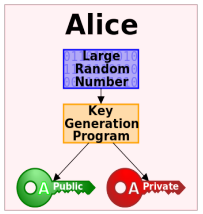


署名



CA2

署名



署名された新しい秘密鍵公開鍵のペアと元の公開鍵

ユーザーの X509 証明書

概念 - 6

- Virtual Organization (VO), VOMS
  - VOMS 認証方式

認証局 (CA)

署名

ユーザー証明書

署名

プロキシ証明書
= 限定された証明書

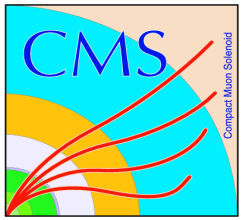
VO の要求
voms-proy-init

VOMS server

ATLAS VOMS
CMS VOMS
LHCb VOMS

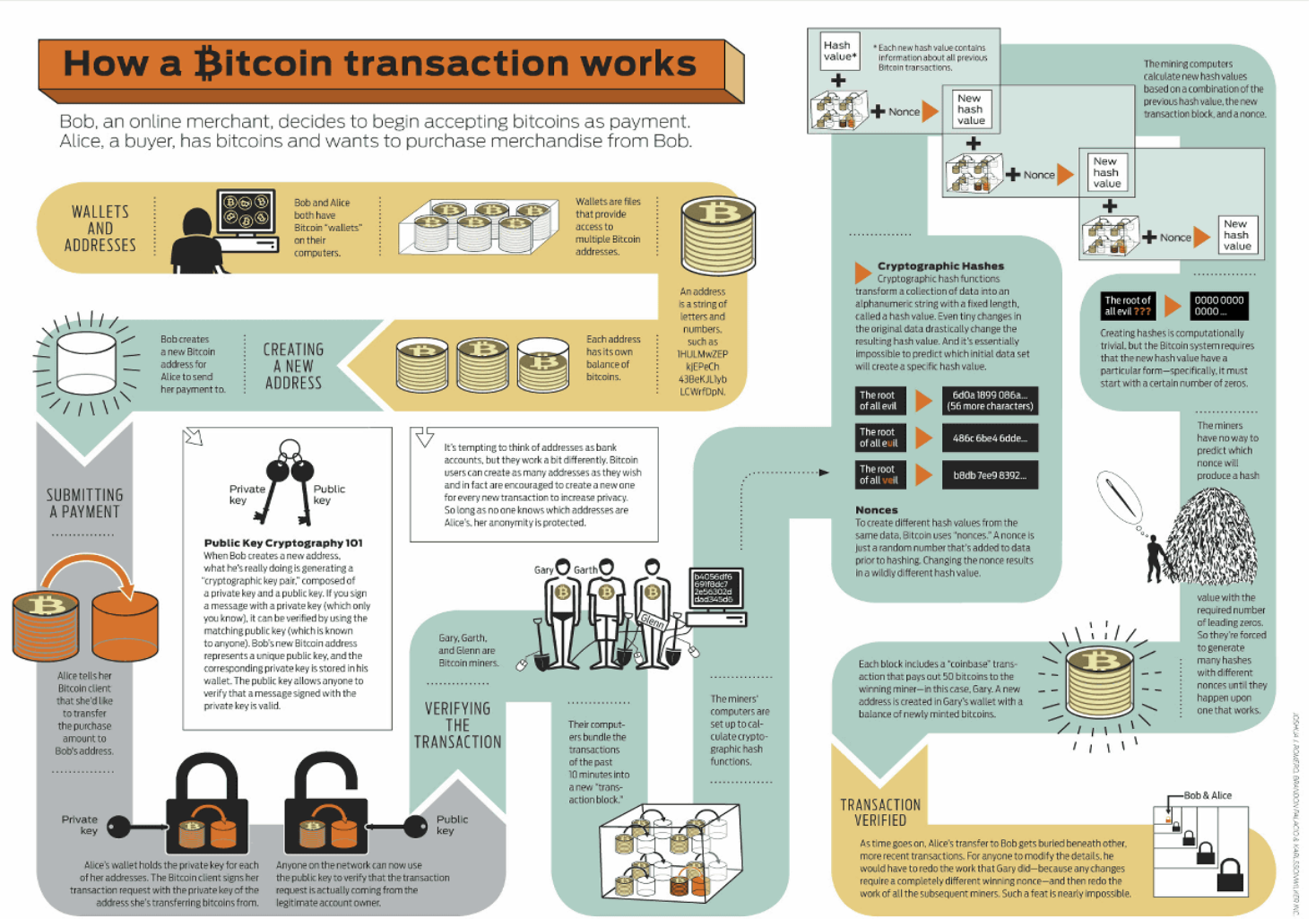
VO 拡張フィールドの発行

VOs



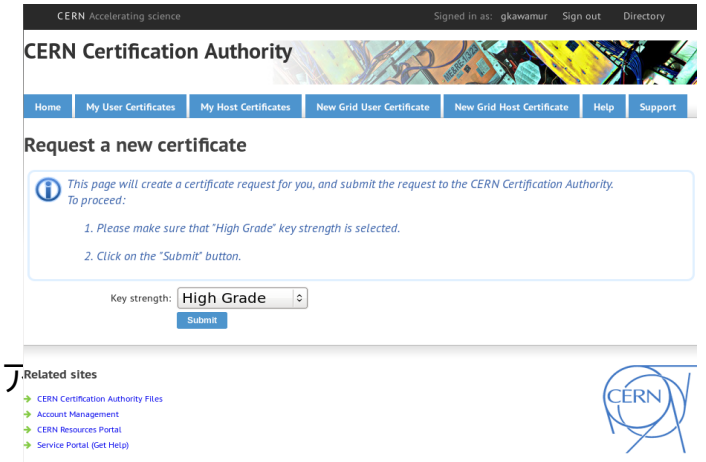
ヒント（実は良く似ています）

- 全員認証局の証明書の無限連鎖（署名＝売買）
  - デジタル通貨 (Bitcoin)



認証局と VOMS

- 日本
  - https://gridka-ca.kit.edu/
- CERN
  - https://ca.cern.ch/ca/user/Request.aspx?template=EE2User



認証局と VOMS

- VOMS top page
  - https://voms2.cern.ch:8443/
- VOMS ATLAS (ATLAS VO の要求)
  - https://voms2.cern.ch:8443/voms/atlas
- VOMS ATLAS ユーザー
  - https://voms2.cern.ch:8443/voms/atlas/services/VOMSCompatibility?method=getGridmapUsers&container=/atlas

CVMFS の設定

- 個人的な好み
  - ~/.bashrc などに書いておくと便利

```
## Alias to initialization of VOMS proxy
alias vinit='voms-proxy-init --voms atlas -hours 200 --valid 200:00'

## Alias to setupCVMFS
setupCVMFS(){
   export LCG_LOCATION=
   export ATLAS_LOCAL_ROOT_BASE=/cvmfs/atlas.cern.ch/repo/ATLASLocalRootBase
   source $ATLAS_LOCAL_ROOT_BASE/user/atlasLocalSetup.sh ""

   ## Using EMI LCG package
   source ${ATLAS_LOCAL_ROOT_BASE}/packageSetups/atlasLocalEmiSetup.sh --emiVersion ${emiVersionVal}
}

setupATLAS(){
   export ATLAS_LOCAL_ROOT_BASE=/cvmfs/atlas.cern.ch/repo/ATLASLocalRootBase
   source $ATLAS_LOCAL_ROOT_BASE/user/atlasLocalSetup.sh ""
}

## Using CVMFS (with EMI LCG client tools)
SetupCVMFS

## Using ATLAS env
setupATLAS
```

ユーザー証明書

- ユーザー証明書の取得

```
## Check important environment variables for your certificate
env | grep X509

## Generating a proxy certificate
export X509_USER_CERT=~/.globus/usercert.pem
export X509_USER_KEY=~/.globus/userkey.pem

## Generate user certificate
## (usercert.p12 was already exported by your browser)
openssl pkcs12 -clcerts -nokeys -in usercert.p12 -out $X509_USER_CERT

## create a private certificate with passphrase
openssl pkcs12 -nocerts -in usercert.p12 -out $X509_USER_KEY

## Set permissions
chmod 644 $X509_USER_CERT
chmod 400 $X509_USER_KEY

## show enddate
openssl x509 -in $X509_USER_CERT -noout -enddate

## show if the certificate is valid
openssl verify -CApath $X509_CERT_DIR -purpose sslclient $X509_USER_CERT
```

プロキシ証明書

- プロキシ証明書と簡単な検証

Generating a proxy
vinit

Enter GRID pass phrase for this identity:
Contacting voms2.cern.ch:15001 [/DC=ch/DC=cern/OU=computers/CN=voms2.cern.ch] "atlas"...
Remote VOMS server contacted succesfully.

voms2.cern.ch:15001: The validity of this VOMS AC in your proxy is shortened to 345600 seconds!

Generating a proxy certificate without VO
grid-proxy-init
voms-proxy-info -all

(it displays information without VO attributes)

Generating a proxy certificate with VO (a normal use)
voms-proxy-init --voms atlas -hours 200
voms-proxy-info -all

(it displays information with VO attributes)

Using another role (if you have another)
voms-proxy-init -voms atlas:/atlas/de/Role=production
voms-proxy-info -all

プロキシ証明書の検証

- 中身を見てみましょう

```
## Check context of your certificate
## The proxy certificate has 3 fields (PK, New PK, New SK)
less /tmp/x509up_u$UID | grep '\-'

-----BEGIN CERTIFICATE-----
-----END CERTIFICATE-----
-----BEGIN RSA PRIVATE KEY-----
-----END RSA PRIVATE KEY-----
-----BEGIN CERTIFICATE-----
-----END CERTIFICATE-----

## Check X509 attribute
openssl x509 -in /tmp/x509up_u$UID -text | less

##  Using a different proxy certificate
## (switch them if you have several ones)
mv -v /tmp/x509up_u$UID /tmp/x509_different_cert
export X509_USER_PROXY=/tmp/x509_different_cert
voms-proxy-info -all
```

Links and references

- RucioUI
  - https://rucio-ui.cern.ch/
- Rucio Documentation
  - http://rucio.cern.ch/index.html
- Software twiki tutorial
  - https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/SoftwareTutorialGettingDatasets
- Athena Docker setup
  - https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/AthenaMacDockerSetup
- Docker container for CVMFS
  - https://github.com/sbinet/docker-containers/tree/master/cvmfs-atlas
- Binet, Sébastien, and Ben Couturier. "*docker & HEP: Containerization of applications for development, distribution and preservation.*" Journal of Physics: Conference Series. Vol. 664. No. 2. IOP Publishing, 2015.
  - http://iopscience.iop.org/article/10.1088/1742-6596/664/2/022007/meta
- ATLAS-D meeting 2015 Rucio Tutorial, Thomas Beermann
- Monitoring Your Grid Jobs, Andrew Washbrook University of Edinburgh, ATLAS Software & Computing Tutorials 14th January 2015 PUC, Chile
- Athena Mac Docker
  - https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/AthenaMacDockerSetup
- Software tutorial using Grid
  - https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/SoftwareTutorialUsingTheGrid