Remote Name Mapping Prototype for Linux NFSv4

Andy Adamson
Center For Information Technology Integration
University of Michigan

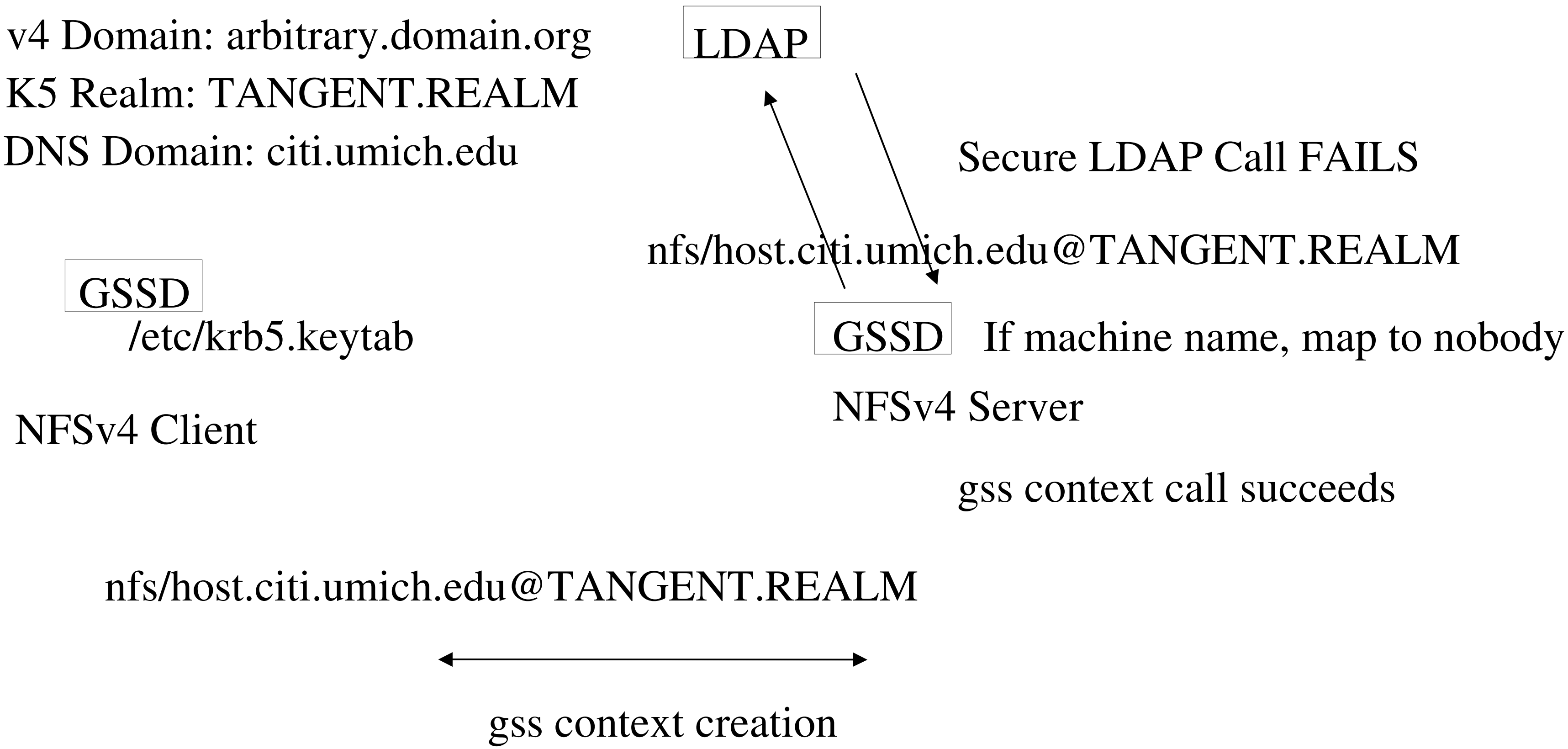
NFSv4 Administrative Domain

- NFSv4 domain = unique UID/GID space
- Multiple Security Realms
  - Kerberos, PKI Certificate Authorities (SPKM3)
- Multiple DNS - NIS domains
- Pick one DNS domain to be the NFSv4 Domain Name <user@nfsv4domain>
  - ACL 'who' and GETTATTR owner and owner_group

Local NFSv4 Domain: Name to ID

- One to one correspondence between UID and NFSv4 domain name
  - joe@arbitrary.domain.org
- GSS Principal name could differ from NFSv4 domain name
  - Kerberos V: joe@ARBITRARY.DOMAIN.ORG
  - PKI: OU=US, OU=State, OU= Arbitrary Inc, CN = Joe User Email= joe@arbitrary.domain.org

Local Mount: Kerberos V



v4 Domain: arbitrary.domain.org

K5 Realm: TANGENT.REALM

DNS Domain: citi.umich.edu

LDAP

Secure LDAP Call FAILS

nfs/host.citi.umich.edu@TANGENT.REALM

GSSD

/etc/krb5.keytab

GSSD

If machine name, map to nobody

NFSv4 Server

NFSv4 Client

gss context call succeeds

nfs/host.citi.umich.edu@TANGENT.REALM

gss context creation

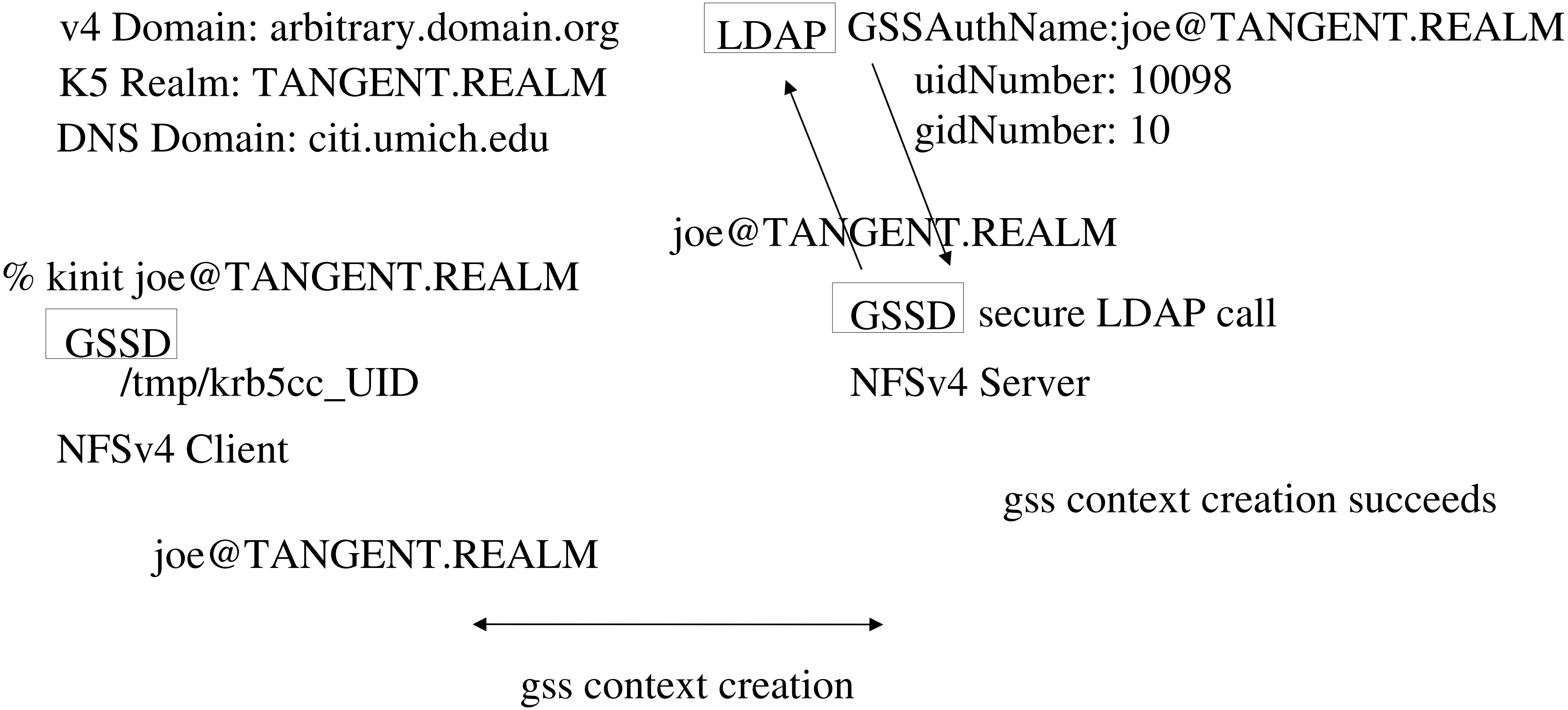
Local Mount: Kerberos V Issues

- Distribution of client keytabs? Linux: yes
  - With no keytab:
    - Allow AUTH_SYS for SETCLIENTID and mount of Kerberos export
    - User Kerberos credentials for SETCLIENTID
- Linux Server: maps machine credentials to nobody (mount)
- Client root user: UID 0?
  - Map to machine principal (no password)
  - Map to per server root principal (with password)

Local Principal: Kerberos V

- New Linux kernel keyring service enables kernel (Kerberos) credential storage, and PAG-like behaviour
- NSS ID mapping
  - getpwid on principal portion assumes UNIX name (posixAccount uid) == K5 principal
- UMICH LDAP ID mapping
  - GSSAuthName attribute added to LDAP posixAccount to associate with uidNumber
- Server GSSD principal mapping failure = context creation failure

Local Principal: Kerberos V



v4 Domain: arbitrary.domain.org

K5 Realm: TANGENT.REALM

DNS Domain: citi.umich.edu

LDAP GSSAuthName:joe@TANGENT.REALM

uidNumber: 10098

gidNumber: 10

joe@TANGENT.REALM

% kinit joe@TANGENT.REALM

GSSD

/tmp/krb5cc_UID

NFSv4 Client

GSSD secure LDAP call

NFSv4 Server

gss context creation succeeds

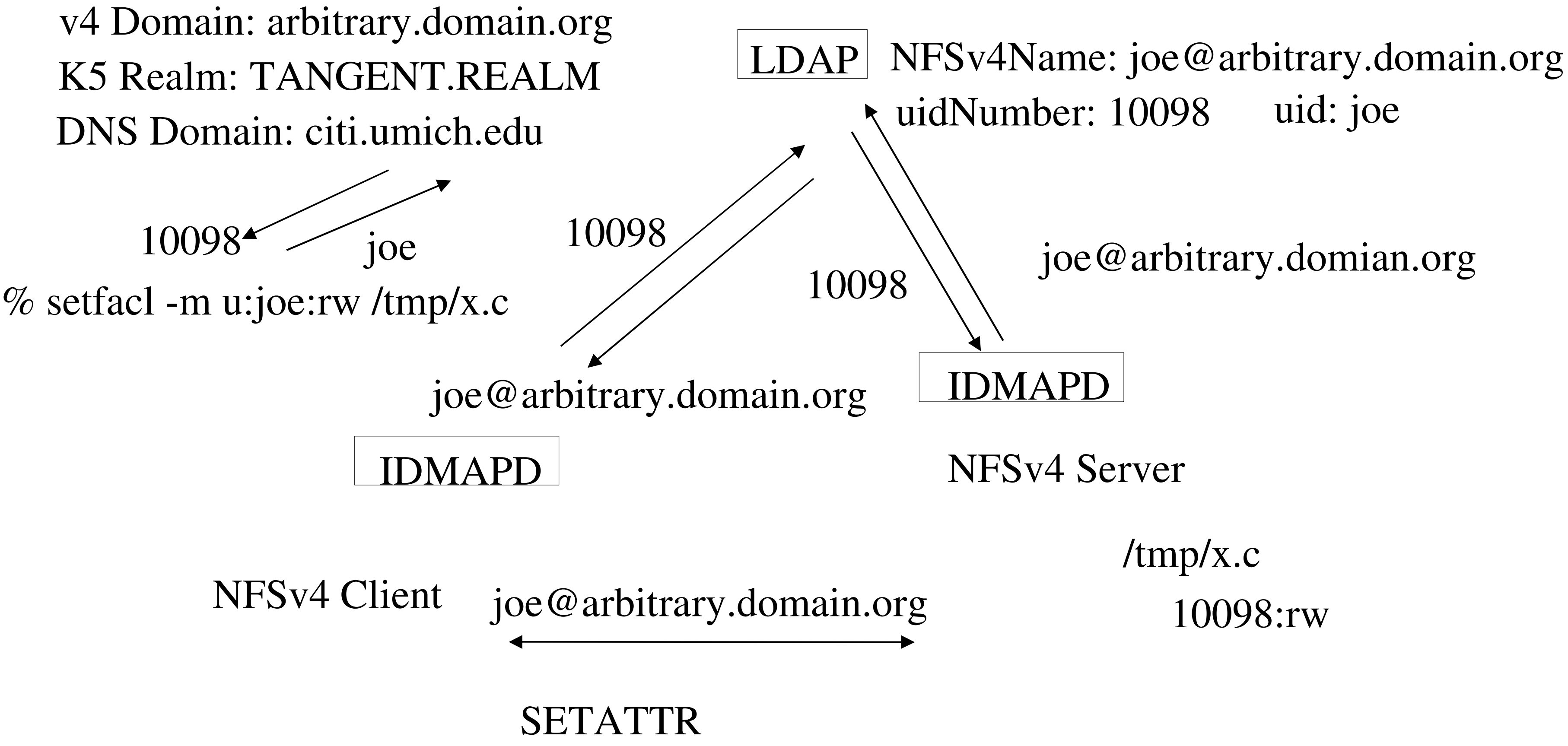
joe@TANGENT.REALM

gss context creation

Local User: Set ACL issues

- setfacl POSIX interface uses UID/GID across kernel boundary
  - two name mapping calls
  - local posixAccount name (no @nfsv4domain)
  - NFSv4Name attribute added to LDAP posixAccount to associate full nfsv4 name with uidNumber
- Linux nfs4_setfacl interface passes string names across kernel boundary
  - no local name needed

Local User: Set ACL



v4 Domain: arbitrary.domain.org

K5 Realm: TANGENT.REALM

DNS Domain: citi.umich.edu

LDAP

NFSv4Name: joe@arbitrary.domain.org

uidNumber: 10098

uid: joe

10098

joe

% setfacl -m u:joe:rw /tmp/x.c

10098

10098

joe@arbitrary.domian.org

joe@arbitrary.domain.org

IDMAPD

IDMAPD

NFSv4 Server

NFSv4 Client

/tmp/x.c

10098:rw

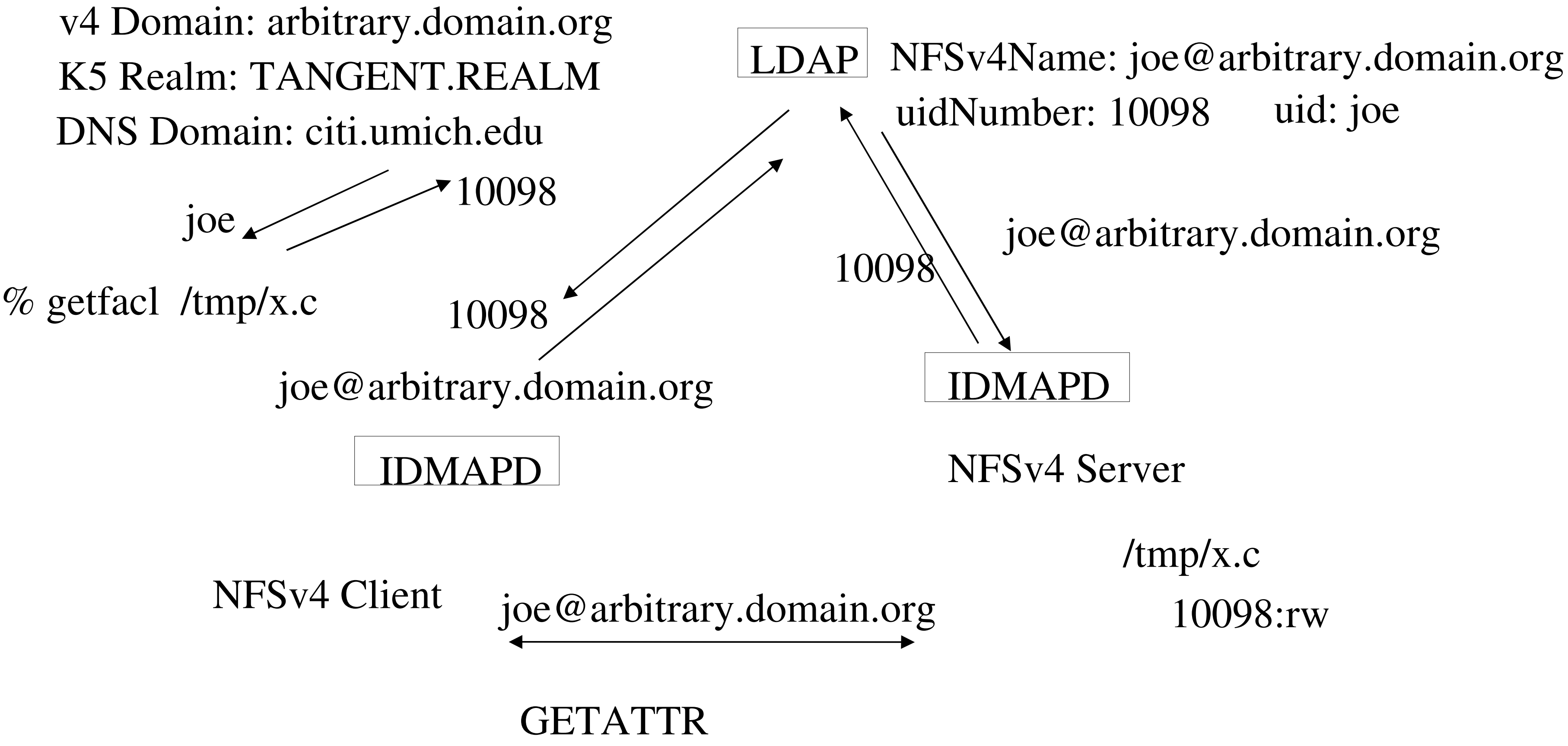
joe@arbitrary.domain.org

SETATTR

Local User: Get ACL issues

- getfacl POSIX interface uses UID/GID across kernel boundary
  - LDAP posixAccount: local name is displayed
  - two name mapping calls
- LINUX nfs4_getfacl interface passes string names across kernel boundary

Local User: Get ACL



v4 Domain: arbitrary.domain.org

K5 Realm: TANGENT.REALM

DNS Domain: citi.umich.edu

LDAP

NFSv4Name: joe@arbitrary.domain.org

uidNumber: 10098 uid: joe

joe

10098

% getfacl /tmp/x.c

10098

joe@arbitrary.domain.org

IDMAPD

NFSv4 Client

10098

joe@arbitrary.domain.org

IDMAPD

NFSv4 Server

/tmp/x.c

10098:rw

joe@arbitrary.domain.org

GETATTR

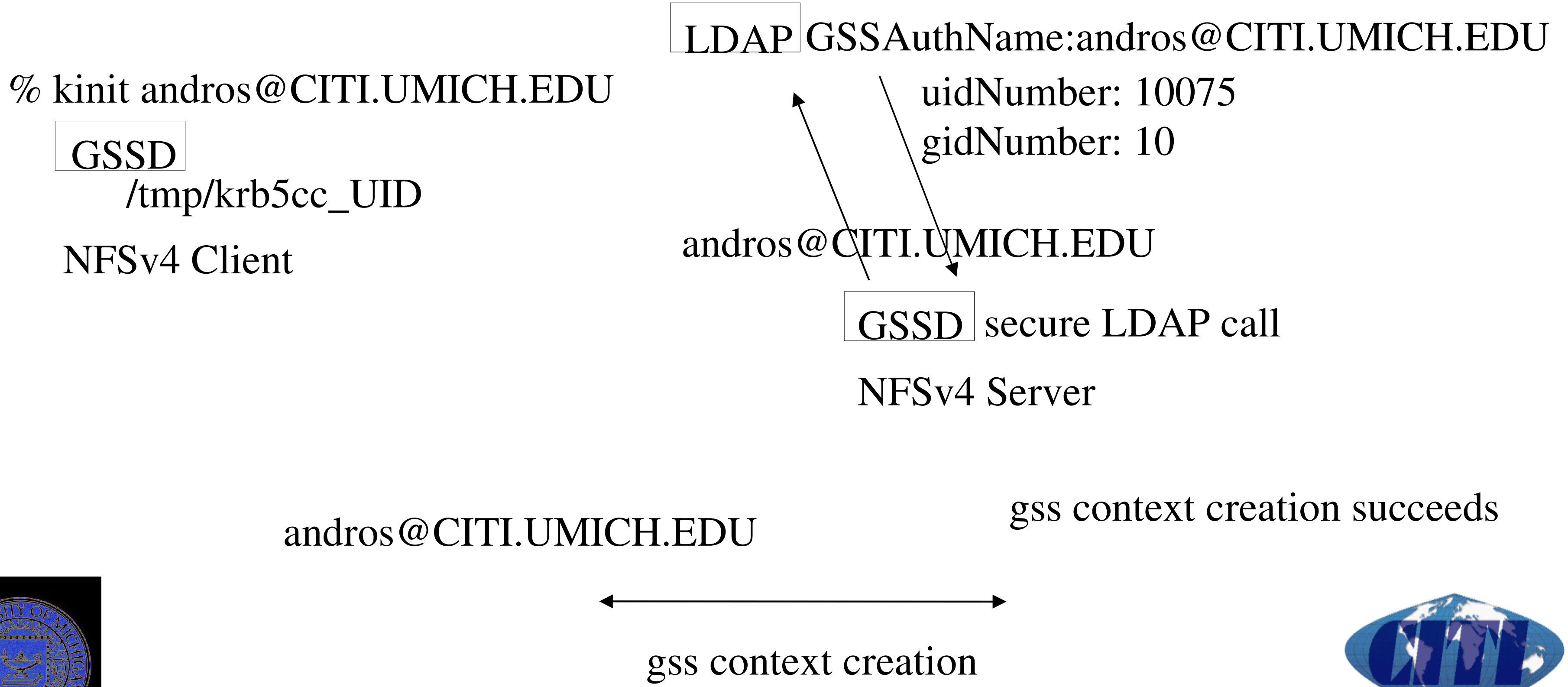
Kerberos V X-Realm and Linux NFSv4

- X-realm GSS context initialization just works
- GSSAuthName and NFSv4Name can hold remote user names.
- Need to add posixAccount with GSSAuthName for UID/GID mapping of remote user
- Set posixAccount shell attribute to /dev/null to grant NFSv4 remote access without local machine access

Remote Kerberos V Principal

v4 Domain: citi.umich.edu
K5 Realm: CITI.UMICH.EDU
DNS Domain: citi.umich.edu

v4 Domain: arbitrary.domain.org
K5 Realm: TANGENT.REALM
DNS Domain: citi.umich.edu



% kinit andros@CITI.UMICH.EDU

GSSD

/tmp/krb5cc_UID

NFSv4 Client

LDAP GSSAuthName:andros@CITI.UMICH.EDU

uidNumber: 10075

gidNumber: 10

andros@CITI.UMICH.EDU

GSSD secure LDAP call

NFSv4 Server

andros@CITI.UMICH.EDU

gss context creation succeeds

gss context creation

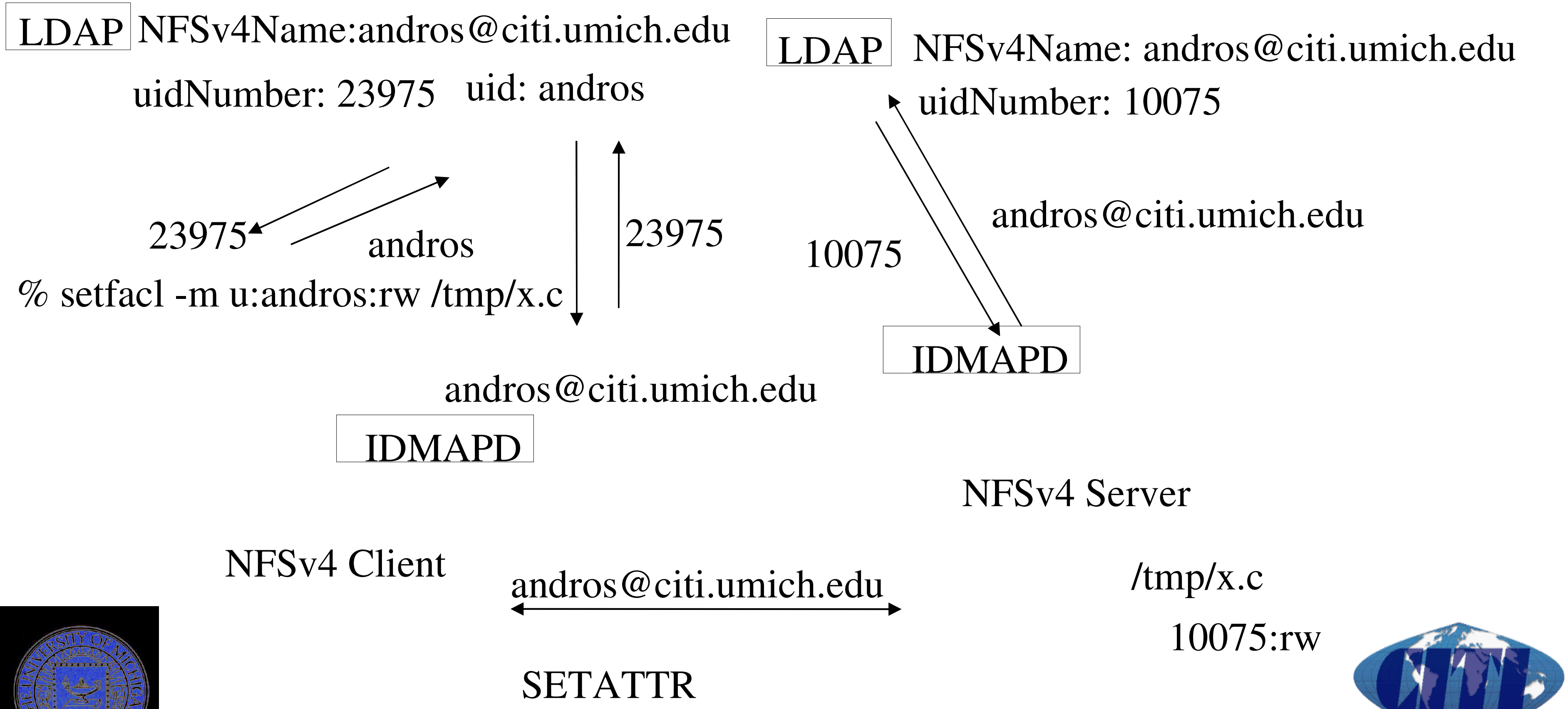
Remote User: Set ACL

- Remote realm: associate NFSv4Name with uidNumber, gidNumber, and GSSAuthName
  - NFSv4domain name always used
- Secure LDAP communication required

Remote User: Set ACL

v4 Domain: citi.umich.edu
K5 Realm: CITI.UMICH.EDU
DNS Domain: citi.umich.edu

v4 Domain: arbitrary.domain.org
K5 Realm: TANGENT.REALM
DNS Domain: citi.umich.edu



LDAP NFSv4Name:andros@citi.umich.edu
uidNumber: 23975 uid: andros

23975 andros

% setfacl -m u:andros:rw /tmp/x.c

23975

andros@citi.umich.edu

IDMAPD

NFSv4 Client

LDAP NFSv4Name: andros@citi.umich.edu
uidNumber: 10075

andros@citi.umich.edu

10075

IDMAPD

NFSv4 Server

andros@citi.umich.edu

SETATTR

/tmp/x.c
10075:rw

Remote User: Get ACL

- Client LDAP name mappings required only for POSIX getfacl
  - NFSv4Name and uidNumber for remote user
  - local user name for remote user
- nfsv4_getfacl displays the off-the-wire ACL name
- Server LDAP NFSv4Name mapping required
- Secure LDAP not required

Remote User: Get ACL

v4 Domain: citi.umich.edu
K5 Realm: CITI.UMICH.EDU
DNS Domain: citi.umich.edu

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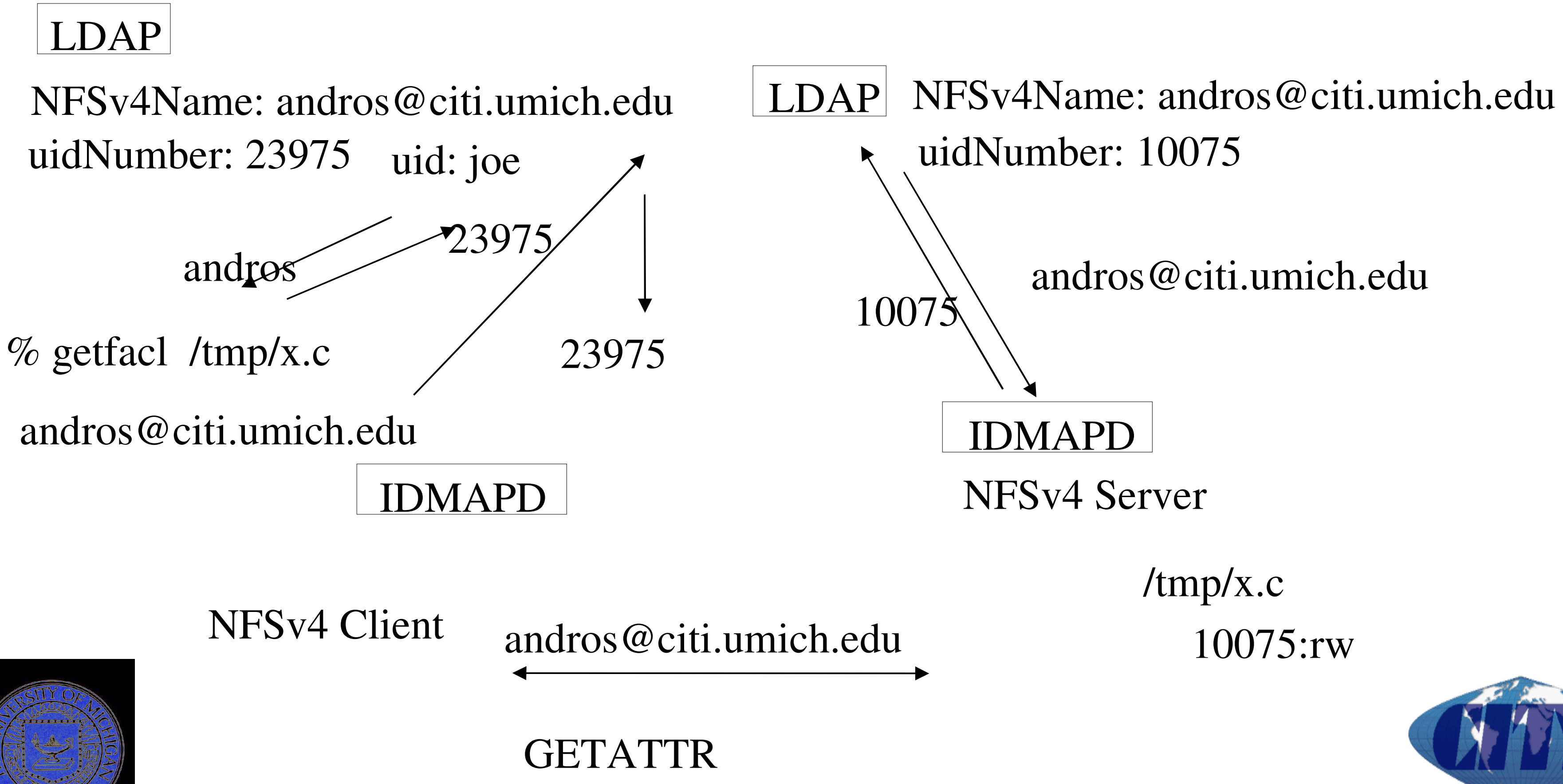

LDAP

NFSv4Name: andros@citi.umich.edu
uidNumber: 23975 uid: joe

andros

23975

% getfacl /tmp/x.c

23975

andros@citi.umich.edu

IDMAPD

NFSv4 Client

LDAP NFSv4Name: andros@citi.umich.edu
uidNumber: 10075

andros@citi.umich.edu

10075

IDMAPD

NFSv4 Server

/tmp/x.c
10075:rw

andros@citi.umich.edu

GETATTR

Any Questions?

http://www.citi.umich.edu/