ONC RPC WG Agenda

- Introductions, Background, Agenda Changes
- Review RPC V2 Changes
- Review RPC Bind Changes
- Review RPC Auth Changes
- RPCSEC_GSS Presentation
  - Mike Eisler, SunSoft
- Next Steps

ONCRPC WG Info

- Charter: Standardize ONC RPC protocols
- WG Chair: Currently OPEN(Steve Nahm is Acting Chair)
- Outstanding drafts
  - Proposed Standards
    - RFC1831 - RPC V2
    - RFC1832 - XDR
    - RFC 1833 - RPC Bind
- Online info
  - oncrpc-wg@sunroof.eng.sun.com
  - oncrpc-wg-request@sunroof.eng.sun.com
  - Archives at playground.sun.com:/pub/oncrpc

ONC RPC WG Drafts

- draft-ietf-oncrpc-remote-00.txt
  - *Current version archived is truncated*
- draft-ietf-oncrpc-rpcbind-00.txt
  - originally posted as draft-ietf-oncrpc-bindv2-00.txt
- draft-ietf-oncrpc-auth-02.txt

RPC V2 Major Changes from RFC1831

Section 5: added reference to Bind document as "recommended method for binding"

Section 7: Changed RPC number registrar to IANA

Section 8: XID wording

- Advice to associate XIDs with specific client-server sessions
  - eg, XID considered unique per each instance of RPC program number, version number and port number
- Arose from comment by NFS vendors which interpreted XID differently

RPC Bind Major Changes from RFC1833

- Section 1: Added an exampleof a universal address
- Section 2: Changed all longs to ints
  - Reflects LP64 convention used for 64-bit systems adopted by DEC, SunSoft, others
- Section 3: Updated protocol style to RPCL style used elsewhere in document
- Section 4: Added Security Considerations section
  - Advice on restrictions on PMAP_SET/UNSET
  - Warning on CALLIT attack

Auth Changes to Previous Draft

- First page: Added Warning about risks in AUTH_DH and AUTH_KERB4
- Section 2.2 (and elsewhere): Added information about when AUTH_BADCRED, AUTH_REJECTEDCRED and AUTH_INVALIDRESP are returned
- Section 2.4.1: Added first step -- create conversation key
- Sections 3.2.1 and 3.2.2: Similar improvements to above two bullets added to AUTH_KERB4 section
- Section 3.2.4: Added additional information about AUTH_KERB4 authentication errors

Next Steps

- Move RPC V2 and RPC Bind drafts to Draft Standard
- Publish Auth draft as Informational RFC
- Submission of RPCSEC_GSS draft

GSS-API Security for ONC RPC

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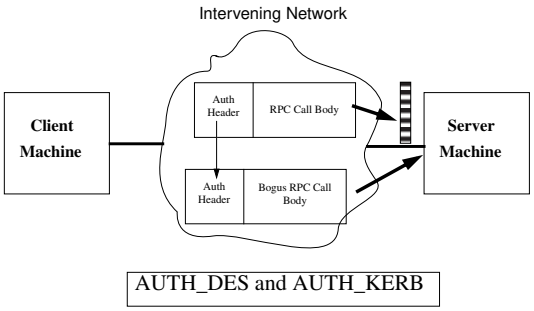
CURRENT RPC SECURITY FLAVORS

- **AUTH_UNIX**
  - simple, fast, de-facto standard
  - trivial to defeat
- **AUTH_DES**
  - uses Diffie/Hellman public key algorithm
  - documented weaknesses(LaMacchia and Odlyzko, 1990)
- **AUTH_KERB**
  - uses Kerberos V4
  - missed market window to complete a product
  - documented weaknesses (Bellovin and Merritt, 1991)

EXERCISING HINDSIGHT ON PAST APPROACHES

- **Flavors had designed in (unforeseen) limitations**
  - AUTH_UNIX had too few Unix group ids
  - AUTH_DES had too small a key size
  - neither AUTH_DES nor AUTH_KERB provided integrity/privacy
- **Adding a security mechanism required per application changes**
  - no notion of flavor or security mechanism independence
- **Security mechanism specifics had to be ported into kernel for NFS implementation.**

INTEGRITY ATTACK



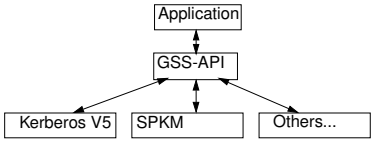
REQUIREMENTS FOR A SOLUTION

- **Support multiple underlying security mechanisms**
- **Support all of Authentication, Integrity, Privacy**
- **Mechanism should be transparent to the application**
- **ISVs should be able to add new mechanisms**
  - Modulo U.S.A export control laws
- **Preservation of Binary and Source compatibility**
- **Use standards where possible**

GSS-API has the above characteristics

GSS-API OVERVIEW

- **RFC 1508 describes the framework**
- **RFC 1509 describes the C language bindings**
- **Similar to TLI**
  - normalizes access to security mechanisms
  - like TLI, punts on generic naming issues

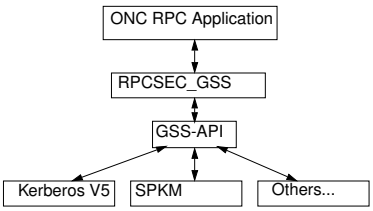


GSS-API OVERVIEW

- **Binds authentication with mechanism**
- **Offers optional integrity or privacy**
- **Permits specification of Quality of Protection**
  - cryptographic algorithm used with integrity or privacy
- **Transport is the responsibility of application**
  - However, some support for channel bindings.
  - GSS-API primitives return tokens which are sent to application's peer
  - However, some support for channel bindings.

RPCSEC_GSS SECURITY FLAVOR

- **A new flavor that encapsulates GSS-API:**



- **Provides virtually all of the GSS-API interfaces to ONC application.**
  - punt on channel bindings

API OF RPCSEC_GSS

Client side example:

```
AUTH *rpc_gss_seccreate(
  CLIENT *clnt,         /* in */
  char *principal,      /* in */
  char *mechanism,      /* in */
  rpc_gss_service_t service_type, /* in */
  char  *qop,           /* in */
  rpc_gss_options_req_t
     *options_req,/* in */
  rpc_gss_options_ret_t
     *options_ret);/* out */
clnt -> cl_auth = rpc_gss_seccreate(clnt,
 "nfs@jurassic.eng.sun.com","kerberos_v5",
 rpc_gss_svc_integrity,
 "GSS_KRB5_INTEG_C_QOP_DES_MD5", NULL,
 NULL);
```


API OF RPCSEC_GSS

Server side example:

```
server_prog(struct svc_req *rqstp,SVCXPRT *xprt)
{
  rpc_gss_ucred_t *ucred;
  rpc_gss_rawcred_t *rcred;

  switch (rqstp->rq_cred.oa_flavor) {
  case RPCSEC_GSS:
    /* get credential information */
     rpc_gss_getcred(rqstp, &rcred,&ucred,NULL);
     if (!authenticate_user(ucred->uid, rcred->mechanism,
          rcred->qop, rcred->service)) {
               svcerr_weakauth(xprt);
               return;
     }
     break; /* allow the user in */
  default:
     svcerr_weakauth(xprt);
     return;
  } /* end switch */
...
}
```


RPCSEC_GSS PROTOCOL

- **Session-based like AUTH_DES and AUTH_KERB**
- **Based on OpenVision's AUTH_GSSAPI protocol**
- **Session has three phases:**
  - Context creation
  - RPC Data Exchange
  - Context Destruction

RPCSEC_GSS PROTOCOL

Context creation request

- **Procedure number in call header set to NULLPROC**
- **AUTH header's credential:**

```
struct opaque_auth {/* credential */
  sec_flavor flavor; /* Set to RPCSEC_GSS */
  opaque body<400>; /* body encoded as rpc_gss_cred_t */
};
struct rpc_gss_cred_t {
    unsigned int version; /* set to 1 */
    unsigned int gss_proc; /* RPCSEC_GSS_INIT */
    unsigned int seq_num; /* ignored */
    enum service; /* ignored */
    opaque handle<>; /* zero length */
};
```

- **AUTH header's verifier is NULL on context create.**

RPCSEC_GSS PROTOCOL

Context creation request

- **Call arguments don't contain NULLPROC args, but instead:**

```
struct rpc_gss_init_arg {
  opaque gss_token<>; /* from GSS-API's
                         gss_init_sec_context() */
  unsigned int qop;
  enum service; /*integrity, privacy, default, or none */
};
```


RPCSEC_GSS PROTOCOL

Context creation response

- **Response results don't contain NULLPROC results, but instead:**

```
struct rpc_gss_init_res {
  opaque handle<>; /* context identifier */
  /* gss_major/gss_minor returned from GSS-API's
     gss_accept_sec_context() interface */
  unsigned int gss_major;
  unsigned int gss_minor;
  unsigned int seq_window; /* maximum number of
      outstanding RPC requests for this context. */
  opaque gss_token<>; /* token from
         gss_accept_sec_context() */
};
```


RPCSEC_GSS PROTOCOL

RPC Call

- **AUTH header format:**

```
struct opaque_auth {/* credential */
  sec_flavor flavor; /* Set to RPCSEC_GSS */
  opaque body<400>; /* encoded as rpc_gss_cred_t */
};
struct rpc_gss_cred_t {
    unsigned int version; /* set to 1 */
    unsigned int gss_proc; /* RPCSEC_GSS_NULL */
    unsigned int seq_num; /* monotonically increasing */
    enum service; /* integrity, privacy, none*/
    opaque handle<>; /* context id from context create
      response */
};
```

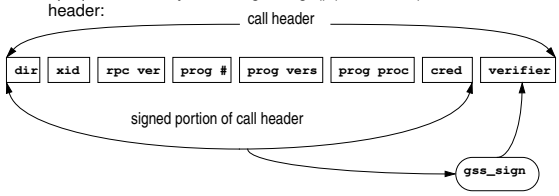

RPCSEC_GSS PROTOCOL

RPC Call

- **AUTH header format:**

```
struct opaque_auth {/* verifier */
  sec_flavor flavor; /* Set to RPCSEC_GSS */
  opaque body<400>;
};
```

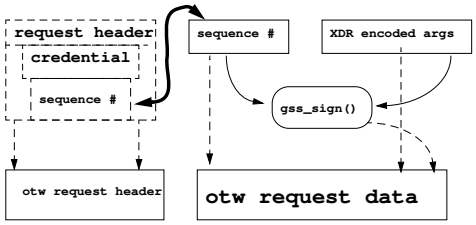
- opaque_auth.body is set to gss_sign() (check sum) of rest of RPC call header:



RPCSEC_GSS PROTOCOL

RPC Call

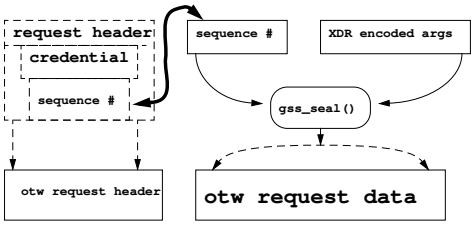
- **Integrity protected requests**



RPCSEC_GSS PROTOCOL

RPC Call

- **Privacy protected requests**



RPCSEC_GSS PROTOCOL

Server processing of requests

- **Server verifies**
  - version number of RPCSEC_GSS from cred
  - service specified in cred
  - context handle in cred
  - sequence number in cred
  - header checksum (gss_sign()) in verifier

RPCSEC_GSS PROTOCOL

Server processing of requests

- **Sequence number processing**
  - Server maintains WINDOW of sequence numbers
  - WINDOW starts from last sequence number seen and extends backwards.
  - WINDOW moves forward to the highest sequence number seen.
  - In case of integrity or privacy, the server will reject message if the sequence number in request body differs from that in cred.
  - requests with sequence #s below the range are silently discarded
    - **prevents reply attacks and problems with networks sending duplicates.**
    - **no danger of denial of service attack because creds are required for attacker to forge requests. Seq# check occurs after the other processing of the AUTH header.**

RPCSEC_GSS PROTOCOL

Server replies

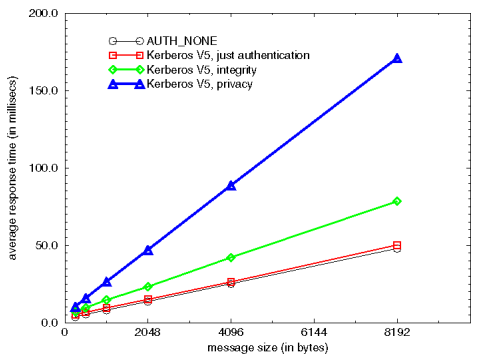
- **Note that ONC RPC doesn't have creds on replies, just verifiers.**
- **The verifier is a gss_sign() of the sequence number of the request.**
- **Integrity or privacy are specified on the call, the reply is encoded the same way.**

RPCSEC_GSS PROTOCOL

Context destruction from client

- **Like a regular data call but:**
  - Procedure number set to NULLPROC
  - gss_proc in the credential set to RPCSEC_GSS_DESTROY

Reply to context destruction

- **LIke a regular reply**

RPCSEC_GSS PROTOCOL: Preliminary Performance