You've Got Mail

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Overview

- Architecture, design and code for a robust correspondence generation system
  - Mail merge capability
  - User maintainable
  - Multiple recipients
  - Multiple, user-selectable output formats

Overview (2)

- Functional requirements
- Database design
- Back-end code
- User interface

Application

- Grants Management system for federal agency
- Intranet usage over LAN and WAN for agency employees at HQ and throughout the US
- Internet usage for applicants for grants and current grantees

Environment

- Oracle 8i database (8.1.7)
- Developer 6i - Forms and Reports
- Oracle 9iAS, Forms Server, Reports Server
- Designer 6i
- Windows NT 4
- Internet Explorer 5.5

Mail Merge Capability

- Boilerplate text is defined
- Tokens are embedded
- Tokens represent data to be retrieved from the database
  - Columns
  - Functions applied to columns

Mail Merge Capability (2)

<<Print_Date>>

<<Auth_Rep_Full_Name>>
<<Auth_Rep_Title>>
<<Legal_App_Name>>
<<Legal_App_Addr>>

Dear <<Auth_Rep_Salut>>:

<<Legal_App_Name>> is 30 days late in submitting the progress report for grant number <<Grant_Nbr>> covering the period ending <<PR_Period_End_Dt>>. This progress report was due on <<PR_Due_Dt>>.

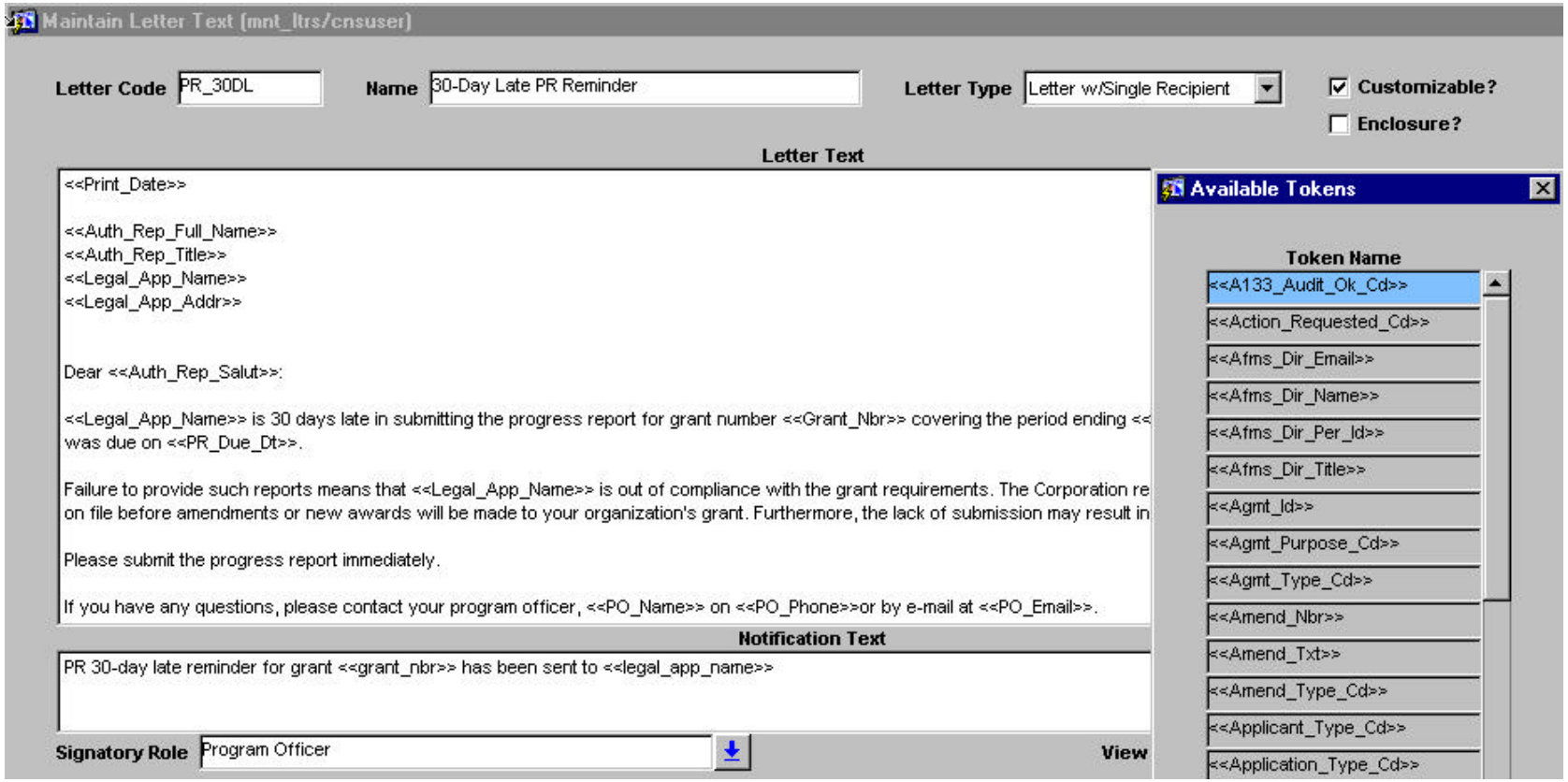
Failure to provide such reports means that <<Legal_App_Name>> is out of compliance with the grant requirements. . . .Please submit the progress report immediately.

If you have any questions, please contact your program officer, <<PO_Name>> on <<PO_Phone>>or by e-mail at <<PO_Email>>.

Multiple Letter Types

- Printed letter with single recipient/addressee
  - Example: Reminder letter to grantee stating that a progress report is overdue
- Personalized letter to multiple recipients
  - Example: Form letter to each state's governor summarizing the grants awarded in the state
- Internal notification
  - Part of application
  - Simplified inbox

Setting up Letters



Distribution

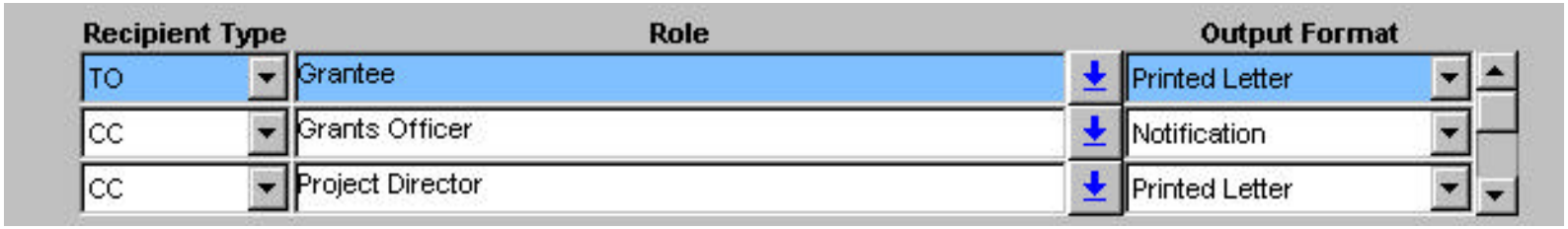
- Multiple recipients/people and roles
  - Recipients are defined by their role in the organization

    - OR -

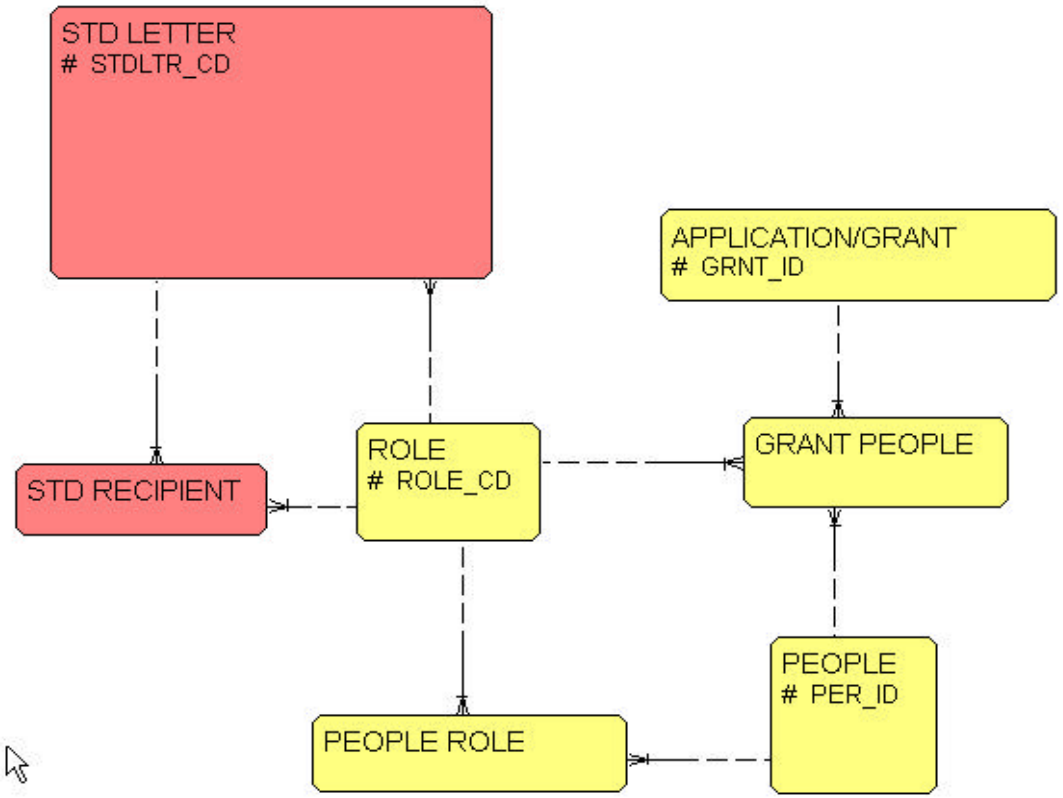
  - Their role for a grant
- Software determines the person based on the role
  - Example: “send a notification to the grants officer assigned to this grant”

Setting up Letter Recipients

- Each recipient has a default/preferred output format
  - Email or printed letter available to all
  - Notification available to internal agency only



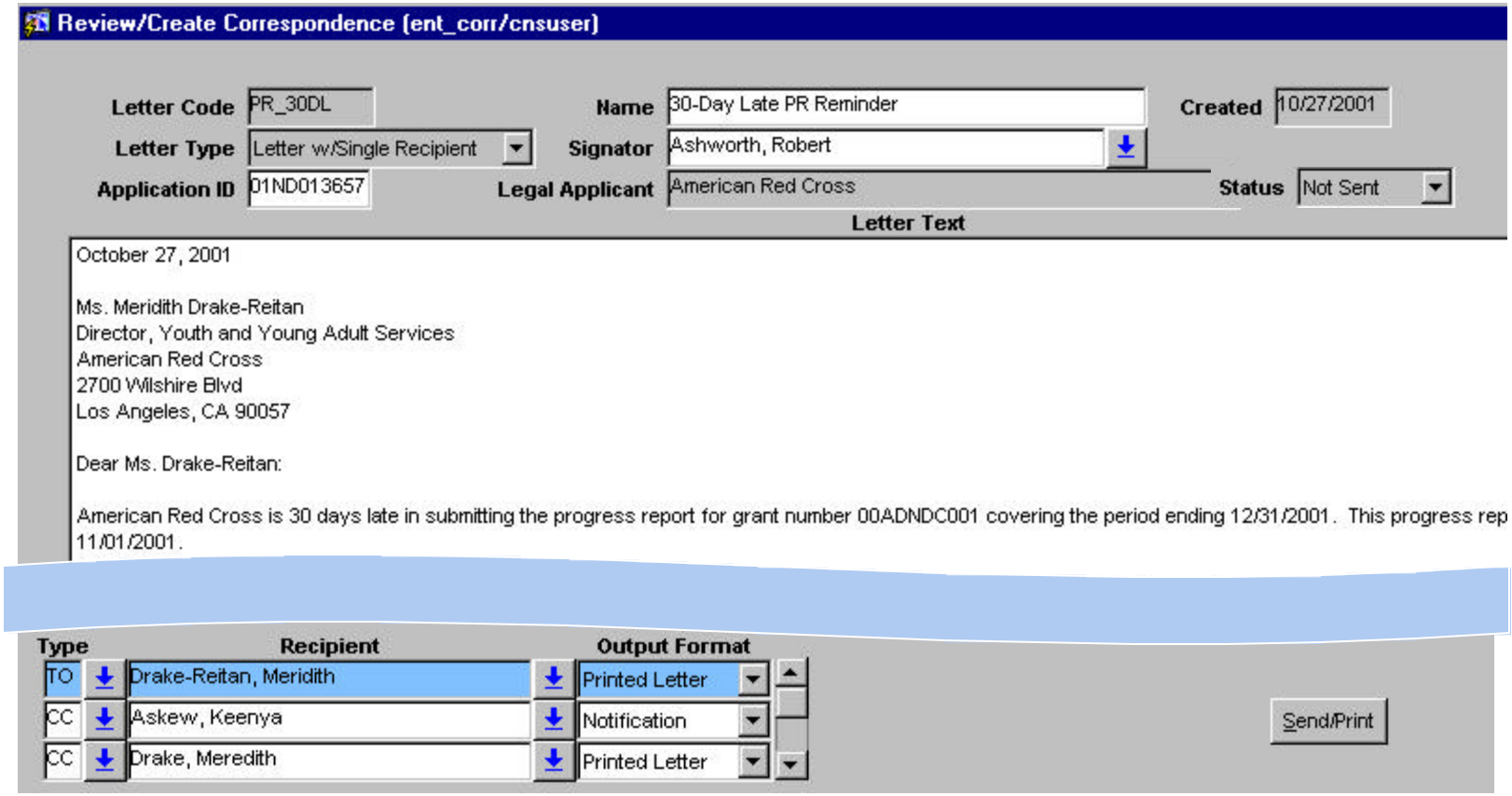
Database Design – Letter Setup



Review/Change Output

- User may alter text, depending on privileges
  - Letter must be defined as “customizable”
  - User must be the signatory for the letter
- May also alter recipient list and destination type for each recipient
- Can hold letters for a period of time and send later

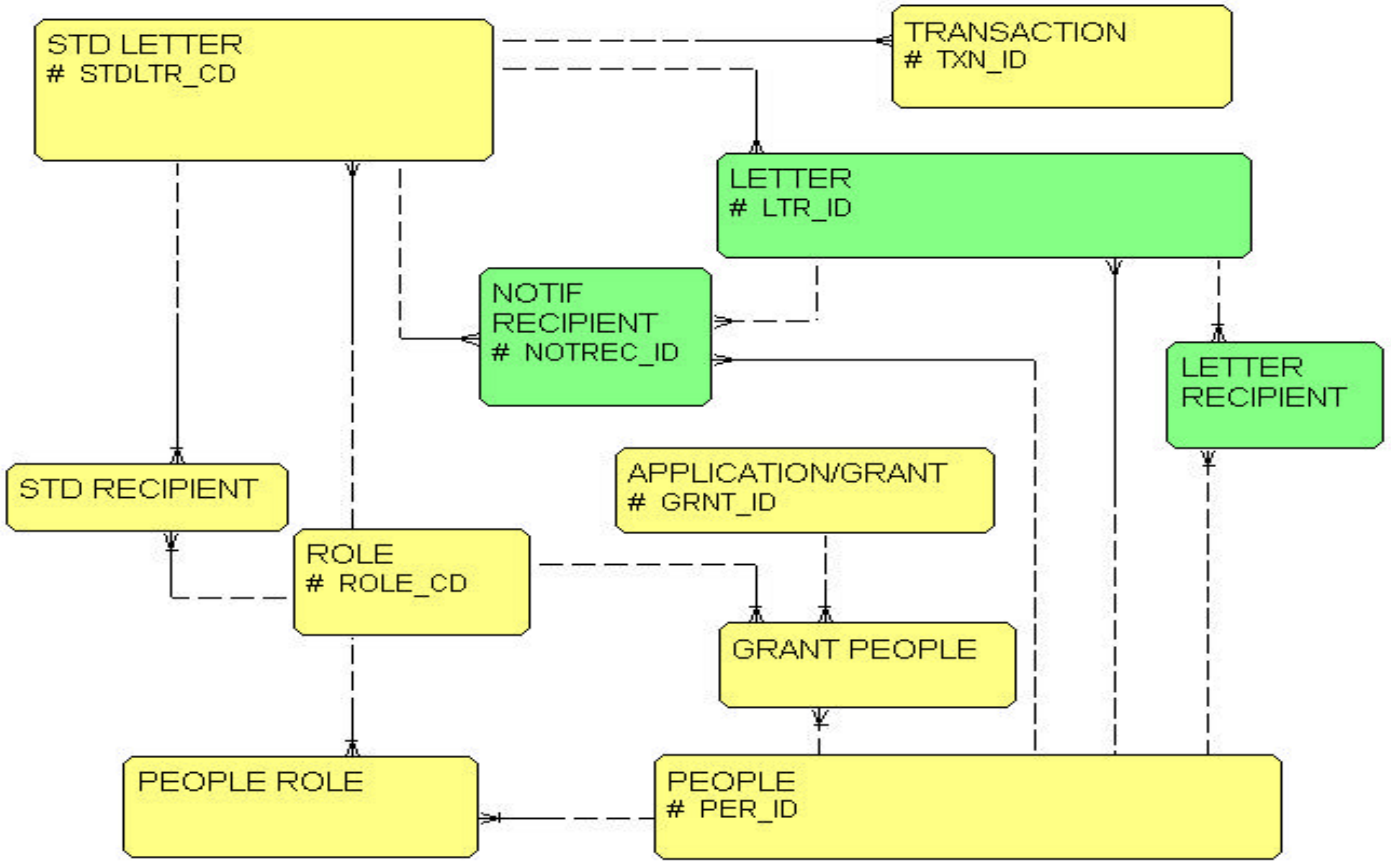
Review Output



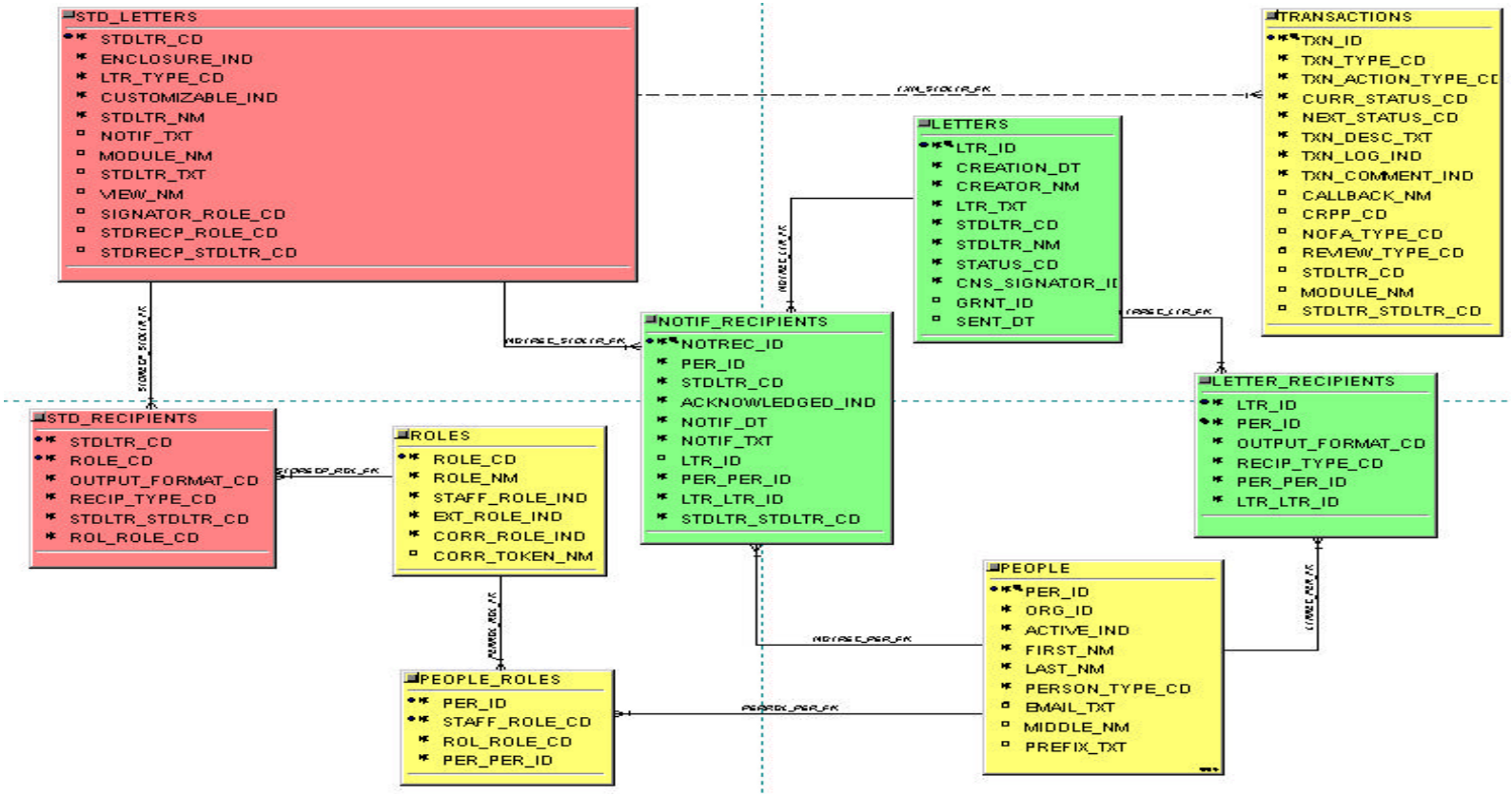
Letters Generated by:

- Event
  - When a grant application is rejected (state transition engine)
- Schedule
  - Send reminder 30 days before progress report is due (DBMS_JOB)
- Manually
  - User presses “Create Follow-up Letter” button on the Site Visit Results form

Database Design - Output



Physical Database Design



You've Got Mail

Now what?

- Have to actually write code
  - Back-end code to generate letter and recipients
  - Front-end code to allow users to customize letter and recipient list, and send letters
  - Code to deliver the letters
    - Report for printed output
    - Email distribution
    - Notifications for inbox distribution

Letter Generation

- Retrieve information on the current grant and grantee/applicant
  - Use a view to encapsulate information and include calculated columns
- Retrieve the letter text and standard recipients
- Parse the letter text and perform the mail merge

Database Views

Source data – Views based on database tables

```
CREATE OR REPLACE VIEW v_corr_pr AS
SELECT
      to_char(SYSDATE, 'fmMonth DD, YYYY')        PRINT_DATE
     , grnt.*
     , grnt.supp_mech_cd                          GRANT_NBR
     , substr(cn_name.format_name
               (arep.prefix_txt,  arep.first_nm,
                arep.last_nm,  arep.suffix_txt),1,120)     AUTH_REP_FULL_NAME
      , arep.title_txt                            AUTH_REP_TITLE
      , to_char (pr.from_dt, 'MM/DD/YYYY')        PERIOD_START_DT
      , pr.pr_status_cd                           PR_STATUS_CD
...  FROM cn_grants grnt,  cn_people arep,
...WHERE grnt.org_id = legal_app.id
```

PL/SQL Package

For each view, a cursor and record are defined.

```
PACKAGE cn_corr IS
    CURSOR c_corr (c_grnt_id IN cn_grants.grnt_id%TYPE)
                    RETURN v_corr%ROWTYPE;
    r_corr c_corr%ROWTYPE;
    CURSOR c_corr_pr (c_grnt_id IN cn_grants.grnt_id%TYPE,
                      RETURN v_corr_pr%ROWTYPE;
    r_corr_pr  c_corr_pr%ROWTYPE;

    PROCEDURE gen_ltr (
            p_grnt_id       IN cn_grants.grnt_id%TYPE,
            p_stdltr_cd     IN cn_letters.stdltr_cd%TYPE);
```

Package Body Components

- GEN_LTR – Driving Procedure
  - Create LETTERS record
  - Create LETTERS_RECIPIENTS records
    - For each STD_RECIPIENT…
    - Translate each role into a person
    - Insert a LETTER_RECIPIENTS record
- Private procedures
  - GET_GRANT_DATA – Retrieve the grant data
  - GET_LTR_DATA - Retrieve the letter and recipient data
  - PARSE_TXT - Parse text
  - XLATE_TOKENS - Resolve tokens

Retrieve the Source Data

```
PROCEDURE get_grant_data (p_grnt_id     IN cn_grants.grnt_id%TYPE,
                          p_view_nm     IN cn_std_letters.view_nm%TYPE,
                          p_rtn_cd      OUT NUMBER,
                          p_rtn_msg     OUT VARCHAR2) IS
BEGIN
  IF p_view_nm = 'V_CORR' THEN
       OPEN c_corr (p_grnt_id);
       FETCH c_corr INTO r_corr;
       IF c_corr%NOTFOUND THEN
          p_rtn_cd := -1;
       END IF;
       CLOSE c_corr;
  ELSIF p_view_nm = 'V_CORR_PR' THEN
       …(same)
  END IF;
EXCEPTION handle other errors, set return code and message
```

Retrieve the Letter Data

```
PROCEDURE get_ltr_data ( p_stdltr_cd      IN cn_letters.stdltr_cd%TYPE,
                         p_letter_txt     OUT VARCHAR2,
                         p_view_nm        OUT cn_std_letters.view_nm%TYPE,
                         p_stdltr_nm      OUT cn_std_letters.stdltr_nm%TYPE,
                         p_signator_token_nm  OUT cn_roles.corr_token_nm%TYPE,
                         p_rtn_cd         OUT NUMBER,
                         p_rtn_msg        OUT VARCHAR2) IS
  CURSOR c_std_letters (c_stdltr_cd IN cn_std_letters.stdltr_cd%TYPE) IS
  SELECT dbms_lob.getlength(stdltr_txt) txt_len, stdltr_txt, view_nm,
         stdltr_nm, rol.corr_token_nm
    FROM cn_std_letters  stdltr,
         cn_roles        rol
   WHERE stdltr_cd = c_stdltr_cd
     AND rol.role_cd (+) = stdltr.signator_role_cd;
  stdltr_rec c_std_letters%ROWTYPE;
  v_letter_txt     VARCHAR2(32000);
```

Retrieve the Letter Data (2)

```
BEGIN
    OPEN c_std_letters (p_stdltr_cd);
    FETCH c_std_letters INTO stdltr_rec;
    IF c_std_letters%NOTFOUND THEN
        p_rtn_cd := -1;
    ELSIF stdltr_rec.txt_len > 32000 THEN
        p_rtn_cd := -2;
    ELSE
        p_rtn_cd := 0;
        dbms_lob.read (stdltr_rec.stdltr_txt, stdltr_rec.txt_len, 1, v_letter_txt);
        p_letter_txt := v_letter_txt;
        p_view_nm := stdltr_rec.view_nm;
        p_stdltr_nm := stdltr_rec.stdltr_nm;
        p_signator_token_nm := stdltr_rec.corr_token_nm;
    END IF;
        Close cursor, handle exceptions, etc
```

Parse Text and Resolve Tokens

- Find tokens identified by << >>
- Resolve the token
- Build a single string that now includes boilerplate text and data

Resolve Tokens

```
PROCEDURE xlate_token (  p_token        IN VARCHAR2,
                         p_view_nm      IN cn_std_letters.view_nm%TYPE,
                         p_rtn_txt      OUT VARCHAR2,
                         p_rtn_cd       OUT NUMBER,
                         p_rtn_msg      OUT VARCHAR2) IS
    stmt                VARCHAR2(1000);
    dyn_var             VARCHAR2(4000);
    v_data_type         VARCHAR2(106);
    no_data_for_token   EXCEPTION;
    CURSOR c_tab_col (  c_tab_name  IN VARCHAR2,
                        c_col_name  IN VARCHAR2) IS
        SELECT data_type
          FROM user_tab_columns
         WHERE table_name = c_tab_name
           AND column_name = c_col_name;
```

Resolve Tokens (2)

```
BEGIN
    -- Verify that there is a database column that corresponds with the token name.
    OPEN c_tab_col (p_view_nm, p_token);
    FETCH c_tab_col INTO v_data_type;
    close cursor and handle not found
    IF v_data_type <> 'BLOB' THEN
        -- build a statement like :dyn_var := cn_corr.r_corr.nofa_name;
        stmt := 'BEGIN :dyn_var := cn_corr.r' || ltrim(p_view_nm, 'V') ||
                '.' || p_token || '; end;';
        EXECUTE IMMEDIATE stmt USING OUT dyn_var;
        IF dyn_var IS NULL THEN
            RAISE no_data_for_token;
        ELSE
            p_rtn_txt := dyn_var;
        END IF;
    END IF;
```

Build Recipient List

```
CURSOR c_recipients (c_stdltr_cd IN cn_std_recipients.stdltr_cd%TYPE) IS
    SELECT output_format_cd, recip_type_cd, corr_token_nm, recip.role_cd
      FROM cn_std_recipients recip,
           cn_roles rol
     WHERE stdltr_cd = c_stdltr_cd
       AND rol.role_cd (+) = recip.role_cd;
```

Remember…

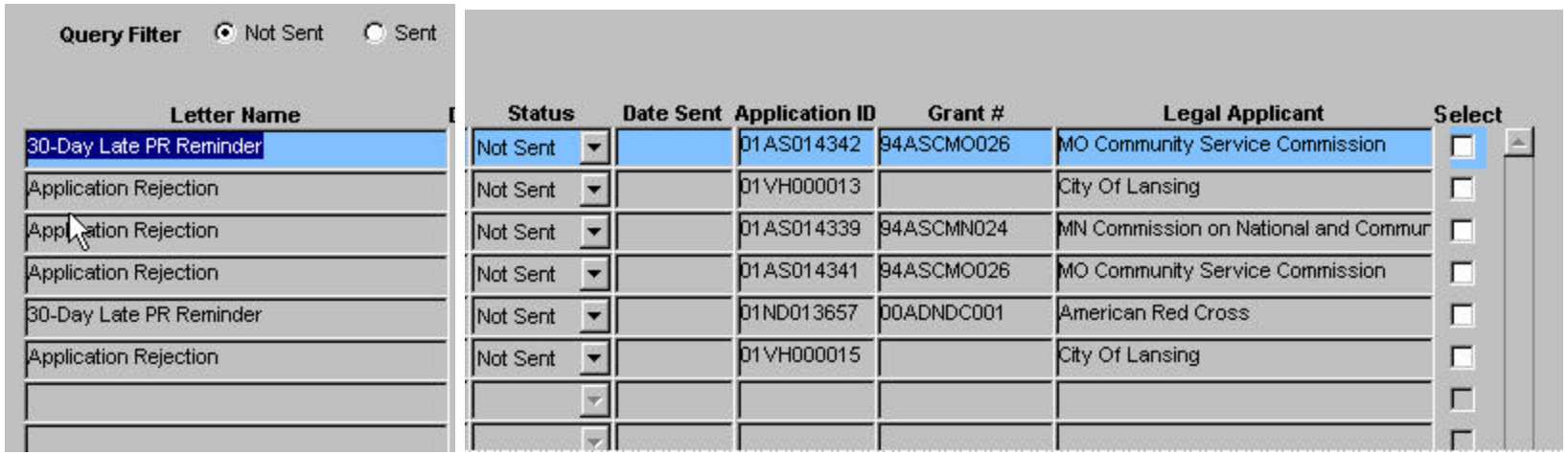
- Recipients are identified by their role
- Each role has a corresponding token name associated with it

So…

- Use the same XLATE_TOKEN routine to translate a role into a person (PER_ID)
- Insert a row into LETTER_RECIPIENTS for each one

Deliver the Mail

- User reviews “outbox”



Deliver the Mail (2)

- Oracle Reports to produce printed letters
  - LETTERS.LETTER_TXT is the entire letter body – Easy!
  - Build the signature block by getting the sender's signature image, name, title
  - Build the cc: list based on the LETTER_RECIPIENTS and translate the PER_ID into a real name
- UTIL_SMTP to send email
- Internal table for notifications

Send the Mail via UTIL_SMTP

```
conn          utl_smtp.connection;      -- smtp connection
smtp_host     VARCHAR2(100);            -- the host name of the smtp server
port          PLS_INTEGER;              -- the port that the smtp server runs on
cr            VARCHAR2(2) := chr(13)||chr(10);     -- carriage return/line feed
reply_rec     utl_smtp.reply            -- a single response from a smtp command
replies_tab   utl_smtp.replies;         -- table of responses from a smtp command
```

```
smtp_host := 'mail.strllc.com'; -- Don't hard code this
port := to_number('25'); -- standard mail port

reply_rec := utl_smtp.open_connection(smtp_host, port, conn);
reply_rec := utl_smtp.helo(conn, smtp_host);
```

Send the Mail via UTIL_SMTP (2)

```
FUNCTION send (p_sender_email    IN cn_people.email_txt%TYPE,
               p_recip_email_tab IN recip_email_tab_type,
               p_subject         IN cn_letters.stdltr_nm%TYPE,
               p_ltr_txt         IN VARCHAR2) RETURN VARCHAR2;

               v_msg     VARCHAR2(32767);
BEGIN
   v_msg := 'Date: ' || TO_CHAR(SYSDATE, 'dd-Mon-yy hh24:mi:ss' ) || cr ||
            'From:' || p_sender_email || cr ||
            'Subject:' || p_subject || cr;

   reply_rec := utl_smtp.mail(conn, p_sender_email);
```

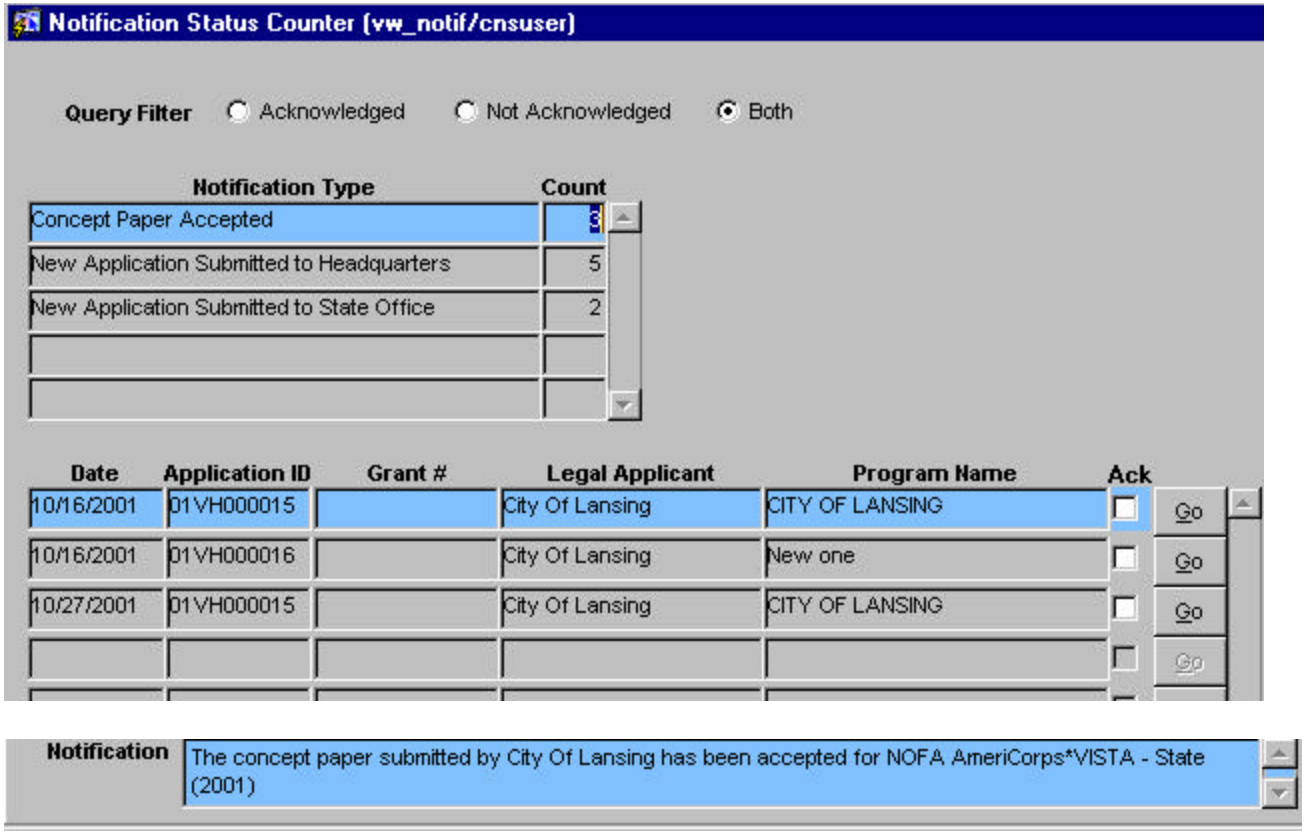
Send the Mail via UTIL_SMTP (3)

```
FOR i IN 1..p_recip_email_tab.count LOOP
   reply_rec := utl_smtp.rcpt(conn, p_recip_email_tab(i).email_txt);
                -- Append TO: email@someplace.com
                -- or     CC: email@someplace.com
                v_msg := v_msg || initcap(p_recip_email_tab(i).recip_type_cd) || ': ' ||
                      p_recip_email_tab(i).email_txt  || cr;
END LOOP;
         v_msg := v_msg || p_ltr_txt;

reply_rec := utl_smtp.data(conn, v_msg);

utl_smtp.quit(conn);
```

Send Notifications instead of Mail



Limitations/Issues

- 32k letter text – PL/SQL VARCHAR2 limitation
- Text only – no pretty formatting
- Each view must be defined in the package. Therefore, developer action is required if new views are required.

Conclusion

- Mail generation can be built using custom-written PL/SQL and standard Oracle built-in packages.
- 100% user-maintainability can be achieved – *almost*
- Parser and token resolution code is reusable for other applications, eg, code generation
- Native Dynamic SQL is the key

About the Authors

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