HEWLETT-PACKARD GENERAL SYSTEMS USERS GROUP

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RESOURCE OPTIMIZATION SERIES

USING A HIERARCHICAL DATA STRUCTURE
IN A COMPUTERIZED GENERAL LEDGER SYSTEM
-A NON-TECHNICAL PRESENTATION

BY

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ABSTRACT

THE PINTON GROUP HAS USED A HIERARCHICAL DATA STRUCTURE TO IMPLEMENT AN
ON-LINE GENERAL LEDGER SYSTEM WITH IMAGE/3000. THIS STRUCTURE HAS
RESULTED IN REDUCED MAINTENANCE AND PROVIDES DIRECT ACCESS TO SUMMARY
INFORMATION. IT HAS MINIMIZED THE IMPACT OF CORPORATE ORGANIZATIONAL
CHANGES OR CHANGES IN REPORTING REQUIREMENTS, FOR BOTH PROGRAMMERS AND
USERS. NEW COMPANIES, DIVISIONS, DEPARTMENTS OR OTHER NEW OPERATING
LEVELS CAN BE ADDED WITHOUT RECODING, REORGANIZING OR REPROGRAMMING.

PRESENTATION

I. INTRODUCTION

SAVING PEOPLE RESOURCES IS ONE OF THE ADVANTAGES THAT COMPUTERIZED SYSTEMS HAVE IN HELPING TO IMPROVE THE OPERATIONAL EFFICIENCY OF A COMPANY. THIS ADVANTAGE HOWEVER IS OFFSET BY THE AMOUNT OF REQUIRED SYSTEMS MAINTENANCE.

SYSTEMS MAINTENANCE CAN NOT ONLY BE TIME-CONSUMING BUT ALSO UNREWARDING, FOR EXAMPLE MODIFYING OR CREATING NEW SOFTWARE FOR THE SOLE PURPOSE OF UTILIZING A DIFFERENT SORT OR PROVIDING ADDITIONAL REPORT SUBTOTALS.

SYSTEMS MAINTENANCE CAN BE DECREASED BY INCREASING THE FLEXIBILITY OF THE SYSTEM AND IT'S RESPONSIVENESS TO CHANGE. IN SOME APPLICATIONS THIS FLEXIBILITY CAN BE ACHIEVED BY UTILIZING HIERARCHICAL DATA STRUCTURES.

II. BACKGROUND

AS SYSTEMS DEVELOPMENT MANAGER FOR THE PINTON GROUP, A WHOLESALE INDUSTRIAL AND AUTOMOTIVE DISTRIBUTOR IN WESTERN CANADA, I HAVE BEEN RESPONSIBLE FOR THE IMPLEMENTATION OF OUR COMPUTER APPLICATIONS, UTILIZING AN HP3000 COMPUTER SYSTEM SINCE OCTOBER 1974.

THE COMPANY HAS SEEN STEADY GROWTH DURING THIS PERIOD, WITH ANNUAL SALES INCREASING FROM 11 MILLION DOLLARS TO OVER 24 MILLION DOLLARS. DURING THIS FIVE YEAR PERIOD THE PINTON GROUP HAS GROWN IN COMPLEXITY: FROM ONE COMPANY WITH FIVE BRANCHES TO FOUR COMPANIES WITH FOURTEEN BRANCHES IN FOUR DIVISIONS.

SOME OF THE SYSTEMS WE DEVELOPED PRIOR TO THE GENERAL LEDGER SYSTEM INCLUDED:

- ORDER ENTRY/ PROCESSING SYSTEMS
- INVOICING
- ACCOUNTS RECEIVABLE
- SALES REPORTING SYSTEMS
- PURCHASES AND INVENTORY REPORTING SYSTEMS
- EXPENSE/BUDGET (RESPONSIBILITY) REPORTING SYSTEM

AS THE COMPANY EXPANDED, SOME OF THE EXISTING SYSTEMS HAD TO BE REWRITTEN. OCCASIONALLY UP TO TWO MAN-MONTHS OF REPROGRAMMING WAS REQUIRED. IN ORDER TO MINIMIZE FUTURE PROGRAM MAINTENANCE AND MAXIMIZE PROGRAM FLEXIBILITY, A SET OF PROGRAMMING STANDARDS EVOLVED.

WE UTILIZE IN EACH OF THE SYSTEMS

    -STRUCTURED PROGRAMMING TECHNIQUES
    -OUR OWN INTRINSICS LIBRARY
    -PARAMETER DRIVEN APPLICATIONS PROGRAMS

WE ALSO USE

    -SPL/3000
    -IMAGE/3000

EARLIER ON IN OUR PROGRAM DEVELOPMENT EFFORT WE USED A NUMBER OF PROGRAMMING TECHNIQUES PROGRESSING TOWARDS MORE FLEXIBILITY IN THE REPORTING STRUCTURES.

WE STARTED WITH HARD-CODED STRUCTURES. FOR EXAMPLE, IN OUR SALES REPORTING SYSTEM, TERRITORY 1-1 WAS DEFINED AS TERRITORY "1" OF BRANCH "1". ALL TERRITORY NUMBERS HAD TO BE CONTIGUOUS. PROGRAM CHANGES RESULTING FROM ORGANIZATIONAL CHANGES WERE DIFFICULT AND TIME CONSUMING TO ACCOMPLISH.

WE PROGRESSED TO TABLE DRIVEN SOFTWARE. TABLE DRIVEN SOFTWARE ALLOWS EASY REORGANIZATION OF EXISTING DATA STRUCTURES AND REPORTING LEVELS BUT DOESN'T ALLOW NEW REPORTING LEVELS TO BE EASILY ADDED. EG. ADDING TWO COMPANY TOTALS TOGETHER TO FORM A NEW "DIVISION" LEVEL OR SET OF SUB-TOTALS.

ALL OF THE APPLICATIONS ABOVE USE NON-HIERARCHICAL DATA STRUCTURES, REQUIRING ON-LINE SORTING OF DATA FOR SUMMARY REPORTING.

FOR EXAMPLE, IN OUR SALES REPORTING SYSTEM, IF A REPORT IS REQUIRED FOR ALL CATEGORY "A" SALES FOR BRANCH "5" FOR FISCAL 1979, THE FOLLOWING OPERATIONS WILL OCCUR:

    - 90,000 RECORDS SCANNED
    - 10,000 RECORDS SORTED
    - SUB-TOTALS CALCULATED

THESE OPERATIONS ARE RUN IN A BATCH JOB AND TAKE 20 MINUTES, REQUIRING ADDITIONAL SYSTEMS RESOURCES IF NEEDED DURING THE PRIME SHIFT AND NOT IMMEDIATELY AVAILABLE TO THE END-USER.

WITH A HIERARCHICAL DATA STRUCTURE, 10,000 RECORDS WOULD BE REPORTED DIRECTLY, ELIMINATING SCANNING, SORTING AND SUB-TOTALLING.

III.   BASIC CONCEPTS OF HIERARCHICAL DATA STRUCTURES

DONALD E. KNUTH, AUTHOR OF "THE ART OF COMPUTER PROGRAMMING" CONSIDERS
TREE   STRUCTURES   "THE MOST IMPORTANT NON-LINEAR STRUCTURES ARISING IN
COMPUTER ALGORITHMS." HIERARCHICAL DATA STRUCTURES AND TREE STRUCTURES
ARE SYNONYMOUS. TREE STRUCTURE MEANS A "BRANCHING" RELATIONSHIP LIKE
THAT FOUND IN THE TREES OF NATURE.

    A. STANDARD TERMINOLOGY
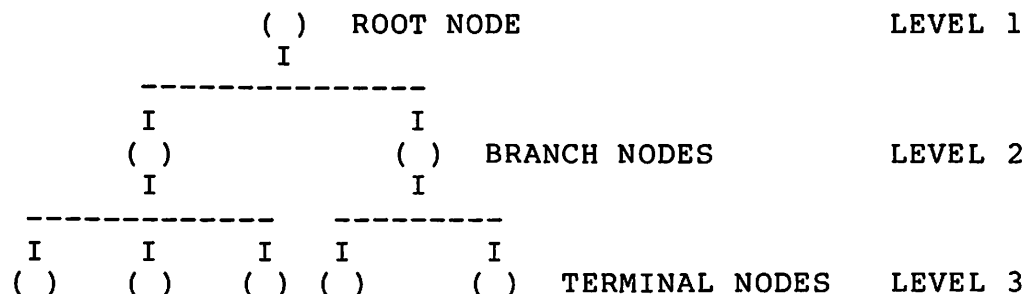
    A BASIC "TREE" IS COMPOSED OF THE FOLLOWING ELEMENTS:

    1. NODES

NODES REPRESENT DATA, FOR EXAMPLE GENERAL LEDGER ACCOUNTS. THERE IS ONE
SPECIFICALLY DESIGNATED NODE, THE TOP NODE, CALLED THE ROOT OF THE
TREE. THE ROOT IS ALSO DEFINED AS LEVEL 1 OF THE TREE. EACH ROOT IS
SAID TO BE THE PARENT OF IT'S SUB-TREES. NON-TERMINAL NODES ARE CALLED
BRANCH NODES. THESE ARE USUALLY THOSE ACCOUNTS BETWEEN LEVEL 2 AND
LEVEL (N-1), WHERE N IS THE LEVEL OF TERMINAL NODES. TERMINAL NODES
CONTAIN POSTED DATA AND REPRESENT THE LOWEST LEVEL IN A TREE.

    2. POINTERS
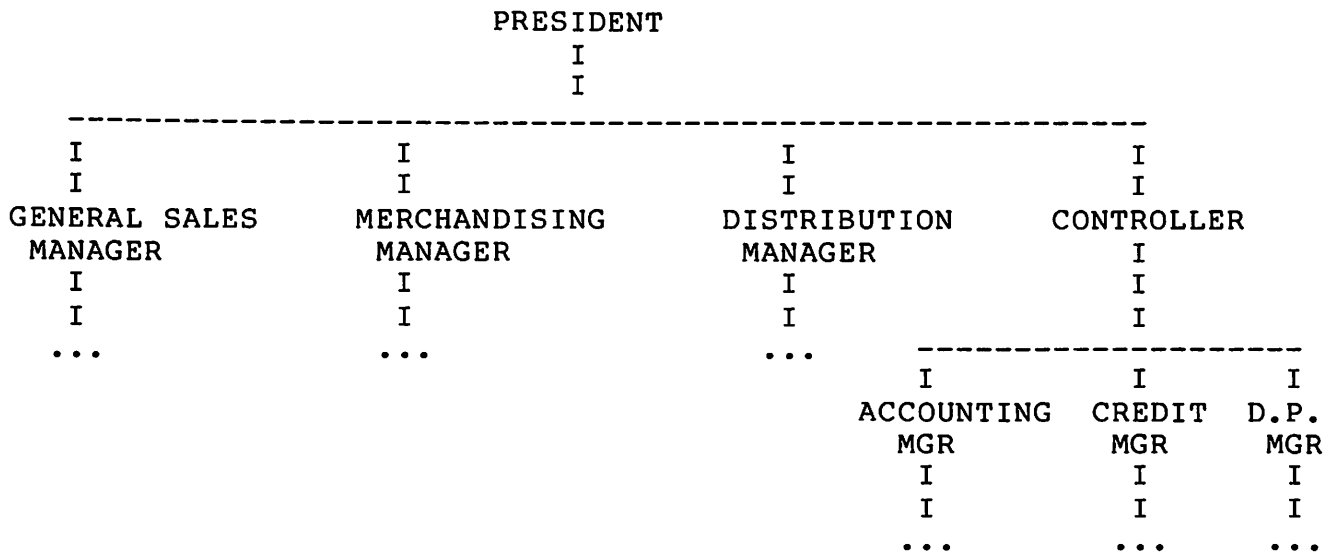
POINTERS ARE THE LINKAGES DETERMINING THE STRUCTURE OF THE TREE AND
LINK THE DATA (NODES) TOGETHER. BACKWARD AND FORWARD POINTERS ARE USED
TO LINK NODES TOGETHER: LEVEL 1 ACCOUNT TO LEVEL 2 ACCOUNTS, LEVEL 2
ACCOUNTS TO LEVEL 1, ETC.

    B. A SIMPLE TREE STRUCTURE

```
                        ( )  ROOT NODE                   LEVEL 1
                         I
             ---------------
         I                 I
        ( )               ( )  BRANCH NODES              LEVEL 2
         I                 I
      -------------    ---------
    I    I    I   I        I
   ( )  ( )  ( ) ( )      ( )   TERMINAL NODES     LEVEL 3
```

C. THE CORPORATION AS A TREE STRUCTURE

AN ORGANIZATION CHART SHOWS THE REPORTING STRUCTURE OF A COMPANY. IT CLEARLY SHOWS THE RELATIONSHIP BETWEEN THE VARIOUS LEVELS OF MANAGEMENT, I.E. WHO REPORTS TO WHO, AND WHO HAS WHAT RESPONSIBILITIES.

```
                              PRESIDENT
                                  I
                                  I
      ----------------------------------------------------------------
      I                  I                    I                  I
      I                  I                    I                  I
GENERAL SALES       MERCHANDISING        DISTRIBUTION       CONTROLLER
  MANAGER             MANAGER              MANAGER              I
      I                  I                    I                  I
      I                  I                    I                  I
    ...                ...                  ...      ----------------------
                                             I            I           I
                                        ACCOUNTING     CREDIT       D.P.
                                            MGR          MGR         MGR
                                             I            I           I
                                             I            I           I
                                            ...          ...         ...
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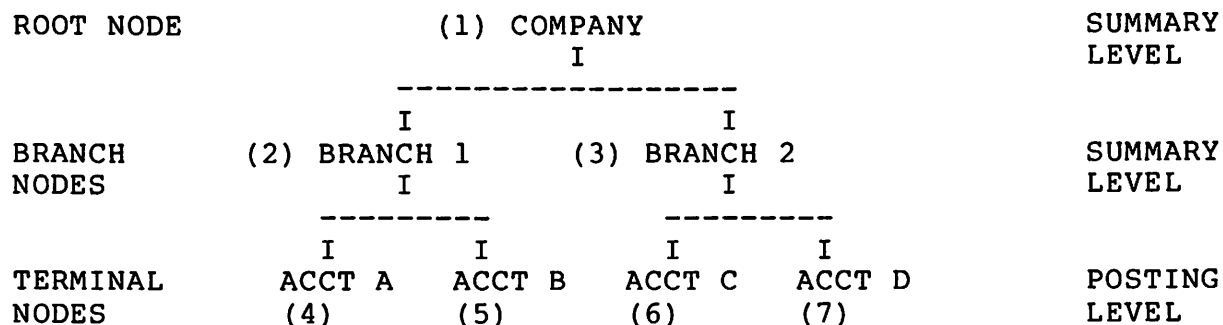
IN THE SAME WAY THAT A CORPORATION CAN BE REORGANIZED BY A CHANGE IN REPORTING STRUCTURE, SO CAN OUR GENERAL LEDGER. COST CENTRES (EG. DEPARTMENTS) CAN BE REDISTRIBUTED OR CONSOLIDATED IN A CORPORATE REORGANIZATION. IN THE SAME WAY SO CAN THE ACCOUNTS IN THE GENERAL LEDGER.

IV. THE PINTON GROUP GENERAL LEDGER SYSTEM

A. THE CHART OF ACCOUNTS

THE GENERAL LEDGER CHART OF ACCOUNTS IS USED TO REPORT THE FINANCIAL POSITION OF THE COMPANY. THE STRUCTURE OF THE CHART OF ACCOUNTS IS ANALOGOUS TO THE ORGANIZATION CHART ABOVE. THE REQUIREMENTS FOR REPORTING ARE BASICALLY THE SAME, THOSE OF RESPONSIBILITY REPORTING, BY COMPANY, BY DIVISION, BY BRANCH AND DEPARTMENT.

THE GENERAL LEDGER SYSTEM USES A HIERARCHICAL ACCOUNT STRUCTURE FOR IT'S CHART OF ACCOUNTS. THE FOLLOWING IS A SAMPLE CHART OF ACCOUNTS ORGANIZED WITH A HIERARCHICAL STRUCTURE:

```
ROOT NODE            (1) COMPANY              SUMMARY
                          I                   LEVEL
                  ------------------
                  I               I
BRANCH      (2) BRANCH 1    (3) BRANCH 2      SUMMARY
NODES             I               I           LEVEL
              ----------      ----------
              I        I      I        I
TERMINAL   ACCT A   ACCT B  ACCT C   ACCT D   POSTING
NODES       (4)      (5)     (6)      (7)     LEVEL
```

THE ACCOUNTS IN EACH CHART OF ACCOUNTS (EG. (1) TO (7) ABOVE) FALL INTO TWO CATEGORIES, POSTING LEVEL ACCOUNTS (TERMINAL NODES) AND SUMMARY LEVEL ACCOUNTS (ROOT AND BRANCH NODES).

   1. POSTING LEVEL ACCOUNTS. THESE ACCOUNTS CONTAIN DETAILED POSTED TRANSACTIONS AS WELL AS MONTH-TO-DATE AND YEAR-TO-DATE TOTALS.

   2. SUMMARY LEVEL ACCOUNTS. THESE ACCOUNTS DO NOT CONTAIN DETAILED POSTED TRANSACTIONS BUT EXIST FOR THE SOLE PURPOSE OF RETAINING THE COMBINED MONTH-TO-DATE AND YEAR-TO-DATE AMOUNTS OF TWO OR MORE POSTING LEVEL ACCOUNTS THAT HAVE ALL BEEN DESIGNATED TO HAVE THE SAME PARENT ACCOUNT.

AMOUNTS POSTED TO THE POSTING LEVEL ACCOUNTS (4),(5),(6) AND (7) ARE SUMMARIZED TO PARENT OR SUMMARY LEVEL ACCOUNTS (2) AND (3), AND THESE TO THEIR PARENT ACCOUNT (1). THE SUMMARY ACCOUNTS TOGETHER WITH POSTING LEVEL ACCOUNTS ARE UPDATED DAILY AND CAN BE ACCESSED ON-LINE.

   B. MULTIPLE CHARTS OF ACCOUNTS

ALL REPORTS ARE DRIVEN OFF THE CHART OR CHARTS OF ACCOUNTS. EACH CHART OF ACCOUNTS IS CONSTRUCTED OF ONE OR SEVERAL TREES OF ACCOUNTS. ONE ADVANTAGE OF USING HIERARCHICAL DATA STRUCTURES IS THE ABILITY TO CREATE A NEW TREE COMPRISED OF OTHER TREES OR CHARTS OF ACCOUNTS, AS SUB-TREES OF THAT NEW STRUCTURE.

CURRENTLY WE CAN DEFINE UP TO 99 CHARTS OF ACCOUNTS FOR ACCOUNTING AND MANAGEMENT REPORTING. UP TO 99 LEVELS OF SUMMARIZATION CAN BE DEFINED WITHIN ANY CHART OF ACCOUNTS. THIS PROVIDES TOTAL FLEXIBILITY AND CONTROL OVER ANY DESIRED SUMMARIZATION.

C. DATA BASE STRUCTURE

THE GENERAL LEDGER IMAGE/3000 DATA BASE CONSISTS OF THE FOLLOWING "FILES":

1. ACCOUNT MASTER FILE
2. YEAR-TO-DATE TRANSACTION FILE
3. RELATIONSHIP FILE

1. THE ACCOUNT MASTER FILE CONTAINS A RECORD FOR EACH ACCOUNT NUMBER (BOTH POSTING AND SUMMARY TYPES). THE RECORD CONTAINS STATIC INFORMATION (ACCOUNT DESCRIPTION, TYPE, STATUS CODES) AND DYNAMIC INFORMATION (MONTH-TO-DATE AMOUNTS FOR 12 MONTHS OF THE FISCAL YEAR). SEPARATE RECORDS ARE CREATED FOR EACH FISCAL YEAR.

2. THE YEAR-TO-DATE TRANSACTION FILES CONTAINS DETAILED TRANSACTIONS FOR EACH POSTING ACCOUNT (BY FISCAL YEAR) GIVING DATE, REFERENCE NUMBER AND AMOUNT. MULTI-LINE COMMENTS ABOUT EACH TRANSACTION CAN BE SAVED IN A SEPARATE DETAIL DATASET. WITH THESE RECORDS, ANY "TOTAL" AMOUNT IN THE ACCOUNT MASTER FILE CAN BE EXPLODED INTO THE TRANSACTIONS THAT CREATED IT.

3. THE RELATIONSHIP FILE ACTUALLY IMPLEMENTS THE "TREE-STRUCTURES". IT CONTAINS "FATHER" AND "SON" ACCOUNT NUMBERS THAT ACT AS THE FORWARD AND BACKWARD POINTERS CONNECTING THE NODES OF THE TREE. WHEN A CHANGE IS NEEDED IN THE HIERARCHICAL DATA STRUCTURES, THIS FILE IS CHANGED.

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V. BENEFITS OF A HIERARCHICAL DATA STRUCTURE IN THE GENERAL LEDGER SYSTEM

IN REPORTING THE FINANCIAL POSITION OF THE COMPANY, WE WANTED TO ENSURE THAT WE HAD A FLEXIBLE AND RESPONSIVE SYSTEM. WE DID THIS BY:

A. MINIMIZING PROGRAM MAINTENANCE AND MAXIMIZING REPORTING FLEXIBILITY.

B. PROVIDING ON-LINE ACCESS TO DETAILED ACCOUNT HISTORY.

C. FACILITATING ON-LINE INQUIRIES OF SUMMARY INFORMATION BY ELIMINATING UNNECESSARY SCANNING, SORTING AND SUB-TOTALLING.

A. MINIMIZING PROGRAM MAINTENANCE AND MAXIMIZING REPORTING FLEXIBILITY.

1. MAINTENANCE BENEFITS

CORPORATE CHANGES RESULT ONLY IN A CHANGE TO THE CHART OF ACCOUNTS, NOT TO THE REPORT PROGRAMS. THE DATA STRUCTURE ALLOWS US TO EASILY MODIFY THE CHART OF ACCOUNTS THROUGH A GENERAL PURPOSE MAINTENANCE PROGRAM WHICH PROVIDES FOR ADDING AND DELETING ACCOUNTS AND SUMMARY LEVELS.

-ADDING AN ACCOUNT. BY ENTERING NEW ACCOUNT NUMBER, FATHER ACCOUNT, DESCRIPTION AND ACCOUNT TYPE.

-DELETING AN ACCOUNT. BY UNLINKING THE ACCOUNT FROM IT'S PARENT AND DELETING.

-REORGANIZING ACCOUNTS/ SUB-TREES/ TREES. BY UNLINKING AN ACCOUNT FROM ITS' PARENT, AND RELINKING TO ANOTHER PARENT ACCOUNT.

-ADDING A NEW LEVEL. BY COMBINING "ADDING AN ACCOUNT" AND "REORGANIZING" FUNCTIONS.

-CREATING A TREE. BY CREATING A ROOT ACCOUNT, ADDING SUMMARY ACCOUNTS AND ADDING POSTING ACCOUNTS.

-CONSOLIDATION OF ACCOUNTS. ORGANIZATIONAL CHANGES MAY RESULT IN TWO OR MORE COST CENTRES BEING CONSOLIDATED. A MECHANISM EXISTS FOR TRANSFERRING HISTORY FROM ONE ACCOUNT TO BE ADDED TO ANOTHER.

2. REPORTING BENEFITS

ALL REPORTS ARE DRIVEN OFF THE CHARTS OF ACCOUNTS. EACH UNIQUE REPORTING SEQUENCE IS REPRESENTED BY A UNIQUE TREE STRUCTURE OR SEPARATE CHART OF ACCOUNTS.

NEW REPORTS ARE OFTEN DEFINED BY UTILIZING EXISTING SUB-TREES AND BUILDING NEW SUMMARY ACCOUNTS. TIED TOGETHER WITH THE EXISTING SUB-TREES THIS IMPROVES THE EFFICIENCY OF BUILDING NEW CHARTS OF ACCOUNTS FOR NEW FINANCIAL OR MANAGEMENT REPORTS.

FOR EXAMPLE, A REPORT REQUIRED BY COMPANY BY BRANCH BY DEPARTMENT WOULD BE REPRESENTED BY ONE CHART OF ACCOUNTS. A REPORT REQUIRED BY COMPANY BY DEPARTMENT BY BRANCH WOULD BE REPRESENTED BY A SECOND CHART OF ACCOUNTS OR SECOND TREE.

IN THIS EXAMPLE THE POSTING LEVEL ACCOUNTS WOULD BE THE SAME ACCOUNTS, AND WOULD BE SHARED BY THE TWO TREES, HOWEVER THE SUMMARY LEVEL ACCOUNTS WOULD BE UNIQUE TO EACH TREE.

3. EXCEPTION REPORTING BENEFITS

REPORTS CAN BE RUN ON ANY TREE OR ANY SUB-TREE CONTAINED IN ANY ONE CHART OF ACCOUNTS.

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SAMPLE PRINTOUT OF A CHART OF ACCOUNTS

****

TREE 01   THE PINTON GROUP   PAGE 1
                       GENERAL LEDGER ACCOUNTS
90909090;@;@;@;@;@;@

LEVEL	ACCOUNT	TYPE	DESCRIPTION
1	9090-9090	80-	COMPANY TOTAL
2	8990-9090	80-	CENTRAL SERVICES DIVISION
3	0090-9090	80-	CENTRAL SERVICES BRANCH
4	0001-9090	80-	SALES DEPARTMENT
5	0001-0190	80-	SALARIES
6	0001-0101	80	REGULAR
6	0001-0106	80	INSIDE SALES
6	0001-0108	80	OUTSIDE SALES
6	0001-0110	80	OVERTIME
6	0001-0112	80	COMMISSIONS
6	0001-0114	80	TEMPORARY HELP- PAYROLL
6	0001-0115	80	TEMPORARY HELP- OTHER
5	0001-0590	80-	EMPLOYEE BENEFITS
6	0001-0501	80	CANADA PENSION PLAN
6	0001-0503	80	GROUP LIFE INSURANCE

B. PROVIDING ON-LINE ACCESS TO DETAILED ACCOUNT HISTORY.

THROUGH IMAGE/3000 AND A SEPARATE YEAR-TO-DATE TRANSACTION DATASET FOR EACH FISCAL YEAR, ALL TRANSACTIONS POSTED TO THE GENERAL LEDGER ARE STORED, CHAINED TOGETHER IN CHRONOLOGICAL ORDER. EACH TRANSACTION CONTAINS TRANSACTION DATE, AMOUNT, REFERENCE NUMBER AND COMMENTS.


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                  SAMPLE PRINTOUT OF ACCOUNT HISTORY

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00253569                      THE PINTON GROUP                  PAGE  1
                    GENERAL LEDGER TRANSACTION REPORT

0025-3569 STATIONERY- REGULAR         07/79-08/79

   REF     DATE        DESCRIPTION              AMOUNT
                                                        YTD    274.74
   V13493  09 JUL79  LANCE BISSETT LTD            9.19
                     STAPLES & STAPLER
   V18189  17 JUL79  GRAND & TOY PENCIL LEADS     3.10
                                                        MTD     12.29
   V25166  11 AUG79  GRAND & TOY PENCIL LEADS     0.74
   V24031  11 AUG79  GRAND & TOY LEAD REFILLS     9.32
                                                        MTD     10.06
                                                        YTD    297.09
```

C. FACILITATING ON-LINE INQUIRIES OF SUMMARY INFORMATION BY ELIMINATING UNNECESSARY SCANNING AND SORTING.

EACH POSTING AND SUMMARY LEVEL ACCOUNT HAS AN ACCOUNT MASTER FILE WHICH CONTAINS MONTH-TO-DATE TOTALS FOR EACH MONTH IN EACH FISCAL YEAR.

AFTER THE DAILY TRANSACTIONS ARE POSTED TO THE YEAR-TO-DATE TRANSACTION DATASET, A SECOND UPDATE PROGRAM UPDATES THOSE TRANSACTIONS TO THE ACCOUNT MASTER FOR EACH POSTING LEVEL ACCOUNT. A THIRD UPDATE PROGRAM UPDATES THE POSTING LEVEL MONTH-TO-DATE TOTALS UP THROUGH EACH TREE STRUCTURE TO THE SUMMARY LEVEL ACCOUNT.

THE TIME REQUIRED TO DO ALL UPDATES TO THE SUMMARY ACCOUNTS IS A FUNCTION OF THE NUMBER OF ACCOUNTS IN THE TREE. TYPICALLY FOR TWO THOUSAND ACCOUNTS THIS CAN TAKE HALF AN HOUR IN OFF-PRIME TIME.
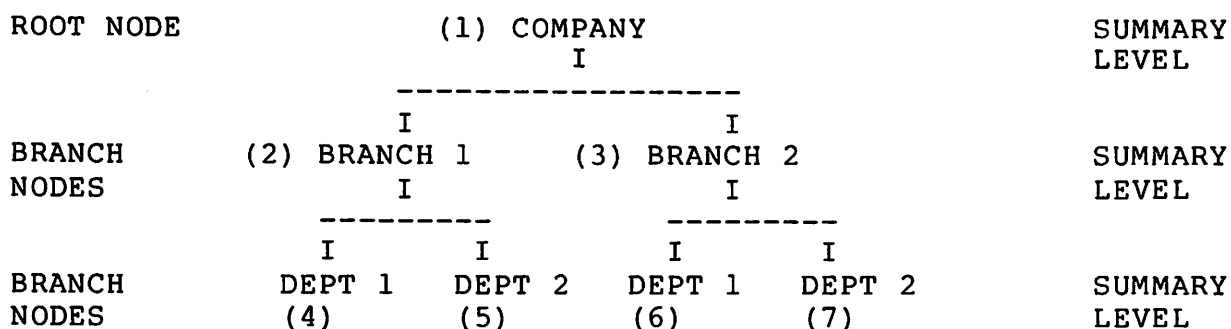
WITH SMALLER CHARTS OF ACCOUNTS REPRESENTING SEVERAL HUNDRED ACCOUNTS, THIS UPDATING COULD ALL BE DONE ON-LINE WITHOUT SIGNIFICANT OVERHEAD.

A NON-HIERARCHICAL FILE STRUCTURE INVOLVES A COMPLETE SCAN OF ALL POSTING OR SUMMARY ACCOUNTS, A SORT AND THEN THE PRODUCTION OF A REPORT. THE NUMBER OF ACCOUNTS CAN RUN INTO SEVERAL THOUSAND FOR A SINGLE COMPANY.

A TREE STRUCTURE ON THE OTHER HAND INVOLVES FOLLOWING THE PRE-DEFINED PATHS CONNECTING THE SUMMARY AND POSTING LEVELS AND PRODUCING THE REPORT DIRECTLY FROM THE ORDER OF THE TREE STRUCTURE.

SUMMARY INFORMATION IS STORED IN MONTH-TO-DATE FORMAT AND IS AVAILABLE STAND-ALONE OR REPORTED TOGETHER WITH THE POSTING ACCOUNTS FOR WHICH THE SUMMARY ACCOUNT IS THE PARENT.

SAMPLE TREE REPRESENTING COMPANY, BRANCH AND DEPARTMENT EXPENSE TOTALS

```
ROOT NODE                  (1) COMPANY                    SUMMARY
                               I                          LEVEL
                         ------------------
                         I                I
BRANCH        (2) BRANCH 1      (3) BRANCH 2               SUMMARY
NODES             I                  I                     LEVEL
                ---------        ---------
              I        I        I        I
BRANCH      DEPT 1   DEPT 2   DEPT 1   DEPT 2              SUMMARY
NODES        (4)      (5)      (6)      (7)                LEVEL
```

IN THE EXAMPLE, TO REPORT DEPARTMENT 2 TOTAL IN BRANCH 2 YOU WOULD ACCESS ACCOUNT (7) DIRECTLY, WHICH CONTAINS THE SUB-TOTAL FOR ALL DEPARTMENT (2) EXPENSES.

CONCLUSIONS

DID WE MEET OUR OBJECTIVES OF SAVING PEOPLE RESOURCES AND PROVIDING A FLEXIBLE RESPONSIVE SYSTEM? YES, SINCE WE PUT THE SYSTEM INTO PRODUCTION THE CHARTS OF ACCOUNTS AND REPORTING REQUIREMENTS HAVE GROWN IN NUMBER AND COMPLEXITY. APART FROM DEBUGGING ALL WE HAVE DONE IS ENHANCE THE SYSTEM, PROVIDING ADDITIONAL SYSTEM FEATURES.