



The Emerging Role of the Federal Government in Healthcare Information Technology - Technical Appendixes

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September 2003

Appendix A – An in-depth look at VistA

VistA Computerized Patient Record System (CPRS)

Overview

CPRS enables clinicians to enter, review, and continuously update all order-related information connected with any patient. With CPRS, staff can order lab tests, medications, diets, radiology tests and procedures, record a patient's allergies or adverse reactions to medications, request and track consults, enter progress notes, diagnoses, and treatments for each encounter, and enter discharge summaries.

Close integration with the Clinical Reminders and Text Integration packages allows better record keeping and compliance with Clinical Guidelines and medical record requirements. CPRS not only allows hospital personnel to keep comprehensive patient records, it also enables clinicians, managers, and QA staff to review and analyze the data gathered on any patient in a way that directly supports clinical decision-making.

Features

CPRS improves the efficiency of entering orders, progress notes, encounter data, and other clinical information in the patient chart, through features such as:

- Order checking for:
 - Out-of-range values
 - Duplicates
 - Maximum order frequency
 - Allergies
 - Potential drug-drug, drug-dosage, drug-overlap, drug-lab, and drug-allergy interactions, with appropriate warnings issued
- Orders integrated with progress notes, results, procedures, diagnosis, and problems;
- Templating utilities for speedy point-and-click composition of notes;
- Interdisciplinary notes that allow several users to enter portions of a single note;
- Tools to create reminder dialogs for point-and-click resolution of clinical reminders to meet Clinical Guidelines;
- Quick orders;
- Order sets;
- Time-delay orders (for pre-admission or discharge orders).

CPRS also improves the accessibility of online clinical information and results via integration with:

- Clinical Reminders
- Adverse Reactions
- Discharge Summary
- Progress Notes
- Inpatient and Outpatient Pharmacy
- Dietetics
- Radiology
- Laboratory
- Notifications
- Health Summary
- Problem List
- Consult/Request Tracking

The application provides access to clinical information from other VAMC sites through Remote Data Views:

- Displays other VAMCs where the patient has been seen;
- From the listed sites, provides the capability to view nationally released Health Summary components and results for many lab tests.

A Graphical User Interface (GUI) provides a consistent, event-driven, windows-style clinical user interface:

- Follows the VistA GUI Guidelines, as well as the common standard for Windows;
- List Manager Interface allows Windows-like actions for terminal-based users;
- Provides parameters and defaults that allow VAMC administrators and CPRS users to fine-tune the functionality and processes specific to their needs;
- Provides communication among VistA packages participating in CPRS through event-driven HL7messaging.

CPRS: Health Summary

Overview

A Health Summary is a clinically oriented, structured report that extracts many kinds of data from VistA and displays it in a standard format. Health summaries can be printed or displayed for individual patients or for groups of patients. The data displayed covers a wide range of health-related information such as demographic data, allergies, current active medical problems, and laboratory results.

Features

- Integrates data from the following packages:
 - Adverse Reaction Tracking
 - Nursing (Vital Signs)
 - Automated Medical Information Outpatient Pharmacy Exchange (AMIE)
 - Patient Care Encounter (PCE)
 - Clinical Reminders Problem List
 - Computerized Patient Record Progress Notes System (CPRS)
 - Radiology Consults/Request Tracking
 - Registration
 - Dietetics
 - Scheduling
 - Discharge Summary
 - Social Work
 - Inpatient Medications
 - Spinal Cord Dysfunction
 - Laboratory System
 - Surgery
 - Medicine
 - VistA Imaging
 - Mental Health
- Health Summary users can print an Outpatient Pharmacy Action Profile with bar codes in tandem with a health summary.
- Health Summary now exports components that allow staff to view remote patient data through CPRS.

Currently, remote data views are limited to predefined, nationally exported Health Summary Types. Remote clinical data can be viewed using any Health Summary Type that has an identically named Health Summary Type installed at both the local and remote sites.

- Clinical Reminders work with Health Summary to furnish providers with timely information about their patients' health maintenance schedules. Providers can work with local coordinators to set up customized schedules based on local and national guidelines for patient education, immunizations, and other procedures.
- Health Summary components 'Progress Notes' and 'Selected Progress Notes' can display the new interdisciplinary progress notes and all of the entries associated with the interdisciplinary note.

CPRS Health Summary

Vista CPRS in use by: Green,Joann (OERRDEMO-ALT)

File Edit View Tools Help

APPLESEED,JOHNNY 2B M Primary Care Team Unassigned Postings
 465-68-0999 Apr 30,1944 (55) Provider: GREEN,JOANN Attending: Baylis,Randall Data CWAD

Available Reports Health Summary Type: CPT - Reminders

Health Summary
 Imaging
 Lab Status
 Blood Bank Report
 Anatomic Path Report
 Dietetics Profile
 Nutritional Assessment
 Vitals Cumulative
 Procedures
 Data Order Summary

Types
 REMTEST
 CPT - Reminders
 CPT - Reminders

***** CONFIDENTIAL CPT - Reminders SUMMARY pg. 1 ***
 APPLESEED,JOHNNY 465-68-0999 2B MED DC

----- CR - Reminders Due -----

The following disease screening, immunization and patient education recommendations are offered as guidelines to assist in your practice. These are only recommendations, not practice standards. The appropriate utilization of these for your individual patient must be based on clinical judgment and the patient's current status.

--NEXT-- --LAST--
 Cholesterol Screen (Male) DUX NOU unknown

----- CRS - Reminders Summary -----

No selection items chosen for this component.

Cover Sheet / Problems / Meds / Orders / Notes / Consults / D/C Summ / Labs / Reports

CPRS: Clinical Reminders

Overview

The Clinical Reminders package is a valuable aid in patient treatment. Reminders assist clinical decision-making and educate providers about appropriate care. Electronic clinical reminders also improve documentation and follow-up, by allowing providers to easily view when certain tests or evaluations were performed and to track and document when care has been delivered. They can direct providers to perform certain tests or other evaluations that will enhance the quality of care for specific conditions.

Clinical Reminders may be used for both clinical and administrative purposes. However, the primary goal is to provide relevant information to providers at the point of care, for improving care for veterans. The package benefits clinicians by providing pertinent data for clinical decision-making, reducing duplicate documenting activities, assisting in targeting patients with particular diagnoses and procedures or site defined criteria, and assisting in compliance with VHA performance measures and with Health Promotion and Disease Prevention guidelines.

The Quality Enhancement Research Initiative (QUERI), an HSR&D program, and the National Clinical Practice Guidelines Committee have joined with the Office of Information, System Design & Development office (SD&D) in designing national reminders and dialogs that will help promote informed decision making and consistency of health care practices. Ischemic Heart Disease (IHD) and Major Mood Disorder (MDD) reminders are two of the first cooperatively developed reminders.

Features

- Allows results that are unique for each patient, by basing reminder evaluation on the patient's clinical data.
- Allows facilities to copy, create, and customize their own reminder definitions, based on local needs.
- Provides components that can be displayed on Health Summaries.
- Provides reminders reports for summary or detailed level information about patients' reminders that are due. Reports allow providers to verify diagnoses, verify that appropriate treatment was given, identify patients requiring intervention, and validate effectiveness of care. Combined reports for multiple facilities or multiple locations can now be generated.
- Provides an enhanced Exchange Utility that allows exchange of reminder definitions and dialogs among sites and Veterans Integrated Service Networks (VISNs).
- Provides clinicians with a simplified method of resolving reminders within the CPRS GUI. Using point-and-click techniques, a clinician can generate text for progress notes, update current and historical encounter data in Patient Care Encounter (PCE), update vital signs, update mental health test results/scores, and place orders.

Clinical Reminders Example: Reminders Resolution Dialog

Reminder Dialog Template: DIABETIC/P.A.C.T. FOOT EXAM

P.A.C.T. ASSESSMENT NEEDED

- PT IS DIABETIC
- PT HAS PVD
- PT IS IMMUNOCOMPROMISED (CANCER TREATMENT, HIV, AIDS, ETC)
- PT HAS ESRD

- Visual Inspection
- Patient had sensation exam using Monofilament RIGHT FOOT
- Patient had sensation exam using Monofilament LEFT FOOT

Plan/Pact Level with Hyperlink

[P.A.C.T. RISK ASSESSMENT LEVELS.htm](#)

- LEVEL 0 NO DEFORMITY, >70% SENSATION, PALPABLE PULSES
INTERVENTION: PATIENT EDUCATION AND ANNUAL FOOT EXAM
- LEVEL 1 NO FOOT DEFORMITY, <70% SENSATION OR NON PALPABLE PULSES
INTERVENTION: PATIENT EDUCATION, DIABETIC NP REFERRAL, ANNUAL
FOOT EXAM

Patient Educations: **Diabetic Foot Care**

* Indicates a Required Field

CPRS: Consult/Request Tracking

Overview

The Consult/Request Tracking package provides an efficient way for clinicians to order consultations and procedures from other providers or services within the hospital system, at their own facility or another facility. It also provides a framework for tracking consults and reporting the results. It uses a patient's computerized patient record to store information about consult requests.

Features

- Allows direct access to Consults functions through menu options in CPRS.
- Uses Consults' own menu options for managing the system, generating reports, tracking consults, or entering results for an existing consult request.
- Allows staff to set up consults as CPRS Quick Orders, streamlining the ordering process.
- Integrates with Prosthetics to track Home Oxygen, Eyeglasses, Contact Lenses, and other Prosthetics services.
- Produces a permanent record of the request and resolution for the patient's medical record.
- Allows all relevant parties to see the consult report in the context of the patient's record.
- Allows use of TIU templates and boilerplate to report findings.
- Allows display of Consult reports through TIU and CPRS.
- Enables clinicians to order a consult at another facility, using HL7 Messaging and the VA Intranet.

CPRS: Consult/Request Tracking

VISTA CPRS in use by: Snow, Charles R. (152.131.2.2)

File Edit View Action Options Tools Help

BABBITT, GEORGE F IA(1&2) Primary Care Team Unassigned Remote
448-65-8829 Apr 09, 1945 (55) Provider: SNOW, CHARLES R Attending: Howser, Doogey Data Postings: CWAD

All Consults Jun 02, 99 (c) VENTRICAL LEAD IMPLANT CARDIOLOGY Proc Consult #

Current Pat. Status: Inpatient
Ward: IA(1&2)
Primary Eligibility: SC LESS THAN 50%

Order Information
To Service: CARDIOLOGY
From Service: CARDIOLOGY
Requesting Provider: SNOW, CHARLES R
Service is to be rendered on an OUTPATIENT basis
Place: Consultant's choice
Urgency: Routine
Orderable Item: VENTRICAL LEAD IMPLANT
Procedure: VENTRICAL LEAD IMPLANT
Reason For Request: Pt is very sick.

Inter-facility Information
This is not an inter-facility consult request.

Status: COMPLETE
Last Action: COMPLETE/UPDATE

Related Documents
Mar 29, 00 CARDIOLOGY

Cover Sheet Problems Meds Orders Notes Consults D/C Summ Labs Reports

CPRS: Text Integration Utilities (TIU)

Overview

Text Integration Utilities (TIU) simplifies the use and management of clinical documents for both clinical and administrative medical facility personnel. In connection with the Authorization/Subscription Utility (ASU), a facility can set up policies and practices for determining who is responsible or has the privilege for performing various actions on required documents.

The Version 1.0 release included Discharge Summary and Progress Notes. With the release of CPRS and Consults/Request Tracking, TIU has been upgraded to integrate with these packages.

Features

- Provides boilerplate functionality for the automatic fill-in of information from VistA files into TIU documents. Boilerplates and embedded objects can be set up for specific types of documents for specific clinical needs.
- Interfaces with the Computerized Patient Record System (CPRS): the template utilities in the GUI version of CPRS allow speedy point-and-click composition of notes, consults, and summaries.
- Templates can be set up for specific types of documents for specific clinical needs.
- Interfaces with Problem List, Automated Information Capture System (AICS), Patient Care Encounter (PCE), Authorization/Subscription Utility (ASU), Incomplete Record Tracking, Health Summary, and Visit Tracking.
- Uses a standardized and common user interface, which allows clinicians and others to retrieve many kinds of documents from a single source.
- Enables healthcare practitioners to enter interdisciplinary notes regarding a single episode of care for a patient. This is accomplished through the addition of a level to the tree structure where a note can have children (subordinate entries) and each of the children can have a different author. This provides for more complete patient records and facilitates input from a variety of practitioners regarding a single episode of care.
- Interfaces with VistA Imaging allowing clinicians to link TIU documents to all types of clinical images such as X-rays, MRIs, and CAT scans.
- Uses an integrated database, which lets clinicians, quality management staff, researchers, and management search for and retrieve clinical documents more efficiently because documents reside in a single location within the database.
- Permits document input from a variety of data capture methodologies such as transcription, direct entry through CPRS or the TIU package, or upload of ASCII formatted documents into VistA.
- Uses a uniform file structure for storage of documents and management of document types.
- Uses a consistent file structure for defining elements and parameters of a document.
- Allows a variety of user actions, such as entry, edit, electronic signature, addenda, browse, notifications, etc.
- Allows a variety of management functions, including amendment, deletion, and identification of signature surrogate, re-assignment, and administrative authentication.
- Follows HL7 interface and other communication standards.

Lexicon Utility

Overview

The adoption of a standardized reference for clinical terminology across VHA enables clinical information to be recorded, transmitted, retrieved, and analyzed in a precise manner independent of clinic or medical center.

The scope of the Lexicon Utility is to express diagnostic clinical problems in easy-to-understand terminology and associate these terms to coding systems such as ICD, DSM, NANDA, etc. It works in conjunction with VistA applications such as Problem List, Encounter Form, and Text Integration Utility (TIU) and provides a comprehensive API so that any application that needs to use standardized terminology can be interfaced.

Features

- Provides a basis for a common language of terminology so that all members of a healthcare team can communicate with each other.
- Provides terminology that is well defined, understandable, unique in concept, and encodable by multiple coding schemes.
- Provides for site modification of text presentation, term definitions, synonyms, short cuts, and keywords.
- Provides the ability to upgrade coding systems (e.g., ICD9-CM to ICD-10) and to add, change, and delete codes.
- Provides for limited views of vocabulary (lexicon subsets).
- Allows each site to add its own vocabulary to the lexicon.
- Accepts the provider terminology if a search of the dictionary does not find a match.
- Uses subsets of terms based on specialty or clinic.
- Allows abbreviations or shortcuts to provide quick access to frequently used definitions.
- Supports CPT terminology and codes.

CPRS: Adverse Reaction Tracking

Overview

The Adverse Reaction Tracking (ART) program provides a common and consistent data structure for adverse reaction data. This module has options for data entry and validation, supported references for use by external software modules, and the ability to report adverse drug reaction data to the Food and Drug Administration (FDA).

Features

- Documents patient allergy and adverse drug reaction data.
- Provides the functionality for other VistA modules to extract and add patient reaction data.
- Provides a reporting mechanism that supports VHA Directive 10-92-070 which specifies reporting of adverse drug reactions to the FDA.
- Includes ART event points in an Application Programmers Interface (API) allowing other VistA packages to know when specific ART events take place so package tasks can be performed.
- Alerts the Pharmacy and Therapeutics Committee each time the signs/symptoms are modified for a patient reaction.
- Generates progress notes. Displays all information at the time of an ART event on the Progress Notes API and allows editing of the note prior to sign off.
- Allows the site to track whether the patient has been asked if he/she has allergies.
- Tracks when the patient chart and ID bands have been marked indicating a particular reaction.
- Differentiates between historical and observed reactions.
- Tracks the particular signs/symptoms for a reaction.
- Allows for configuration of allergy files.
- Allows for editing and verification of reaction data.
- Allows for the addition of comments for each reaction to ensure completeness in reporting.
- Contains extensive reporting capabilities.
- Contains an online reference guide.

CPRS: Authorization/Subscription Utility (ASU)

Overview

The Authorization/Subscription Utility (ASU) provides a method for identifying who is authorized to perform various actions on clinical documents. These actions include signing, co-signing, and amending. ASU originated in response to Text Integration Utilities' document definition needs. Current security key capabilities were unable to efficiently manage the needs of clinical documentation (Discharge Summaries, Progress Notes, etc.).

Features

- Defines, populates, and retrieves information about user classes. User classes can be defined hospital-wide or more narrowly for a specific service and can be used across VistA to replace and/or complement keys.
- Links user classes with Text Integrated Utilities (TIU) document definitions and document events.
- Allows sites to maintain membership of users in User Classes and to distribute such maintenance tasks.
- Lists class members as active or inactive.
- Allows infinite hierarchies of subclasses.
- Defines business rules to further manage document activities.

Appendix B – An in-depth look at MUMPS

What is MUMPS

Mumps¹ (also known as M) is:

- A database management system, and
- A programming language, and
- An operating system

all rolled into one. Mumps is non-proprietary and runs on a variety of platforms. In its heyday (mid eighties to mid nineties), nearly a dozen vendors implemented the M ANSI standard language on more than 200 platforms, and under virtually every type of operating system available.

Mumps as a database management system

The Mumps environment includes a high performance database management system. Data is stored in the form of globals. A global can be thought of as a persistent multi-dimensional array. Mumps allows true multi-dimensional subscripting, allowing the use of both numeric and textual subscripting. There are no controls or rules for constructing data structures, and no schema or data dictionary for describing database records. Where as this might appear to have some drawbacks, it provides incredible flexibility and speed of development.

Fully integrated graphical user interfaces make the Mumps global structures accessible to external, non-Mumps applications, increasing the value of Mumps as a database management system. There is some debate in the IT industry as to the performance of a Mumps database versus a relational database such as Oracle, explaining why some vendors have chosen to migrate to a new environment.

Mumps as a programming language

Mumps is a comprehensive, procedural, programming language, comparable to COBOL, FORTRAN, or BASIC. Mumps has a relatively small command set and the code is extremely compact because commands can be abbreviated, lines contain multiple commands, and each command can be associated with a separate run-time condition. For the most part, Mumps is an interpreted language, although Mumps compilers do exist. Mumps provides the power and flexibility of a 3rd generation language with the programming ease of a 4th generation language.

Arguably, one of the strongest features of Mumps is that it uses untyped variables – i.e. no declaring of variables and no errors because a variable was erroneously declared as an integer, when it is in fact a double (!). Mumps has only one data type: strings, however, the language can interpret these strings in a variety of ways: text strings (of course), binary strings, floating-point values, integer values, and Boolean values. Interpretation of strings is done inside functions, or implicitly while applying mathematical operators.

An obvious side effect of the fact that Mumps has only the string data type is that it has well-developed and powerful string handling commands. Related to this is a feature known as indirection. Indirection allows data held in string variables to be interpreted at run-time as if they were commands. (From the perspective of an old Mumps programmer, this feature is tricky to understand and even harder to explain, but once understood it is invaluable!)

The Mumps programming language, in conjunction with its database, includes powerful dynamic array handling features.

¹ The official name for Mumps is “M Technology”, however a substantial portion of the M community still refers to M as Mumps, as does this paper. Both terms refer to the same technology.

Mumps as an operating system

Early Mumps implementations were complete operating systems, as well as programming languages. Current-day implementations usually run under a normal host operating system, however with Mumps still performing “operating system” tasks (such as implicitly opening a file/global when it is referenced), the host operating system is still “transparent” to the programmer.

Mumps and Portability

Mumps is extremely portable. The ISO standard includes statements on portability, identifying the minimum set of requirements that all M implementations must meet. As already noted, Mumps has been implemented on over 200 platforms and multiple operating systems. It is easily possible to share a Mumps database between different architectures, because all the values are stored as text strings. Mumps has been integrated with relational data manipulation tools, industry-standard SQL, SQL-based connectivity, and interfaces to windowing managers, making it one of the most portable, flexible tools available.

History of Mumps

Mump’s roots are in the healthcare industry. It was developed at Massachusetts General Hospital by Dr. Octo G. Barnett, Dr. Neil A. Pappalardo, and Dr. Curt W. Marble (among others) and named MUMPS (Massachusetts General Hospital Utility Multi-Programming Systems). They wanted a better system for their laboratory. The language was first implemented in 1966/1967 and ran on a PDP-7.

Shortly after, the original team split up and in 1969, Dr. Pappalardo and Dr. Marble went on to found Meditech, one of the leading healthcare information systems in use today.

The Mumps community grew rapidly and the Mumps User Group (MUG) was born. The first meeting was held in Boston in 1972 and was attended by 40 people. In close conjunction with MUG, the MUMPS Development Committee was formed and released their first standard in 1975. In 1977, MUMPS became an ANSI standard, becoming the third computer language to gain American National Standard status. It received Federal Information Processing Standard (FIPS) approval in 1986 (FIPS 125).

Mumps basically kept growing in popularity through the 90s and then slowed (not quite to a standstill). The last ANSI standard modification was in 1995. In 1998, Intersystems (a major Mumps vendor) acquired Micronetics (another major Mumps vendor). In 2002, the M Technology Association ceased to exist and ANSI standards were administratively withdrawn.

Mumps – A Dead Language?

So what of Mumps today? Is Mumps a dead language? Not a chance! Although the M Technology Association no longer exists, M still seems to be alive and well today. There are many legacy systems that still have Mumps as the underlying technology. IDX, Quadramed, MEDITECH, Eclipsys, EPIC, Cerner, McKesson/HBOC, Keane, and the Veterans Administration Software (VISTA, FileMan, DHCP, SAIC - CHCS) all have their roots in Mumps. Mumps also still has an active population in Europe².

Caché

InterSystems, in addition to its own Mumps offering and those versions of Mumps it has acquired, developed a next-generation, post-relational database product, Caché, released in 1997. This new product, featuring M Technology language compatibility, also incorporates many of the values of M Technology implementations. Many Mumps programmers and vendors, including VA and Vista, have incorporated Caché into their existing systems and continue to develop their products using Caché. Although technically Caché is a different product, a behind the scenes look at Caché source reveals amazing similarities between the two languages. In other words, a Mumps programmer, by any other name is a . . . Caché programmer!

² <http://www.camta.net/links-associations.html> - web page for the UK and Europe M technology association.

Mumps Chronological History

Much of this timeline was lifted directly from these two Mumps web sites:

<http://www.geocities.com/SiliconValley/7041/ref.html#MUMPS2M>

<http://207.224.6.57/mdc/index.htm>

- 1966/1967** Mumps was first developed and implemented at Massachusetts General Hospital.
- 1969** The first two papers written about Mumps:
 1. Greenes RA, Pappalardo AN, Marble CW, Barnett GO; *"Design and implementation of a clinical data management system"*; *Comput Biomed Res*; 2:469-485
 2. Greenes RA, Pappalardo AN, Marble CW, Barnett GO; *"A system for clinical data management"*; *AFIPS Conf. Proc Vol. 35. Montvale, New Jersey: FJCC, AFIPS Press; 207-230*
- 1974** Hoskyns moves into Mumps. It implements one of the earliest Mumps systems in the UK on a PDP 11.
- 1975** First standard created. It lists the minimum that would be compatible between the different implementations, and assured portability across different hardware platforms.
- 1977** The 1975 standard gets approved by ANSI (American National Standards Institute). MUG-Europe meets for the first time in Amsterdam.
- 1978** InterSystems Corporation founded by Terry Ragon. The first Mumps implementation goes live in Finland.
- 1980** Terry Ragon wrote an official request to the MUMPS Development Committee, requesting a change of name from MUMPS to M. Micronetics was formed by Richard T. May, David J. Marcus, and Bernard S. Schoch.
- 1982** MUG-UK's first meeting takes place in London.
- 1984** MDC/ANSI standard revised to incorporate language enhancements and cleaned up and formalized the text of the standard.
- 1986** Mumps approved as a Federal Information Processing Standard (FIPS). (Identical to ANSI X11.1-1984)
 Cybertools incorporated by Mark Roux.
- 1987** Extensao Software founded in Rio - Brazil. The New England M Users Group is the first user group dedicated to this programming language.
- 1988** KB Systems, Inc. formed by Richard Sulzer and David Middleton.
- 1989** MUG Finland holds its first meeting in Helsinki. German MUG is formed. Atlas Development Corporation founded by Robert Atlas.
- 1990** Revised ANSI Standard for Language Specification: added block structured features, extrinsic variables and functions, encapsulation features enhanced looping commands and improved database handling.
- 1992** Original ISO Language Specification (identical to ANSI X11.1-1990)

- 1993** The name M (or M-Technology) becomes an officially used nickname of MUMPS.
The FIPS standard is revised (identical to ANSI X11.1-1990)
- 1994** ANSI Standard revised for GKS Binding.
- 1995** Throughout 1995, the ANSI Standard added more M-related standards: language standards, Open *M* Interconnect, binding, M/X Window System binding, *M* TCP/IP binding, *M* Windowing API, transaction processing and error processing.
Renewed ISO Language Specification (identical to ANSI X11.1-1995)
Japanese National Standard (identical to ANSI X11.1-1990)
Canadian National Standard (identical to ANSI X11.1-1990)
Extensao changed its name to X-Tension Software Corporation and went global through its office in Florida.
- 1997** Intersystems releases Caché
- 1998** Micronetics acquired by Intersystems.
- 2002** M Technology Association ceases to exist. ANSI Standards administratively withdrawn.