# 1.A: LABORATORY INFORMATION SYSTEM OVERVIEW

University of Washington Medicine
Department of Laboratory Medicine
Laboratory Information Systems
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## Overview

University of Washington Medicine includes the School of Medicine, a state supported institution, the University of Washington Medical Center (UWMC), Harborview Medical Center (HMC), nine primary care outpatient clinics (UW Physicians Neighborhood Clinics or UWPN), and the Seattle Cancer Care Alliance (SCCA). The total number of licensed inpatient beds exceeds 900 and the total number of annual outpatient visits exceeds 650,000. UWMC acts as secondary and tertiary referral center for Seattle and a five-state region, including services in transplantation and oncology. Harborview Medical Center, owned by King County and managed by the University of Washington, serves as the major level 1 trauma center and is a major burn center for the Pacific Northwest and Alaska. The SCCA was formed in 2000, merging oncologists from the Fred Hutchinson Cancer Research Center (FHCRC), UWMC, and Children's Hospital and Regional Medical Center (CHRMC). Other closely affiliated institutions include CHRMC and the Puget Sound Veterans Administration Medical Center. Common clinical computer systems service UWMC, HMC, SCCA, and UWPN. CHRMC and VAMC operate their systems independent of UW Medicine.

## Laboratory Information Systems Environment

Since the early 1980's, Laboratory Medicine has used the Misys (Sunquest) Flexilab Laboratory Information System (LIS) with the Multiple Hospital (MULHOS) option (Misys Information Systems, Tucson, AZ 85711). HMC, UWMC, SCCA, and primary care laboratories duplicate tests requiring rapid turn around time and share other testing. More than 55 analytical instruments perform testing and are interfaced to the LIS. The Antrim Financial System was installed June 1999 and handles the billing of Lab Medicine outreach clients and patients. HIPAA compliant billing interfaces exist to most major insurance carriers.

The clinical environment depends on electronic access to laboratory results. Sunquest is interfaced to clinical systems and data repositories (see below). The current system retains all patient data online since September, 1998. With the exception of some outpatient reports, most results are sent and retrieved electronically. Over 4 million billable tests and 35 million results are processed annually.

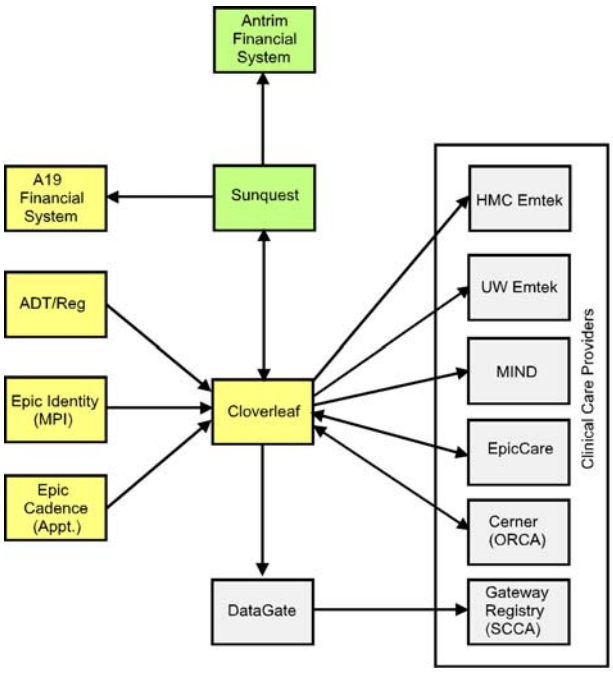
Locally develop applications supplement the Misys LIS. These include an on-line test directory (http://byblos.labmed.washington.edu), a web-based application providing both laboratory and clinical personnel with test information (e.g., collection information, reference ranges, etc.), and a hematopathology database (Hemepath) supporting the reporting of flow cytometry. File servers and the LIS hold more than 3 terabytes, including large databases containing flow cytometry and molecular information.

## UW Clinical Information Systems

The LIS interacts with a complex hybrid of locally developed and commercial systems. Most systems are common to both hospitals. Except as noted, all interfaces to/from the LIS are passed in real-time through a Cloverleaf HL7 interface engine (Healthdyne Information Enterprises, Marietta, GA 30067). The LIS is interfaced to four major clinical patient information systems. Sunquest receives orders and sends results to EpicCare (Epic Systems Corporation, Madison, WI 53711), which acts as a permanent electronic patient record for UWPN clinics. Results for inpatients are sent to the Clinical Information System (CIS), an implementation of Eclipsys Continuum 2000 (previously Emtek; Eclipsys Corporation, Delray Beach, FL 33483). This system provides clinical flowsheets for inpatients. Results are also sent to the MINDscape, a locally developed electronic patient record based on web browser technology. MIND has most laboratory data since mid-1995 and all data including microbiology since August 30, 1998. Cerner Millenium Powerchart stores clinical results and documentation since September 2003 and

will replace and integrate many existing clinical systems. Lab results have been backloaded to 2001. Physician order entry is planned. HMC, UWMC, and UWPN each utilize their own patient number. MIND and EpicCare link patients to all patient numbers. Since spring, 2000, Sunquest sends laboratory data to the FHCRC Gateway System, a registry of bone marrow transplantation patients. Epic Cadence supports outpatient scheduling Epic Prelude supports patient registration, Epic Identity manages the master patient index, and Epic Resolute performs professional (Medicare Part B) billing functions. Locally developed administrative systems manage the admissions/ discharge/transfer (ADT) and patient billing (Part A Medicare). ADT data is automatically transmitted to the LIS real-time via the Cloverleaf HL7 interface engine. Laboratory billings are passed to the administrative system nightly.

Figure 1: Logical connections to/from the laboratory system for clinical functions




UW has been the recipient of National Library of Medicine grants. These include the Integrated Advanced Information Management System project (IAIMS), funding the integration of information systems used for patient care. Through x-terminals, Windows thin clients, and personal computers, clinicians can access the Emtek System, run web browser applications such as MIND, access the laboratory and other departmental systems, and access online references such as Ovid, Micromedix, PubMed, and electronic journals. Other NLM grants include telemedicine applications for hematology-oncology conferencing under the Next Generation Internet (Phase I and II) and a NLM doctorial and postdoctorial training grant for biomedical and health informatics.

Table 1: UW Developed Information Systems

| System | Purpose | Information Present |
|---|---|---|
| MIND<br>MINDscape<br>MAP | Electronic Medical Record | HMC/UWMC reports (discharge notes, radiology, pathology, operative notes, etc.), administrative information (clinic visits, diagnoses, procedures), lab results, pharmacy, problem list, reminders |
| Reg/ADT | Registration and ADT | Patient registration, admissions/discharges/transfers |
| Unisys "A19" Mainframe | Administrative functions | Billing and accounting |
| Gateway | FHCRC Research Registry | Patient diagnoses, procedures, lab results, outcomes (Bone marrow transplantation) |

Table 2: Commercially Developed Information Systems

| System | Purpose | Information Present |
|---|---|---|
| Sunquest/Misys | Lab Information System | HMC/UWMC/UWPN lab results |
| Antrim/Misys | Lab Financial System | Sunquest outside patient billing (live 6/99) |
| EpicCare | Electronic Medical Record | UWPN order entry, results reporting, electronic medical record |
| Cerner Powerchart (ORCA) | Electronic Medical Record | UW, HMC, and SCCA order entry, results reporting, electronic medical record (under installation) |
| Sunrise (Emtek) | Most inpatients | HMC/UWMC inpatient flowsheet, limited results reporting (also called Clinical Information System or CIS) |
| Epic Identity | Manage multiple patient numbers across enterprise | Links different patient numbers from UWAMC organizations |
| Epic Cadence | Patient Scheduling | Outpatient clinic scheduling |
| Epic Resolute | Patient Registration | Patient registration functions |
| Epic Resolute | Professional Billing | Medicare Part B billing and accounting |
| Cloverleaf | HL7 message router | HMC/UWMC/UWPN: reports to MIND, Eclipsys; orders/reports to EpicCare, ADT distribution |
| STC Datagate | HL7 message router | FHCRC message router |

## Networking and Computer Room Environment

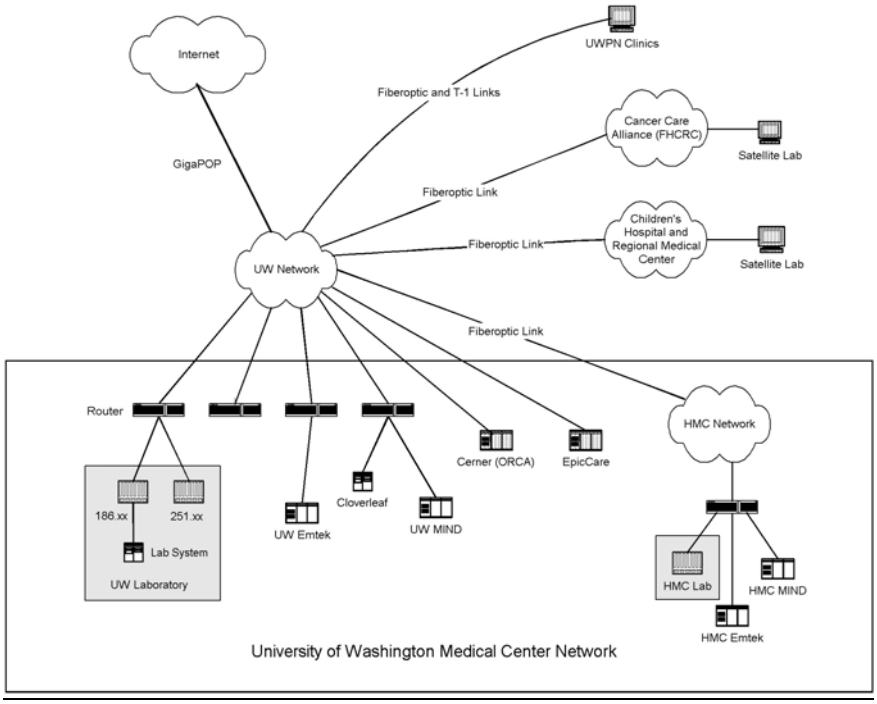
UW supports a TCP/IP network with high-speed fiber-optic connections to HMC, UWPN Clinics, SCCA, and most metropolitan Seattle locations where UW provides health care services. This network is connected to the Internet through 10 gigabit routers (gigapop). The Misys Sunquest LIS is located at UWMC. Fiber-optic links connect the LIS to satellite laboratories at HMC, Roosevelt (outpatient), and SCCA. The UW Computer and Communications (C&C) provides services for the campus network, email and web servers, including an email server for the Medical Center, and the institutional culture assumes that users have access to web browsers and e-mail. The SCCA and CHRMC support networks independently of C&C. Within the UW network, Laboratory Medicine manages three class C gigabit subnets using HP 4000m Procurve 10/100 (Hewlett-Packard, Palo Alto, CA 94394) hubs. Most connections to desktops and servers are made with Category 5 cabling. Netscreen firewalls and VPNs protect the laboratory network environment and connect the satellite sites to the central computer facility.

The computer room consists of approximately 500 square feet raised floor space cooled by two Liebert 75,000 BTU Challenger air-conditioners. Both air-conditioning units are connected to a temperature alarm and control box (Sensaphone 6500, Phonetics, Aston, PA 19014) programmed to start the alternate cooling unit and telephone personnel under high temperature conditions. An EPE uninterruptable power supply (MGE UPS Systems, Costa Mesa, CA 92626) provides up to 30-minutes of battery power, and a Halon fire extinguisher system protects the room. Most routine tasks are initiated automatically (including system backups). The computer room is attended from 8 AM to 6 PM Monday-Friday and runs in a “lights out” mode at other times.

## Office Automation

Laboratory Medicine supports a heterogeneous office automation network consisting of more than 600 Apple Macintoshes and Windows computers. More than twenty Dell and HP Windows Servers provide printing, file, and database services, including more than 3 terabytes of storage. MS-SQL Server and Filemaker are used as databases; PC operating systems include OS-X for the Macintosh and XP Professional and Windows 2000 for Intel based computers. Microsoft Office applications are used for email, word processing, and other office automation applications. Flatbed scanners, 35-mm slide scanners, LCD projectors, a 35-mm slide maker, digital cameras, digital microscope cameras [Nikon (12 MP) and Olympus (3 MP)], and video/audio conferencing equipment are also available within the Department. Teleconferencing of the Hematology-Oncology and Lab Medicine Grand Rounds occur regularly.

Figure 2: The University of Washington Network




## Hardware

### Misys Laboratory (Sunquest) Lab0/Lab1 (main LIS processors)

| | |
|---|---|
| 2 | IBM p570 (2 CPUs) with 2 processors, 4 megabytes memory, 4 TB disk storage |
| 2 | 3480 Ultrium 2 200 GB cartridge tape drive |
| 16 | Xyplex Maxserver 1620-014 terminal servers |
| 1 | Xyplex Maxserver 9000 terminal servers |
| 50+ (approx) | VT510, VT520 terminals |
| 10 | C. Itoh CI-5000 printers (worksheets) |
| 25 | Okidata 320 printers |
| 2 | Genicom line printers |
| 10 | HP facsimile machines |
| 5 | Zebra Z4M barcode printers |
| 35 | Zebra DA402/DA2844Z barcode printers |
| 10 | Axiom/Cognitive Solutions Blaster SR/SR Advantage barcode printers |
| 50 | Symbol LS4000 series barcode readers |

| | |
|---|---|
| Software | AIX V5.2.0.0 Maintenance Level 7<br>Intersystems Cache for UNIX (IBM PowerPC) 4.1.16 (Build 233_3 + Adhoc 1341) Sat Apr 3 2004 08:16:46 EST<br>Misys Flexilab, version 5.4.2 |

### Personal Computers and Servers

| | |
|---|---|
| 1 | RALS POCT instrument controller (Compaq server) serving 130 Roche glucometers |
| 1 | Lane Telecom Passport Fax Server (Dell 2600, Windows 2000 Professional) |
| 20+ | Windows domain/data servers (Dell 2600, 2800, Windows 2000, 2003 Advanced Server) |
| 1 | EMC/Dell disk array |
| 500 | Windows 2000, XP (Dell Optiplex) |

| | |
|---|---|
| | Instrument processors |
| 2 | Misys / Dell 2650 / Red Hat Enterprise Linux AS release 3 (Taroon Update 4)<br>Linux minerva 2.4.21-27.ELsmp #1 SMP Wed Dec 1 21:59:02 EST 2004 i686 i686 i386 GNU/Linux |

## Online Instruments

| | |
|---|---|
| 5 | Abbott CellDyn 3700 hematology counters |
| 1 | Abbott CellDyn 3200 hematology counter |
| 1 | Abbott CellDyn 3500 hematology counter (Roosevelt Outpatient Lab) |
| 1 | Abbott CellDyn Slide Maker Stainer |
| 1 | Sysmex XE2100 (Seattle Cancer Care Alliance) |
| 1 | Sysmex XT2100i (Seattle Cancer Care Alliance) |
| 4 | Beckman LX-20 (x4) chemistry analyzers via Datalink (x2) |
| 4 | Beckman DXi immunoassay analyzers via Datalink (x2) |
| 2 | Beckman Access II |
| 2 | Olympus AU400 chemistry analyzers |
| 1 | Olympus AU400 chemistry analyzer (Seattle Cancer Care Alliance) |
| 1 | Olympus AU640 chemistry analyzer (Seattle Cancer Care Alliance) |
| 1 | Beckman CX3 Chemistry analyzer (Roosevelt Outpatient Lab) |
| 7 | Bectin-Dickinson Bactec 9240 |
| 1 | Benetech AFP Expert prenatal screening management interface |
| 1 | Bayer Centaur |
| 2 | Biorad Variant II |
| 2 | bioMerieux Vitek II System |
| 2 | Dade-Behring Nephelometers |
| 4 | Diagnostic Stago COMPACT coagulation analyzers |
| 5 | Radiometer 725 BGA via Datacare (Windows 2000 - UW) |
| 5 | Radiometer 725 BGA via RADIANCE datamanager (HMC) |
| 1 | BIOMIC |
| 2 | IRIS IQ200 & AX4280 automated complete urinalysis system |
| 1 | SEBIA Phoresis |
| 1 | BioMerieux BacTAlert 3D (under installation) |
| 1 | DYNEX DSX (under installation) |
| 4 | Beckman LXC chemistry analyzer (under installation) |
| 2 | Sysmex XE2100 heme analyzers via SYSMEX MOLIS-WAM datamanager (UW) (under installation) |
| 3 | Sysmex XE2100 heme analyzers via SYSMEX MOLIS-WAM datamanager (HMC) (under installation) |

## Misys Financial (Antrim Financial)

| | |
|---|---|
| 1 | HP/Digital Alphaserver 800 5/400 with 256 megabytes main memory |
| 2 | RZ-28M 2.1 gigabyte disk drives |
| 4 | RZ-1CB 4.3 gigabyte disk drives |
| 1 | TLZ04 DAT tape drive |
| 1 | TZ-89 DLT tape drive |
| | |
| Software | OpenVMS (Alpha) V7.3-1<br>Multinet 4.3<br>Intersystems Open M [ISM] for OpenVMS V7.x (Alpha) 6.4-F.14 (BUILD03+DASxxx+CLOxxx+DASyyy+JO1 169) 2-NOV-2000 10:02:27.71<br>Antrim Financial System, version 3.2 (Y2k compliant) |