

# **ART Patient Management and Reporting Software**

Dr. Jeffrey Stringer, Principal Investigator  
Thomas Hubschman, Software Architect

## **1. Overview**

### **Background**

The Patient Tracking System (PTS) and Patient Management & Reporting Server (PMRS) are integral components of the Lusaka HIV Care and Treatment Program. The data system is built on a set of clinical forms designed to implement ART as part of the Presidents Emergency Plan For AIDS Relief (PEPFAR) in Zambia. The Centre for Infectious Disease Research in Zambia (CIDRZ), together with the Lusaka Urban District Health Management Team (LUDHMT), developed the clinical forms and patient tracking software. The data system is currently expanding to University Teaching Hospital (UTH), the primary referral hospital in Zambia and the oldest public ARV program in the country. With the rollout to UTH, this data system manages well over half the patients on ART in Zambia: 9,000 patients enrolled in HIV care, almost 6,000 of whom are on ART.

### **Patient Tracking System**

The Patient Tracking System is a facility-level tool to track late patients for follow-up, ensure key indicators are collected for every patient, monitor program growth daily, provide instant drug regimen reports, and allow precise characterization of the patient population. The primary goal is to improve clinical care by providing a quick review of key indicators for all patients, issuing daily notification of late patients, and ensuring proper drug regimen prescriptions.

### **Patient Management and Reporting Server**

The Patient Management and Reporting Server allows for central consolidation of data and the transfer of information across sites. The PMRS provides instant access to data from multiple sites, with precise information about patient populations and key indicators from each location. Program enrollment, drug prescriptions, laboratory results, adherence levels, and other essential data can be tracked in aggregate or by site. The primary goal is to improve the operations and effectiveness of a multi-site program.

### **Clinical Forms**

A comprehensive set of forms were developed by clinical personnel to meet the needs of the Lusaka program, providing guidance and prompts for good care. Medical personnel involved in the design of the forms included Zambian and American experts in clinical care, pharmacy, laboratory, and adherence counseling. The PTS is currently optimized for the Lusaka forms but its flexibility would allow adaptation to other forms systems.

## **2. Patient Tracking System Architecture**

### **Hardware**

The Patient Tracking System runs on a standard home computer. The only recommended adaptation of the standard PC is increased memory. Sites with unreliable electricity may require an Uninterruptible Power Supply (UPS) in addition to the PC.

## **Software**

The Patient Tracking System utilizes a web-based interface; the underlying application can be altered without having to reconfigure this user interface. The software is written in the Java programming language and uses only open source software components. Java allows for the software to be deployed across a variety of platforms, including Windows PC, Linux, Unix and Macintosh. The use of open source software enables the PTS to be completely free of licensing costs. The PTS is a standalone system: no network or central server is required to implement the software.

## **Cost**

Because there are no software licensing costs or specialized hardware, the basic cost per clinic is approximately **\$1200** for a computer with additional memory. A standard UPS can usually be sourced for an additional \$250.

## **3. Patient Management & Reporting Server Architecture**

### **Network**

The PMRS server requires some form of network connectivity between sites. This can be a wireless network, a dial-up connection, or even manual data transfer via USB key. Any of these transfer mechanisms will allow a PMRS server to aggregate site data into one central reporting server.

### **Hardware**

The hardware requirements for a PMRS server depend on the size of the ART program. As a program grows by adding more sites and patients, the hardware requirements of the PMRS server will grow with it. The server software can be installed on a variety of computer platforms, ranging from a Windows home PC all the way up to a high capacity multiprocessor enterprise UNIX server.

### **Software**

Like the Patient Tracking System, the PRMS server has been developed entirely in Java using open source software components. The PMRS server provides a browser interface which allows for the server to be accessed by a number of diverse clients across a LAN, WAN or the Internet.

## **4. Future Developments**

### **Adapting PTS to Other Forms**

A current priority is to begin integrating alternate forms systems with the PTS, beginning with the WHO's Patient Record Card. This should assist PTS implementation in resource-poor locations in rural Zambia.

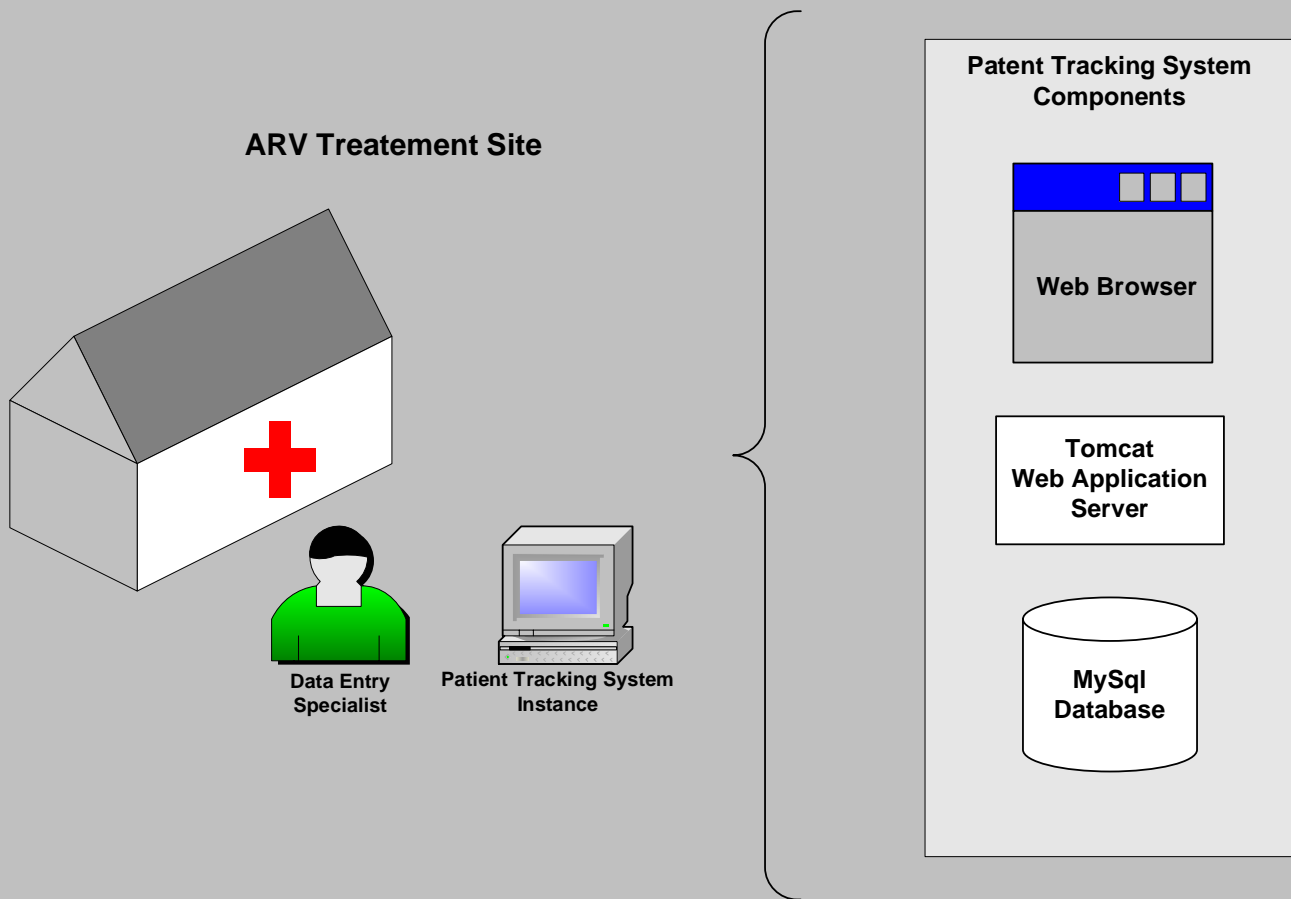
### **New Versions of PTS & PMRS**

Development of the CIRZDZ ART software is ongoing. Soon individual clinics will be able to generate their own PEPFAR monthly reports. Upcoming developments are outlined in the attached PTS and PMRS diagrams.

### **PTS & PMRS beyond Zambia**

With support, CIDRZ can offer assistance to programs interested in implementing the PTS and/or PRMS in locations outside Zambia. One of the development goals of the PTS system was to create a low cost system flexible enough to be implemented in a variety of environments.

# Patient Tracking System Architecture



## PTS Development Timeline

**COMPLETE**  
Patient Tracking System 1.0

Patient Tracking System 2.0

Patient Tracking System 3.0

### Basic Tracking & Reporting

- Basic patient data for all visits, e.g., CD4 count, WHO stage
- Late clinical and pharmacy patient lists
- Overview of site information

### Expanded Tracking & Analysis

November 2004

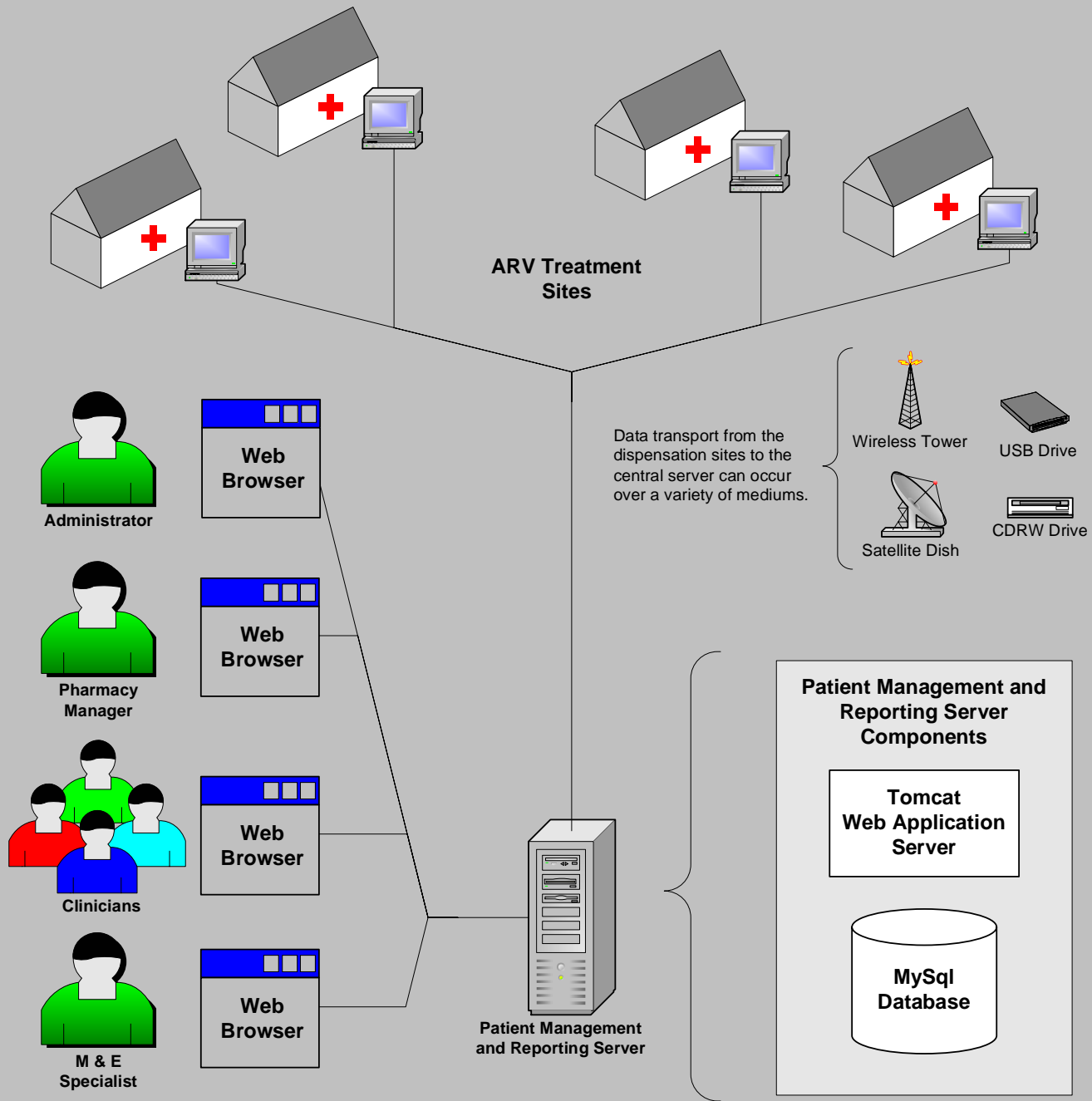
- More patient data, e.g., full lab results, pill counts, home visits
- Generate PEPFAR reports at clinic
- Historical trends
- Tracking patient transfers, defaults

### Clinical Care Checks

April 2005

- Smart clinical support features, e.g., flagging dangerous combinations of drugs and patient laboratory results or clinical errors (AZT + anemia), ARV eligibility checks, proper pediatric dosages
- Support for alternate forms systems

# Patient Management & Reporting Server Architecture



## PMRS Development Timeline

**COMPLETE**  
Patient Management & Reporting Server 1.0

Patient Management & Reporting Server 2.0

### Data Aggregation & Reporting

- Central data aggregation
- Drug regimen report
- PEPFAR reports

### Sophisticated Reporting & Management

February 2005

- Transfer patient data across clinics
- Allow complex analysis of site and program performance, trends and patient outcomes

# Patient Flow Chart Using CIDRZ Forms

