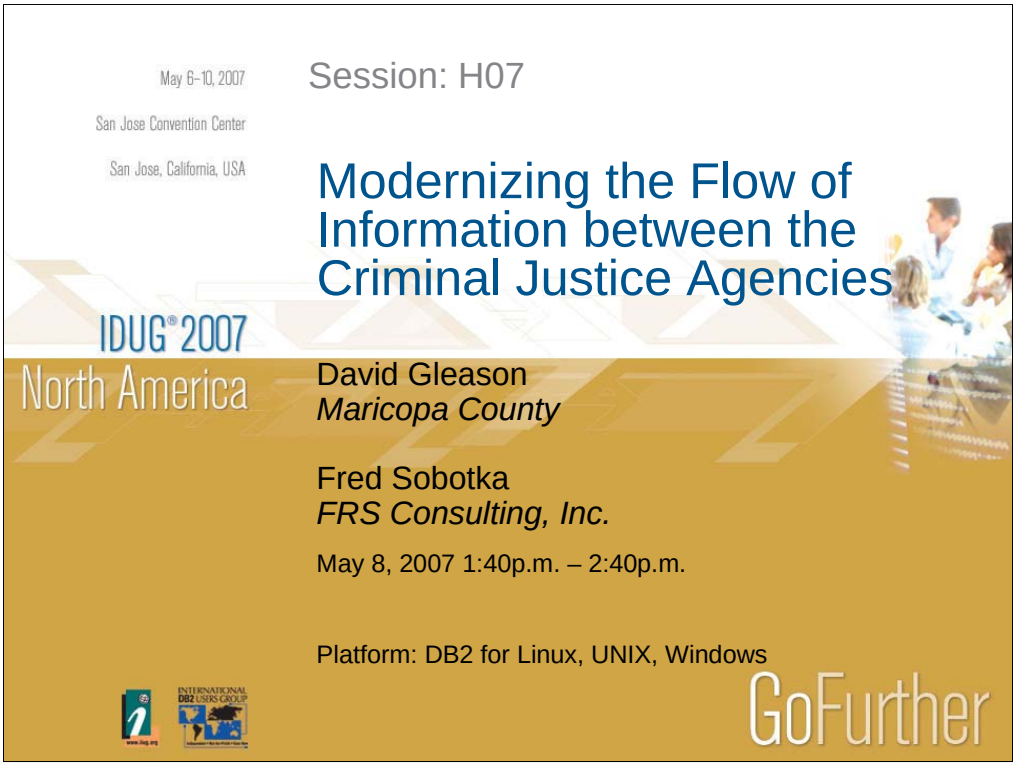


The Integrated Criminal Justice Information Systems (ICJIS) agency works with multiple Criminal Justice and Law Enforcement agencies within Maricopa County, Arizona, as well as agencies at the state and federal level to exchange many different types of information. We are constantly challenged to find new ways to efficiently manipulate and store these data exchanges. Many of those exchanges conform to various standards, such as the Department of Justice's Global Justice XML Data Model (GJXDM). Our newer Java applications use DB2 version 9 databases to process data exchanges with pureXML. Older Java applications use DB2 version 8 databases. We have also migrated a few databases from DB2 V7 and V8 to DB2 9. We will discuss strategies and conventions that ICJIS adopted as well as some lessons learned.

Outline

- Introduction to Maricopa County ICJIS
- Technical infrastructure
- Data exchanges
- Applications
- Lessons Learned

GoFurther

ICJIS – Integrated Criminal Justice Information Systems

Web sites

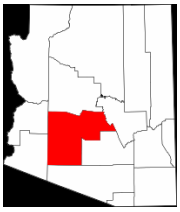
http://en.wikipedia.org/wiki/Arizona

http://www.az.gov

http://www.maricopa.gov

http://www.maricopa.gov/icjis/about.aspx

Maricopa County Facts



- Over three million residents
- 9,226 sq. mi. (larger than four states)
- 4th most populous county in the US
- 70% of Arizonans live in Maricopa County
- Includes Phoenix, the 5th largest city in the US
- County population in 2000 exceeded population of all of Arizona in 1990
- Criminal population is increasing as well

3

GoFurther

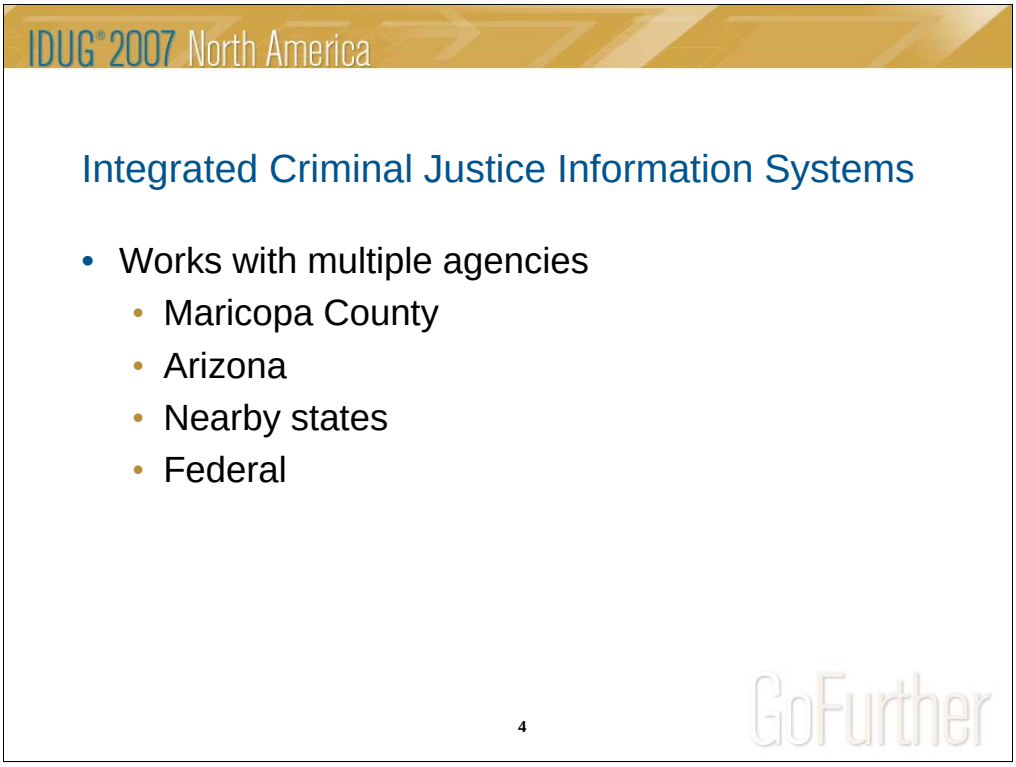
The Maricopa County Superior Court has consistently been recognized as one of the 10 largest court systems in the nation in the fourth most populous county in the nation. Updated estimates for 2005 place the county's population at over 3.6 million people.

http://www.enchantedlearning.com/usa/states/area.shtml

Geographic	Square miles
New Hampshire	9,351
Maricopa County	**9,226**
New Jersey	8,722
Connecticut	5,544
Delaware	1,954
Rhode Island	1,545

Maricopa County established: Feb 17, 1871; Arizona Statehood: Feb 14, 1912; Budget: $2.5 Billion (02-03)

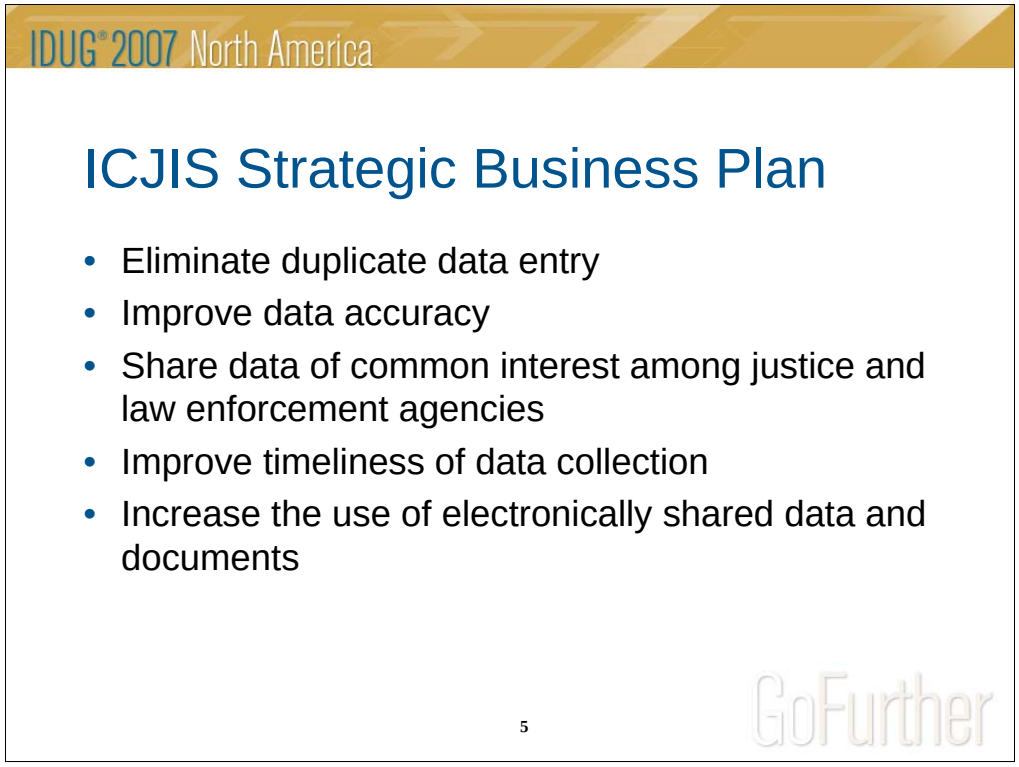
Cities within Maricopa County: Apache Junction, Avondale, Buckeye, Carefree, Cave Creek, Chandler, El Mirage, Fountain Hills, Gila Bend, Gilbert, Glendale, Goodyear, Guadalupe, Litchfield Park, Mesa, Paradise Valley, Peoria, Phoenix, Queen Creek, Scottsdale, Sun City, Sun City West, Surprise, Tempe, Tolleson, Wickenburg, Youngtown



As published in the ICJIS Strategic Plan, the core reason for ICJIS is spelled out in **Proposition 400 (1998)**. It states that **"Monies derived from the tax levied pursuant to this Resolution shall be used solely to ... Fund the following for the purpose of reducing the expense of adult and juvenile jail facilities ... Implementing an integrated criminal justice information system."**

ICJIS acts as a mediator between multiple Criminal Justice and Law Enforcement agencies within Maricopa County. ICJIS also shares electronic data with the Arizona Deportment of Public Safety (DPS).

Data flows from one agency through various ICJIS-provided middleware applications before being routed to another agency.



ICJIS Fundamentals –Origins and Purpose

The Governing Body of ICJIS adopted the **ICJIS Strategic Business Plan** with a list of opportunities for improvement, including the following:

Opportunities to Improve Processes:

The ICJIS project will identify opportunities to improve processes to enhance case flow within the justice system. Examples include:

Eliminate duplicate data entry at various stages of operations

Improve data accuracy

Share data of common interest among justice and law enforcement agencies

Improve timeliness of data collection

Reduce reliance on paper-based processes

Increase the use of electronically shared data and documents

Implement the use of a common case identifier for incidents

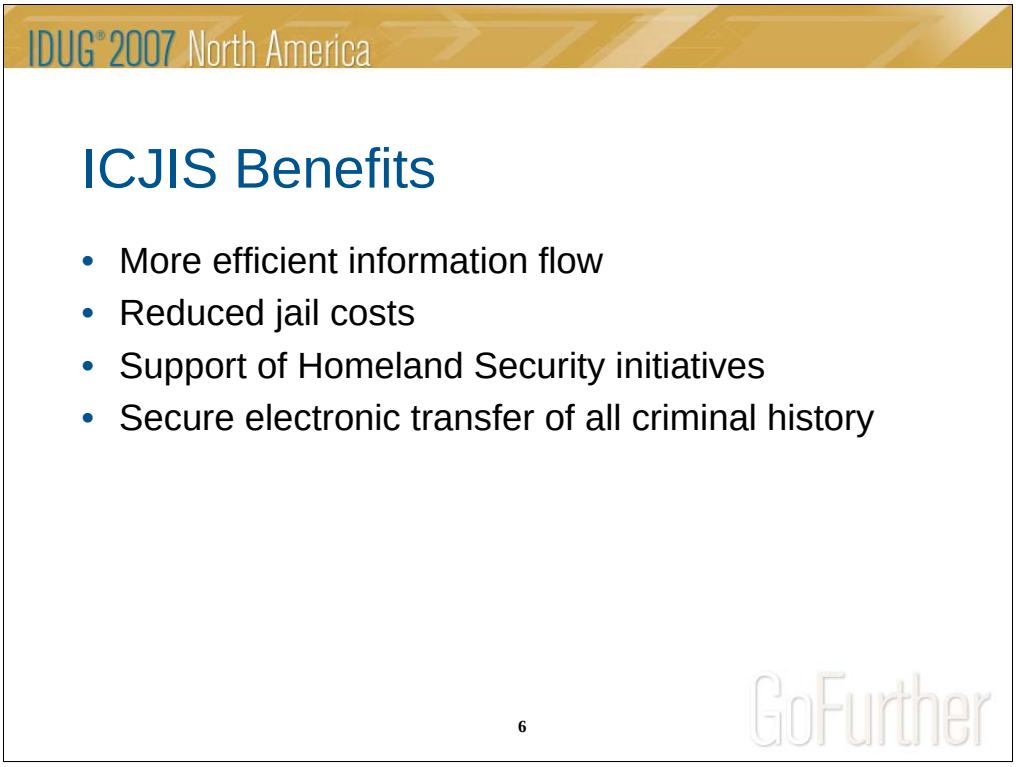
Streamline the ability to determine current subject status in the system without separately querying each of the existing department databases

Develop a common data dictionary to improve the consistency and reliability of data between systems

Eliminate inconsistencies between paper files and computer databases within and between agencies

Develop an enterprise view of the justice system to provide management information to assist in planning, assessing and improving the effectiveness of justice programs

Provide an appropriate level of network security and confidentiality for J&LE Community information electronically transported between agencies internal and external to the County



The Strategic Business Plan lists the benefits of ICJIS as follows:

Benefits: Maricopa County will realize the following benefits by the end of Phase I, currently estimated to conclude on June 30, 2007:

More efficient information flow with the ability to exchange data between all justice agencies within Maricopa County. Critically identified data exchanges will reduce **duplicate data entry** and contribute to a **more accurate and efficient justice system**.

Reduced jail costs through **enhanced business and operational processes** throughout the entire justice system.

Support of Homeland Security through the improved electronic communication with the Department of Public Safety (DPS), local law enforcement, and federal agencies.

Improved ability for authorized justice agencies to **identify the status of a subject** in the County justice system.

Enhanced program planning and evaluation through the development of improved management and statistical reports.

Secure electronic transfer of all criminal history record information in compliance with Federal and State standards.

Maricopa County Jail System

- The county's jail population is increasing
- Processing tasks were lengthening average stay
- Longer stays meant higher housing costs
- Needed better ways to manage information related to booking, scheduling, arraignment
- Book the prisoner into the system as quickly as possible

GoFurther

http://www.mcso.org

Maricopa County tax payers approved up to $1,000,000,000.00 (spread across several years) to fund continued improvements for the county jail systems. ICJIS and other agencies are using monies generated by the 1/5th cent sales tax increase to fund modernization projects.

Technical Infrastructure

GoFurther

Maricopa County Justice IT Infrastructure

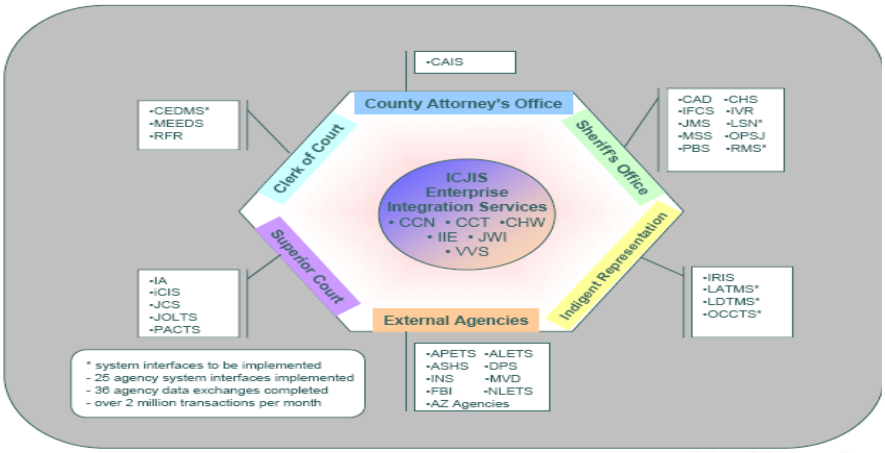
Host/Server Hardware Platforms	Operating Systems	Application Development Languages	Application Architectures	Database	Presentation Layer
Bull Mainframe	GCOS8	COBOL	Terminal to Host	RMS/ISAM	Terminal emulation
Compaq/DEC/VAX	VMS	Datatrieve	Microsoft DNA	IDS-II	Terminal
Compaq/DEC/Alpha	OpenVMS	PacBase	Client/server	Informix	Client/Server
Sun	Sun Solaris	Powerbuilder		Sybase	Browser
HP-Compaq	HP-UX	Delphi		SQL Server	
RS/6000	AIX	Visual Basic		DB2	
AS/400	OS/400	ASP		Access	
HP-Compaq Intel based	Win NT	VMS Basic		Paradox	
	NetWare	C			
		Informix Fourgen			

9

GoFurther

When ICJIS was started in 2000, the Maricopa County Criminal Justice and Law Enforcement agencies used many diverse systems.

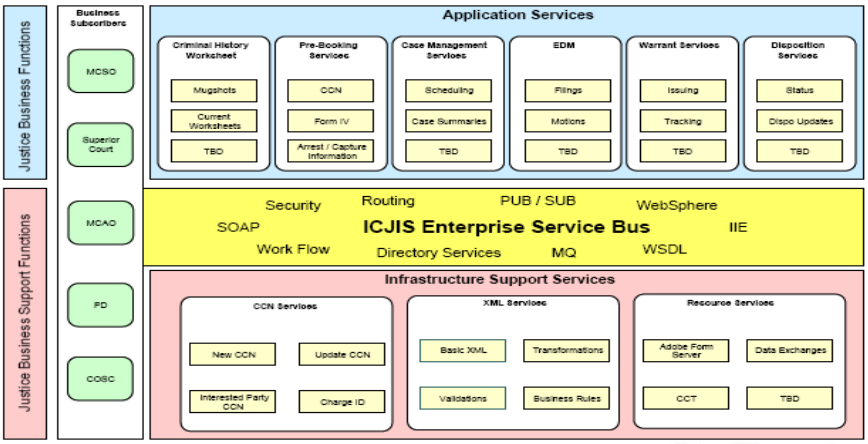
ICJIS Environment -- 2005



GoFurther

The evolution has begun. The Integration Engine is in the middle, processing requests from our partner agencies.

ICJIS SOA Roadmap



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GoFurther

This is where we would like to go. We are still making progress.

Infrastructure

- Integration Engine
- DB2 and Informix
- WebSphere
  - Application Server
  - MQ, Message Broker
- Tivoli
  - Omegamon
- DataPower XML Appliance
- IDS/II – Bull mainframe
- Microsoft SQL Server

GoFurther

The Integration Engine has been used by ICJIS and its partner agencies since 2001.

Integration Engine

- Growth rate in data transmissions over last 6 years
  - Increased from 500,000 to 26 million per month
- Data Exchanges
  - FTP
  - Socket
  - ODBC
  - MQ

GoFurther

Increased utilization

ROI

Stakeholders

Audit

Not a true “repository”

More of a conduit (pass through)

ICJIS has developed a number of applications that facilitate the exchange of data/information between the justice agencies of Maricopa County.

Asynchronous Messaging

- Naming conventions
  - Queue managers
  - Local, alias, remote queues
- Some messages can flow across network zones

  Zone 1 : Most secure (database servers)

  Zone 2 : Majority of production servers

  Zone 3 : Development servers
- MQ health monitoring with Tivoli/OMEGAMON

GoFurther

ICJIS adopted WebSphere MQ in 2003

Criminal Justice and Law Enforcement Agencies

- Maricopa County Attorney's Office (MCAO)
- Maricopa County Sheriff's Office (MCSO)
- Superior Court, Justice Court, Juvenile Court
- Adult Probation
- Public Defender

GoFurther

These agencies are our primary customers.

Other Agencies

- Arizona Department of Public Safety (DPS)
- Local police departments
- Homeland Security
- Nlets
- Border Patrol
- FBI

GoFurther

Nlets → The International Justice & Public Safety Information Sharing Network
http://nlets.org

DPS http://www.dps.state.az.us/

DHS: http://www.fbi.gov/

FBI: http://www.fbi.gov/

Border Patrol: http://www.cbp.gov/

Data Exchanges

GoFurther

Data Exchanges Pre-ICJIS

- Manual data entry
- Hardcopy reports
- Physical file folders exchanged and copied
- Phone calls
- FAX

GoFurther

Schedule Court Event

Assign Attorney

File A Case

Common Case Number

Release Subject

MEEDS

IA Court

eFiling

In the past, the same data was entered multiple times. Each re-entry increased the likelihood of errors.

Improved ICJIS Data Exchanges

- Flat files moved by FTP
- Middleware introduced – Hub and Spoke model
- Routing data based on TRXID
- ODBC/JDBC connections

GoFurther

TRXID -> Transaction ID

Integration Engine (Quovodx)

HL-7 protocol

Applications

GoFurther

Pre-Booking Application

- Web-based application replaced lengthy manual process of booking subject into county jail
- Local Police dept. can send data electronically
- Electronic exchange between applications
  - Transactions
  - XML

GoFurther

Average time to book decreased from 2 hours to under 10 minutes. Arresting officers can get back out on the streets to patrol and protect Maricopa County citizens. The Pre-Booking application is a data source for the Integration Engine.

Release Subject Application

- MQ/Message Broker
- XML appliance
- Adobe LiveCycle server

GoFurther

We use the Message Broker application to implement a work flow between two of our partner agencies. An XML document arrives in a specific queue and the application sends it to the DataPower XML appliance to perform an XSL transformation. The transformed document is sent via a web service to the Adobe Live Cycle server to render a PDF document. The resulting PDF document is sent via email to a distribution list.

JWI (Justice Web Interface)

- Portal to criminal information networks
  - NLETS
  - FBI
  - AZ DPS
- Mobile devices
- MQ
- DB2
- WebSphere Application Server

GoFurther

The JWI application replaces access to a large number of legacy application that were used to enter and/or retrieve data from state and national criminal information networks. JWI is a WebSphere application that uses DB2 to store information for each authorized use. Various MQ triggered applications are used to facilitate the exchange of data between NLETS, FBI, and AZ DPS.

Sheriff's deputies have access to the JWI portal via wireless VPN from their patrol cars.

CHW (Criminal History Worksheet)

- Java application
- MQ
- DB2
- XML Appliance
- Adobe LiveCycle

GoFurther

Various agencies have need to produce a report detailing a person's criminal activities. They use the JWI portal to request historical information about a subject. Once the data has been retrieved, it is organized into a composite summary of the subject's arrests and convictions. The user can also request that the data be formatted into a PDF document.

A companion application, CHW (Criminal History Worksheet), formats the data from legacy systems or from XML input files into a specialized XML document that is rendered into an editable PDF document by the Adobe Live Cycle application.

Preparation by hand can take as long as 3 or 4 hours. The CHW application has been significantly reduced the preparation time to be under 15 minutes.

Developer's Toolbox

- Commercial
  - WSAD/RAD
  - XMLSpy and Oxygen
  - StyleVision
  - DreamWeaver
- Open Source
  - Eclipse
  - Ant
  - CVS

GoFurther

The ICJIS team uses many different tools in the day-to-day work. Commercial products and Open source products are used.

DB2 Monitoring Toolset

- Health monitoring vs. performance monitoring
- RRDTool can graph any time-series numeric data
- Nagios (formerly NetSaint)
  - Custom plugins for DB2
  - Snapshot publishing to central server
  - Mostly passive monitoring (pushing, not polling)
- Tivoli/Candle/OMEGAMON
  - Existing DB2 agent provides many indicators

GoFurther

ICJIS uses several tools to help us monitor the ever increasing flow of data through our applications and networks.

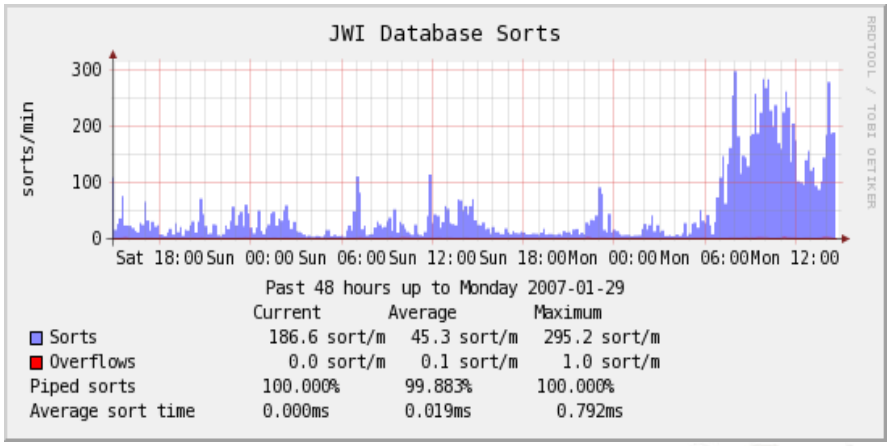
RRDTool is the industry standard data logging and graphing application. Use it to write your custom monitoring shell scripts or create whole applications using its Perl, Python or PHP bindings. RRD is the acronym for Round Robin Database. It is a system to store and display time-series data (i.e. network bandwidth, machine-room temperature, server load average).

http://rrdtool.org

Nagios is an open source host, service and network monitoring program. We use it to monitor the health of several systems and critical applications. It can send email messages or SMS pages to alert support personnel of problems. It also maintains a web site that can be monitored to see graphically the state of our entire complex.

http://www.nagios.org/

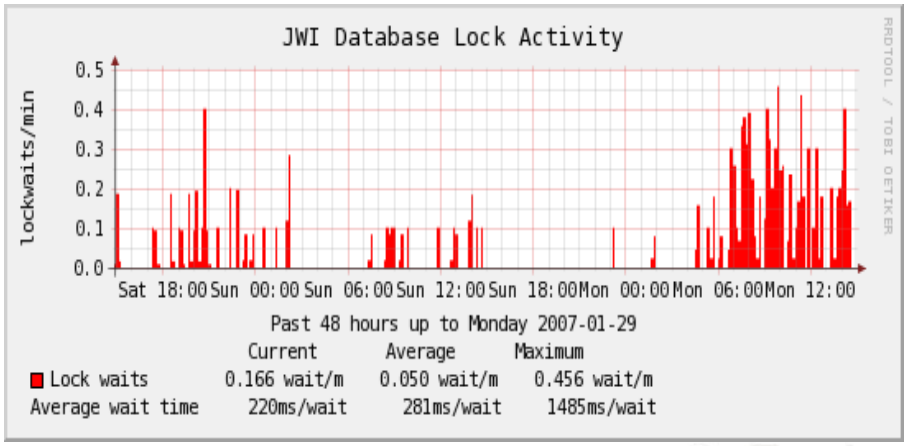
DB2 Monitoring -- Database Sorts



GoFurther

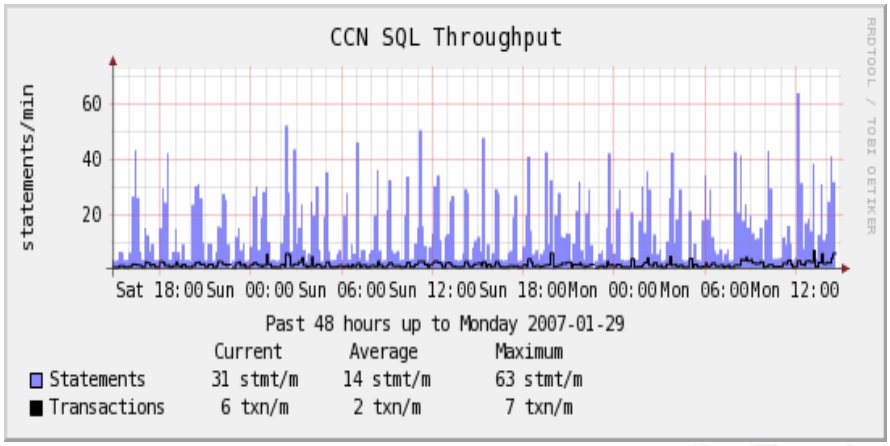
A graph showing database sorts for a 48-hour period for one of our production databases.

DB2 Monitoring -- Database Lock Activity



A graph showing database lock activity for a 48-hour period for one of our production databases

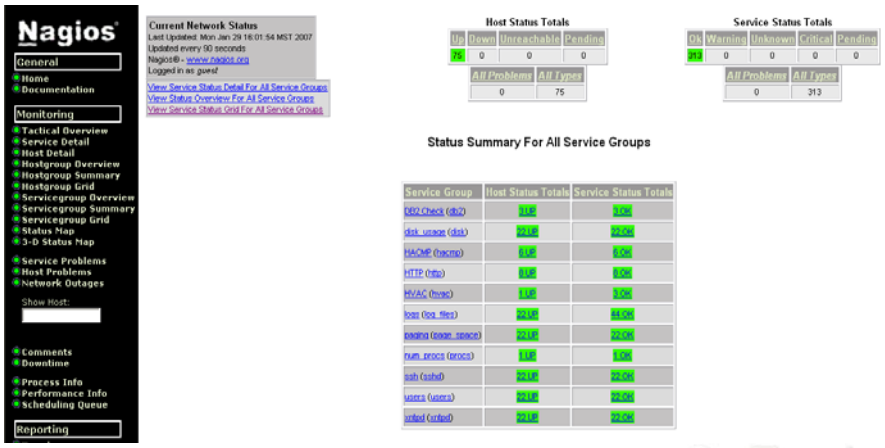
DB2 Monitoring -- SQL Throughput



GoFurther

A graph showing database SQL Throughput for a 48-hour period for one of our production databases

Nagios – Status Summary



30

GoFurther

Service Groups

DB2

Disk usage

HACMP

HTTP

HVAC

Log files

Paging space

Num procs

Ssh

Users

Xntpd

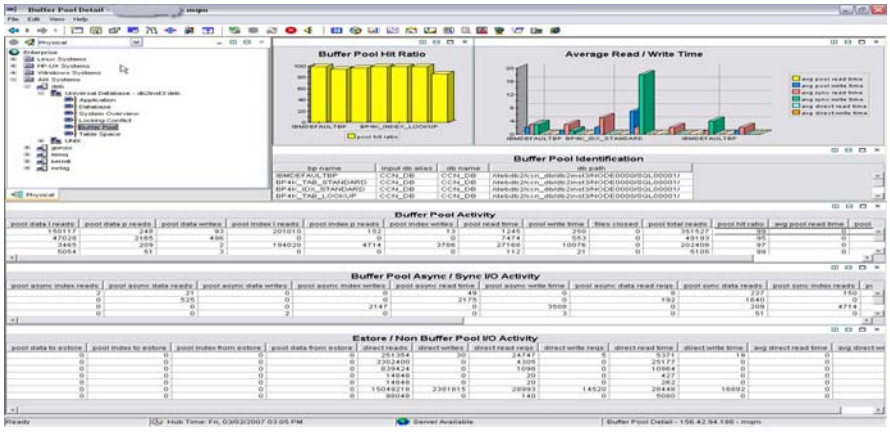
22 different systems

3 different databases

6 Highly available systems

8 web servers

OMEGAMON – Buffer Pool Info



GoFurther

Sample display showing buffer pool usage for one of our production databases. OMEGAMON's main feature is its ability to alert our staff whenever there are problems. Through a GUI we can define thresholds for any combination of basic attributes provided by DB2 through its performance monitor interface. Whenever a threshold is breached, OMEGAMON is programmed to run a custom script. We currently use these scripts to send email and SMS notification to ITSM personnel.

DB2 Naming Standards

- Separate BPs and tablespaces for data and index
  - Table
    - CREATE TABLESPACE S09 PAGESIZE 4096 MANAGED BY AUTOMATIC STORAGE EXTENTSIZE 32 PREFETCHSIZE AUTOMATIC BUFFERPOOL BP4K_DATA1
  - Index
    - CREATE TABLESPACE S09X PAGESIZE 4096 MANAGED BY AUTOMATIC STORAGE EXTENTSIZE 32 PREFETCHSIZE AUTOMATIC BUFFERPOOL BP4K_INDEX1
- Use automatic storage for all new databases
- DMS spaces in older DBs use AUTORESIZE

GoFurther

We are not completely there yet …

Newer databases generally conform to our standard. As time and maintenance permits, older databases are migrated into our standard naming conventions.

Opportunities to Exploit pureXML

- Provides valuable flexibility
- Able to support multiple schemas
  - Both large and small
- XML standards and schemas
  - GJXDM -- Global Justice XML Data Model
  - NEIM -- National Information Exchange Model
  - W3C standards
  - Home-grown

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GoFurther

http://niem.org

ICJIS has been working with the GJXDM schema for XML documents for a few years. The Department of Justice (DOJ) mandates that all data exchanges between Criminal Justice organizations will conform to either the current GJXDM (version 3.0.2) or the evolving NIEM (version 1.0) schemas.

Key Uses for DB2 pureXML

- XML document containing multiple Address fields
  - Residence
  - Employment
  - Crime location
  - Arrest location
- XPATH query extract data
- Use web service to validate/geocode address

GoFurther

We have several data exchanges that are now using an XML sub-schema based on the GJXDM XML schema. These XML documents contain information that future applications can extract via XPATH queries.

Sample XQUERY

- xquery
  for $a1 in db2-fn:xmlcolumn
  ('BOOKING.FORM')/PrebookIcisExchange/Booking/Arrest
  let $date := $a1/ActivityDate/text()
  let $time := $a1/ActivityTime/text()
  let $locArrest :=
  $a1/ArrestLocation/LocationDescriptionText/text()

- for $l3 in db2-fn:xmlcolumn
  ('BOOKING.FORM')/PrebookIcisExchange/Offense/Incident
  Location
  let $locOffense := $l3/LocationDescriptionText/text()

35

GoFurther

The FORM IV document is generated each time a subject is booked into the Maricopa County jail system. The document contains data relevant to the criminal event and the subsequent arrest.

This XQUERY illustrates how easily the following items can be extracted from a FORM IV document.

- Date and time of arrest
- Offense location
- Arrest location

Sample XQUERY Continued

- return

```
<info>
    <when>     { $date } at { $time } </when>
    <Offense> { $locOffense }  </Offense>
    <Arrest>    { $locArrest }      </Arrest>
</info>
```


GoFurther

This portion of the XQUERY formats the results into a simple XML document.

Sample XQUERY Output

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<info>
    <when>
        2006-05-02 at 08:08:13.000
    </when>
    <Offense>
        8800 N xx DR
    </Offense>
    <Arrest>
        8601 N yy AV PHX AZ 85000
    </Arrest>
</info>
```

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GoFurther

This is the output produced when the XQUERY is executed using a command similar to the following:

```
db2 -td@ -d -i -x -v -f locations.sql
```

The addresses returned should be sanitized/validated prior to use. The arrest location and the criminal offense location can be plotted onto a map using applications like Google Earth or Microsoft's Virtual Earth.

Migrating Databases and Applications

- DB2 version 7
- DB2 version 8
- DB2 version 9 – best practices
- Java 1.3
- Java 1.4
- Java 1.5

GoFurther

We have some experience migrating our simple databases from version 7 to version 8.

We have just started the migration of some WebSphere-based servlets and their DB2 version 8 database to DB2 version 9. These servlets are currently storing a large XML document as a BLOB. We expect to see some very positive improvements in the application.

- Warrants
- CHW
- FAC

Upgrading Java Application

- Application tasks
  - Validated XML document
  - Parsed XML data to extract
  - Queried existing DB2 database

GoFurther

We are also starting migration of another application. This application currently parses an XML document to find selected data elements that are then used to access a DB2 database (version 8). We will be changing the application to store the XML document into an XML column in a DB2-version 9 database. We will use XPATH queries to extract the data elements mentioned above. We expect to see significant reduction in the size of the code needed to process the data as well as increasing the applications reliability and performance.

After Migration to DB2 9

- Store original input document into XML column
  - XPATH queries select relevant data elements
  - Use these elements to query DB2 database
- Application size reduced
  - Fewer jar files needed
- Logic to retrieve data elements simplified
- Enhancements to application are easier
- Original XML document available for other ad-hoc queries

GoFurther

XML document validation will be removed from application. The DB2 pureXML engine will do that work. The application will also no longer need to parse the XML. The application will be simplified.

DB2 was selected as part of the “convergent architecture”.

Lessons Learned

GoFurther

Business Lessons Learned

- Budget adequately for training
- Use subject matter experts whenever possible
- Hire good consulting companies
  - Insist on knowledge transfer
  - Insist on code ownership
- Replace staff/consultants as necessary
- Beware of office politics

GoFurther

The ICJIS agency was created with several key business analysts from all of the partner agencies that used ICJIS' services. These analysts helped define the role and direction we took for several of the early data exchanges. Most of the programming staff has been with the ICJIS since it started. Several good consulting companies were selected to help in areas were the ICJIS staff was weak. Knowledge transfer and formal training helped bring the ICJIS staff up to speed on many new technologies.

We also learned that sometimes an organization has to "cut its losses". Some staff and consultants were replaced.

Project Lessons Learned

- Get good requirements
- Don’t over analyze project
- Don’t take 6-months to design project prior to coding
  - Developers forget why

GoFurther

Requirements will make or break a project. Taking too long to came to agreement on what needs to be done will cause many problems.

Development Lessons Learned

- Use the right tools
  - software
    - commercial
    - open source
  - hardware
- Comply to Standards
  - Industry
  - Government
  - Local

GoFurther

The right tools combined with adequate hardware and software make implementing new projects easier.

Adhere to industry standards.

Questions

GoFurther

Session: H07

Modernizing the Flow of Information between the Criminal Justice Agencies

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GoFurther