Healthcare process management in Python: a use case

CRS4@Polaris Park, Sardinia

Agenda

- what field do we work in?
- what's the project?
- why (and how) Python?
- did it work?
- whither?

what field do we work in?

Healthcare Flows

distributed

medicine

semantic and computational management of biomedical and heterogeneous data

clinical systems integration and traceability in health processes

To Err is Human
Building a Safer Health System

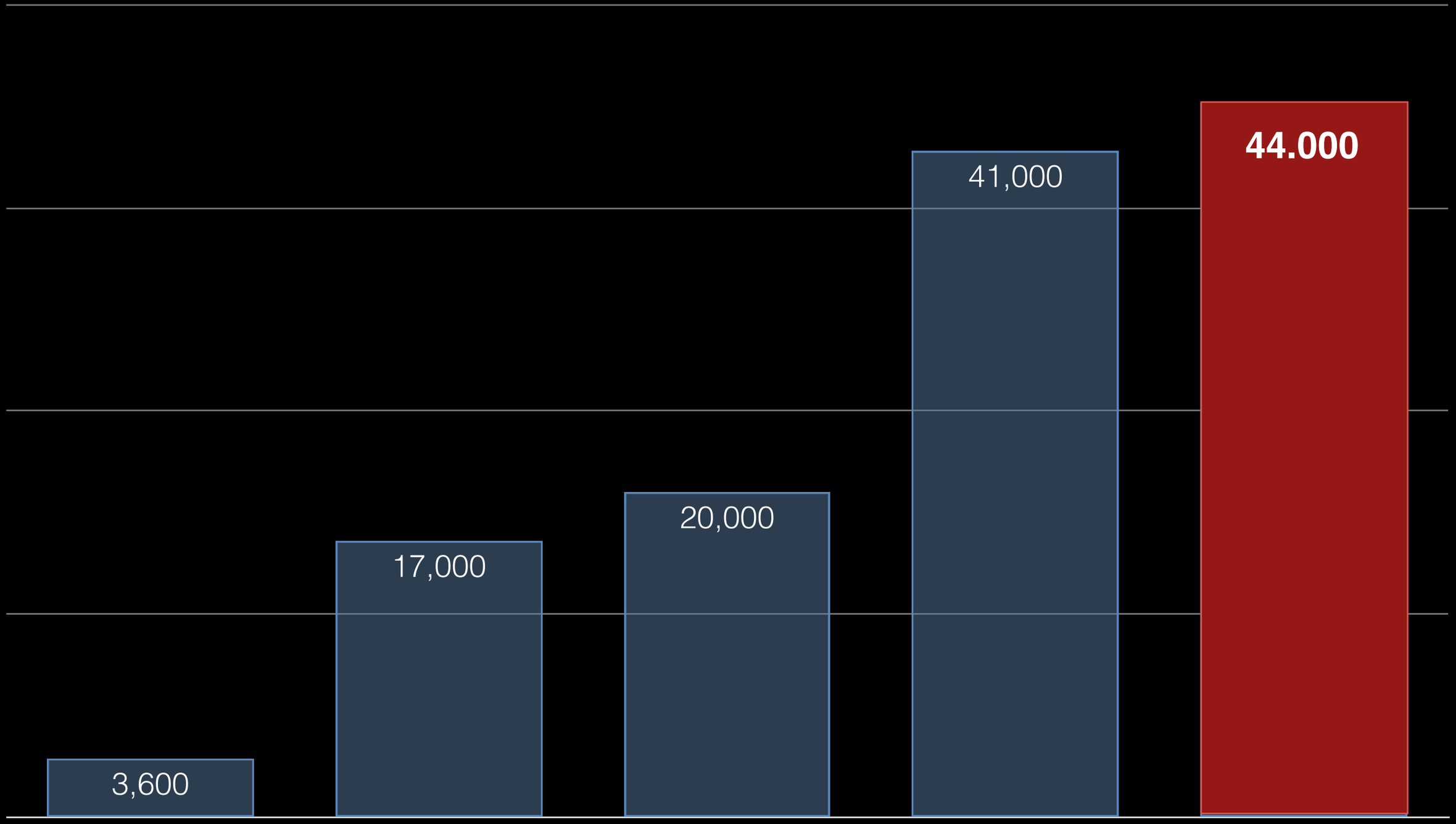
(Institute of Medicine, 2000)

44 to 98 thousands

people die each year in US as a result of preventable medical errors

Institute Of Medicine, *To Err Is Human: Building a Safer Health System*, 2000

Death causes in the U.S.



Institute Of Medicine, ***To Err Is Human: Building a Safer Health System***, 2000

Kenneth D. Kochanek, M.A.; Jiaquan Xu, M.D.; Sherry L. Murphy, B.S.; Arialdi M. Miniño, MPH, and Hsiang-Ching Kung, Ph.D , ***Deaths: Preliminary Data for 2009*** , Division of Vital Statistics, 2011

hospitals with automated clinical information systems had

15% less mortality

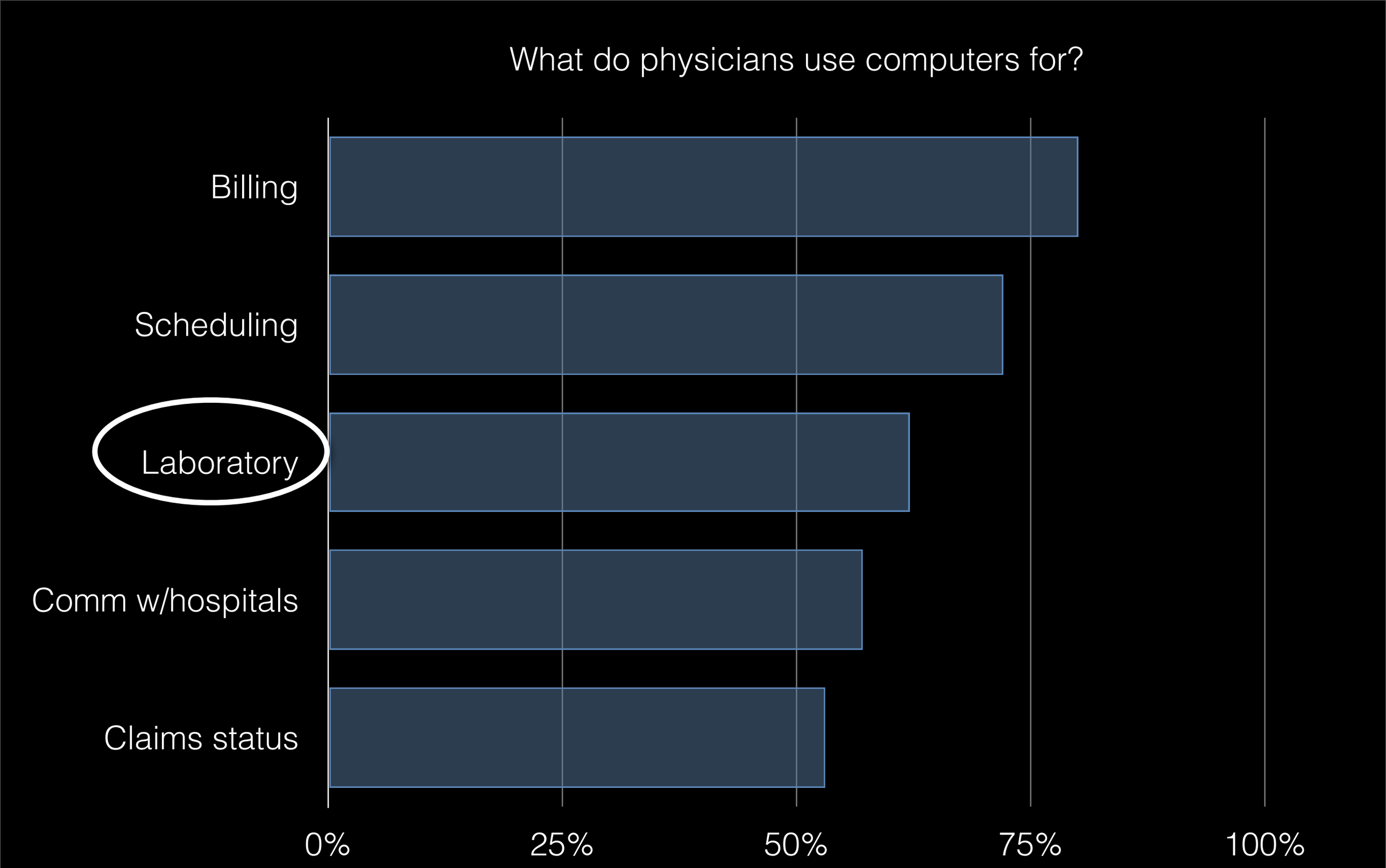
16% less post-operative complications

R. Amarsingham, M.D et al. *Clinical Information Technologies and Inpatient Outcomes - A multiple hospital study;* Archives

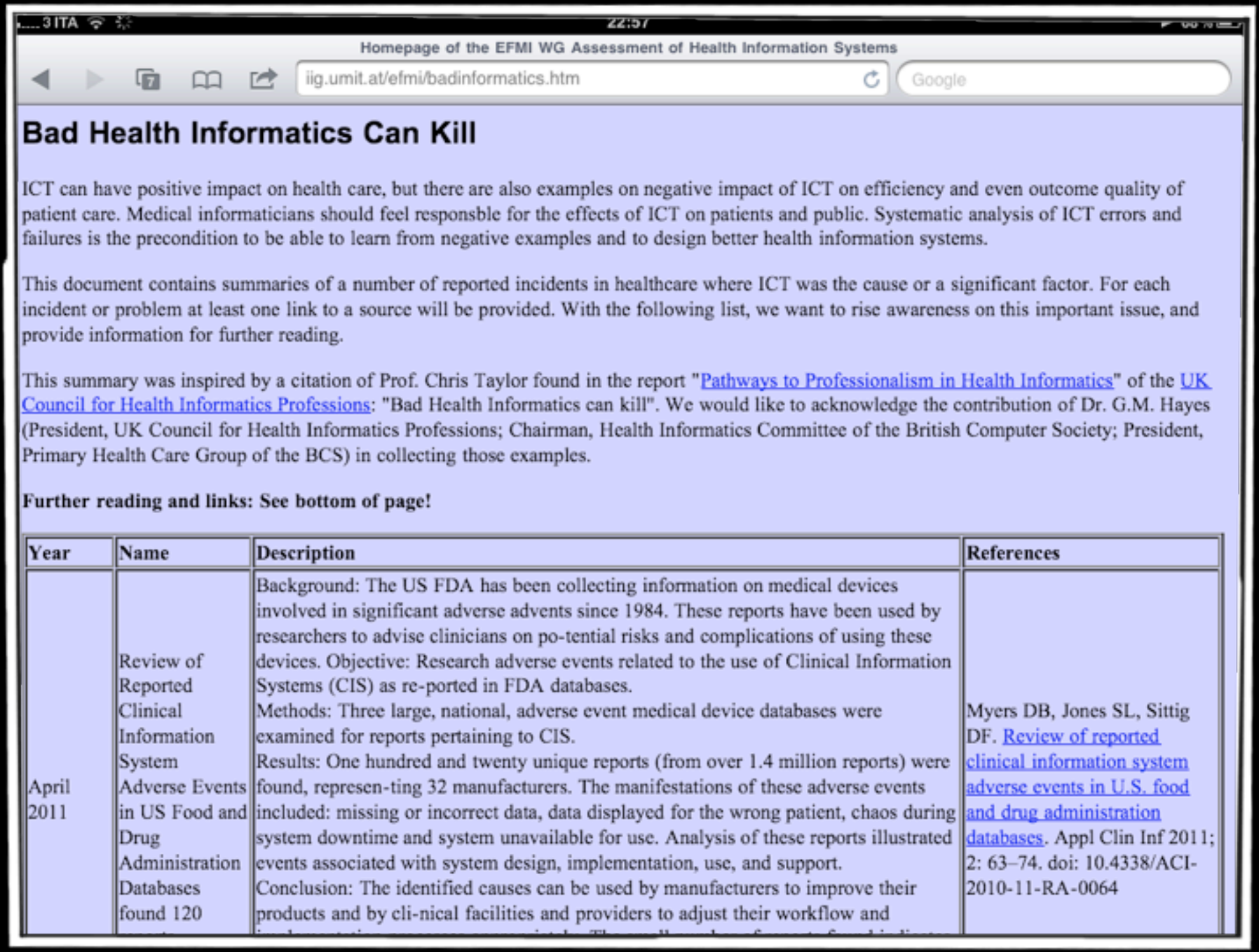
healthcare ICT yearly budget
in Italy is about

1 billion €

Osservatorio ICT in Sanità, *ICT in Sanità: l'innovazione in cerca d'autore*, 2011



Modern Physician / PricewosterhouseCoopers survey of executive options on key information systems issues; Modern



Bad Health Informatics can kill

HL7

- global authority
- interoperability
- HL7 v2 / v3
- documents, and more

IHE

Abbott

AGFA

CRS4

Stanford

IBM

Harvard

Inpeco TIH

Carl Zeiss

US Social Security adm

Siemens

...and 438 more

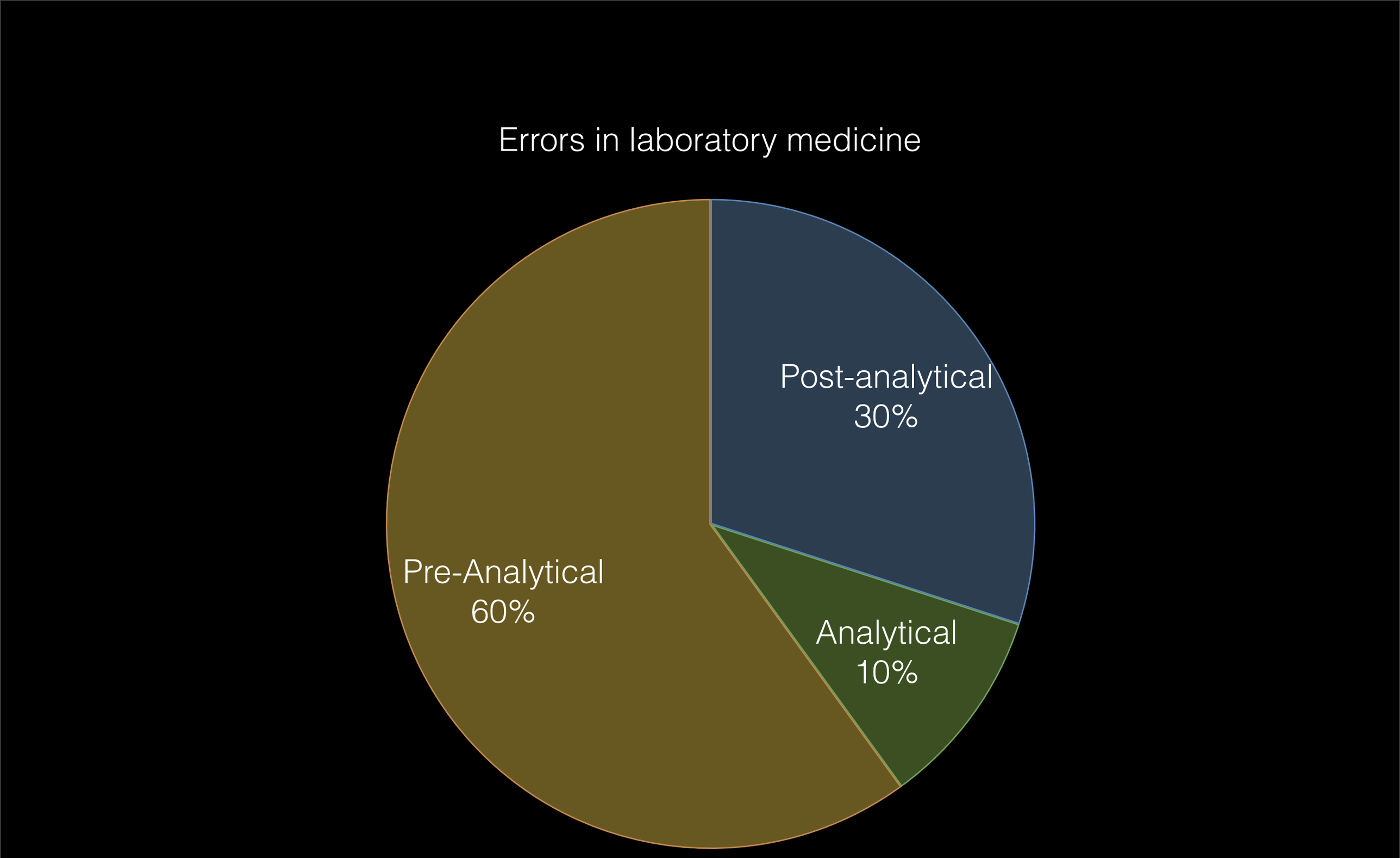
what's the project?

laboratory services leverage

60% - 70%

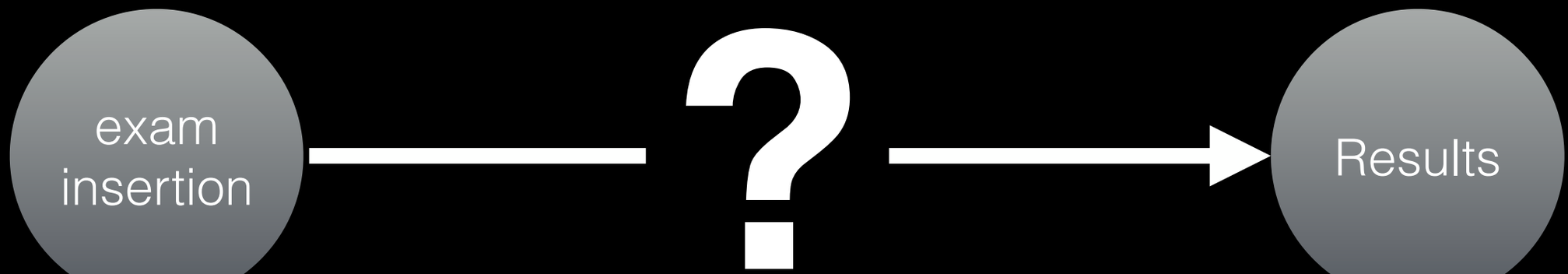
of critical decision making

ToybertME, Chevret S, Cassinat B, Schlageter, Forsman; *Why is the laboratory an afterthought for managed care*

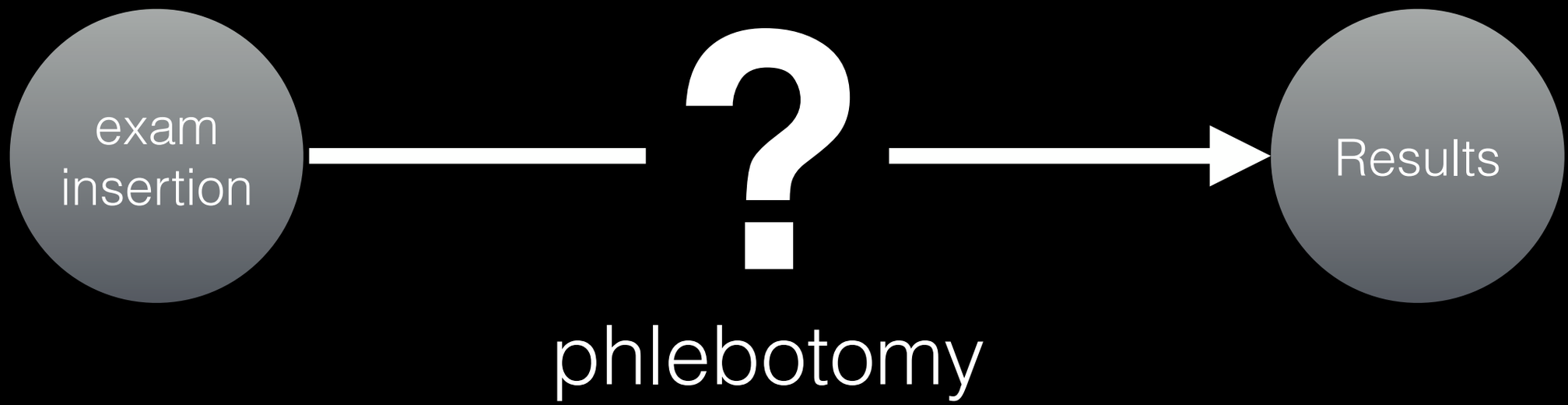


J. Kalra*, Medical errors: impact on clinical laboratories and other critical areas;* Clinical Biochemistry 37 (2004) 1052-1062

Laboratory test



Laboratory test



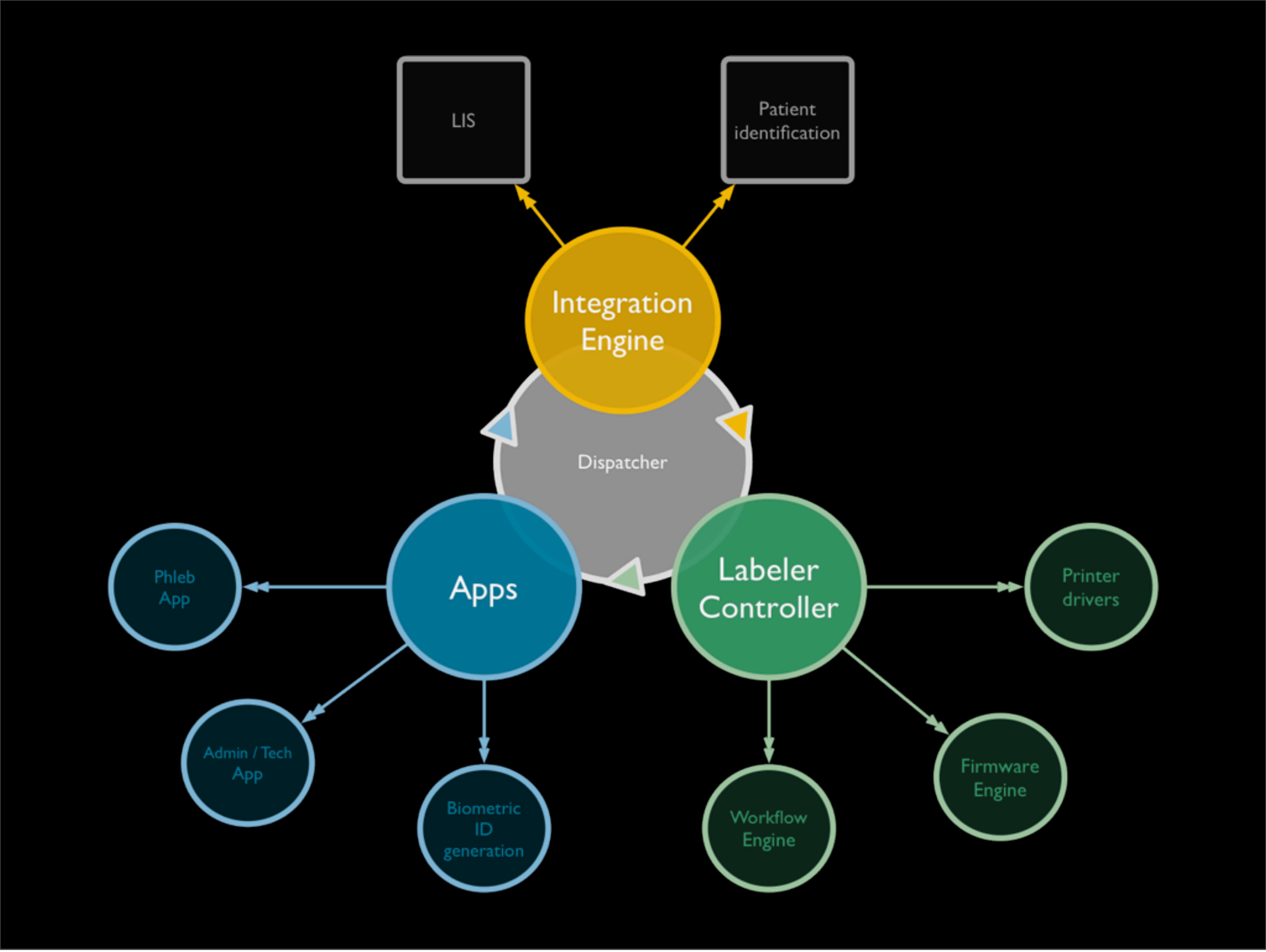
What can go wrong

- typing errors
- patient misidentification (and swapping)
- wrong test order entry
- wrong tube type / number
- problems in associating samples with patients
- ...

tubes and labels

Our scenarios

- new patient and exam insertion
- query mode in phlebotomy room
- query mode in ward room
- request mode at GP's office


LIS
Patient identification
Integration Engine
Dispatcher
Phleb App
Apps
Admin / Tech App
Biometric ID generation
Labeler Controller
Printer drivers
Workflow Engine
Firmware Engine

why (and how) Python?

why?

1. readability

not everyone involved is a developer;
code audits should be easy to do

2. agility

lots of ever-changing standards, laws and requirements

3. portability

must support different operating systems and environments

4. completeness

lots of different ICT needs in a project of this scope

5. ease of deployment

as self-consistent as possible;
as few external packages as possible

Our requirements

- 1. readability
- 2. agility
- 3. portability
- 4. completeness
- 5. ease of deployment

Python's best features

- 1. readability
- 2. agility
- 3. portability
- 4. completeness
- 5. ease of deployment

how?

"it's not Java"

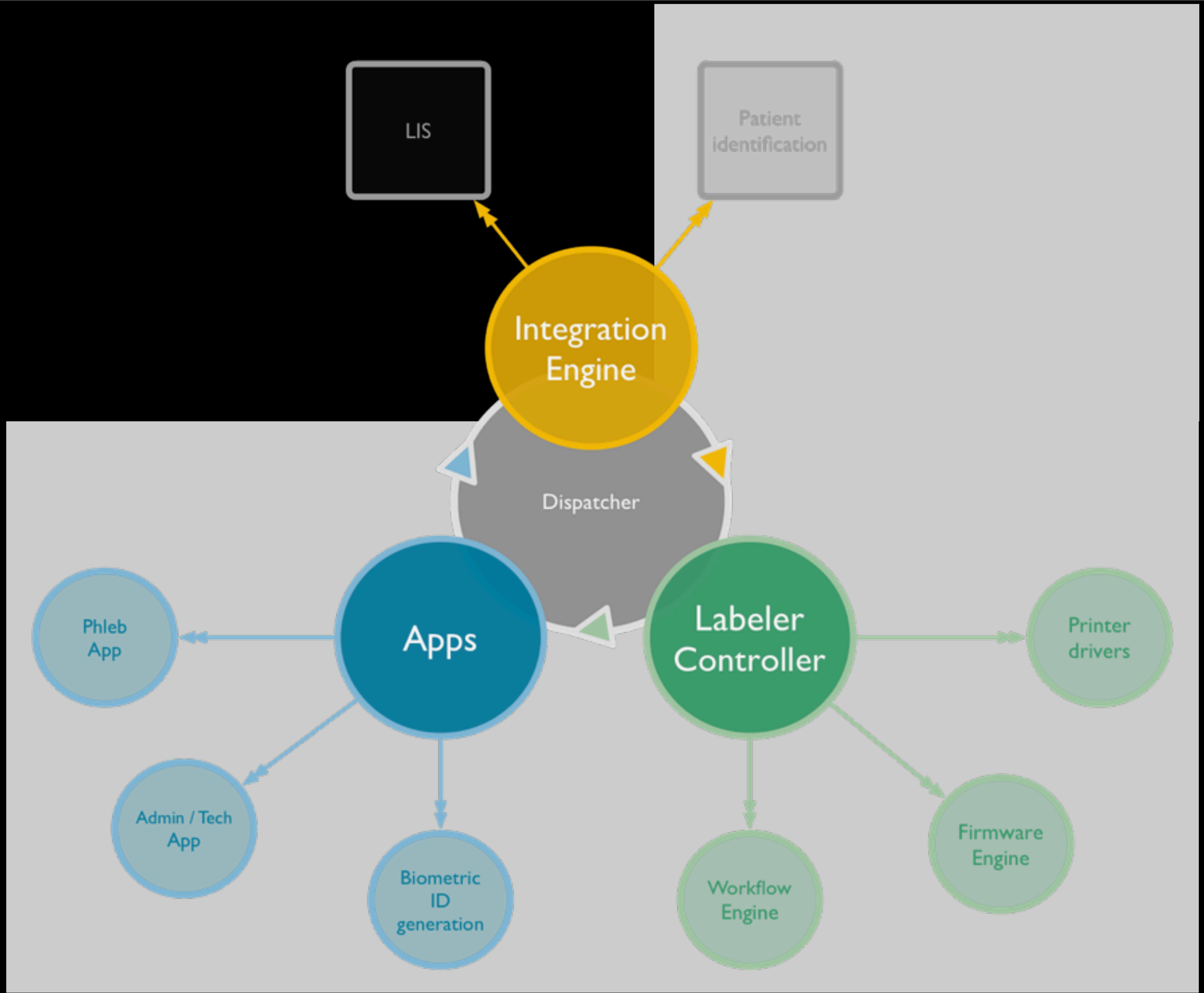
First Law of Python advocacy

shut up and show them the prototype

Zeroth Law of Python advocacy

you are probably already using Python

did it work?


LIS
Patient identification
Integration Engine
Dispatcher
Phleb App
Apps
Admin / Tech App
Biometric ID generation
Labeler Controller
Workflow Engine
Printer drivers
Firmware Engine

1.hardware drivers

Managing hardware with Python

- PySerial, python-usb, ctypes...
- use struct!
  - see lightning talk @ 18:30 :-)
- hardware CLI
- fast scripting for hardware testing
- build second/third level APIs

2. asynchronous messages and networking

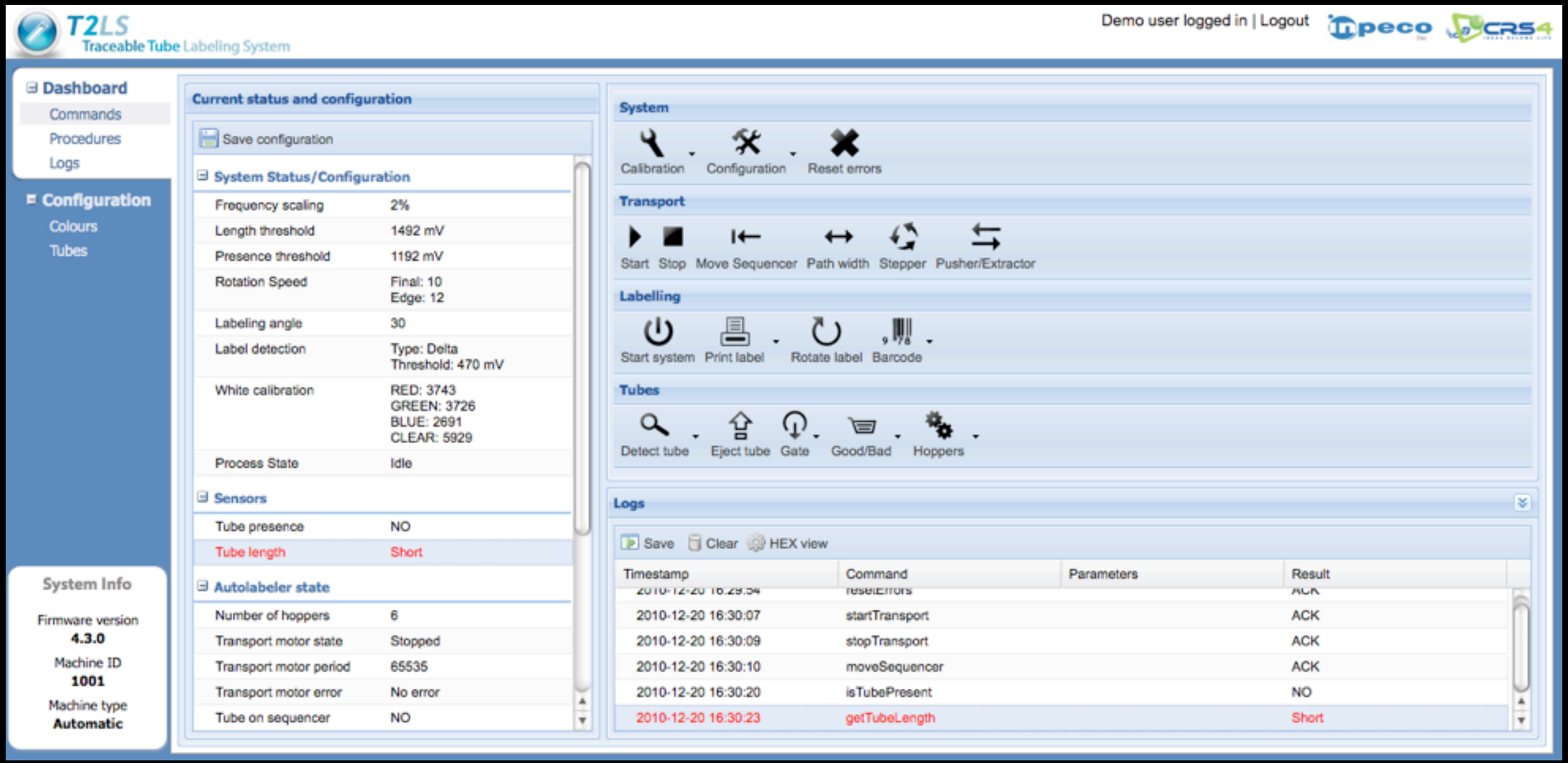
One word: Twisted

- one of Python's killer apps
- write new protocols in minutes
  - once you finally *get it* :-)
- non blocking, asynchronous
- look, ma: no Apache!
- very robust and quite scalable
- XMLRPC, SOAP, SSL come for free

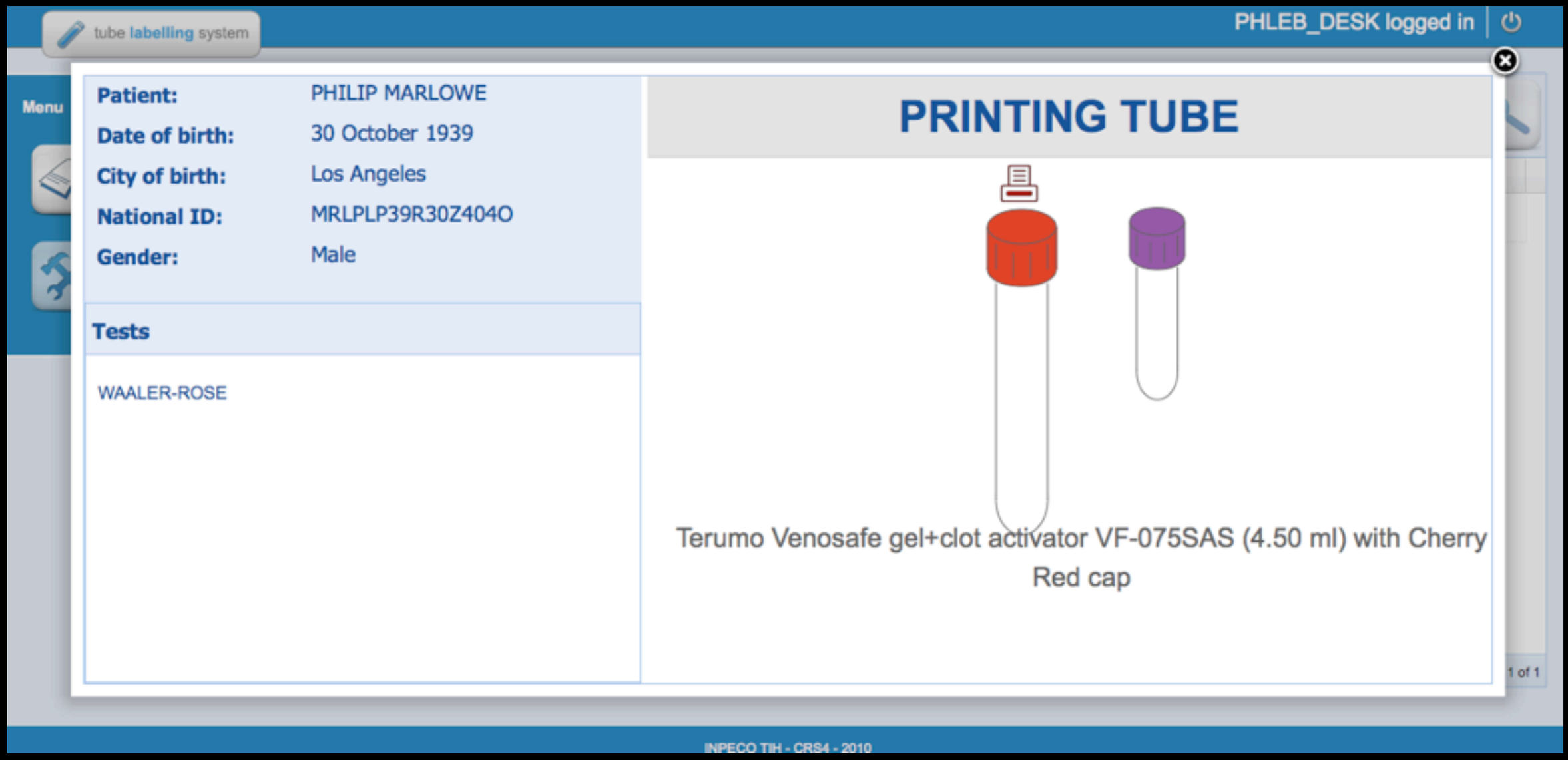
3. applications

Why web apps

- no deployment or client maintainance
- support several usage and business models
- modern interfaces: RIA, AJAX, etc.
- Django of course!
- MVC, reusable components
- very useful even outside the web
    - loose coupling always a good idea



admin's application



phlebotomist's

IHE certification

- our system was certified as IHE-compliant during Connectathon Europe 2011

- LB, LIP, PDQ-S, PDQ-C

AO G. Brotzu

whither?

Python in Healthcare SIG

- established on march 2011
- last edit of wiki on 2011-03-17
- mailing list
  - 18 messages in 4 months
  - last message in April

No Country for Old Snakes...

- HL7 implementations
  - we only have v2...
  - ...and it's quite limited
- everyone uses Java
- Mirth
  - made in Java
  - scriptable in Javascript

...or is it?

- we must work together
- Healthcare ICT is important
    - philosophically
    - and economically -in fact we're hiring ;-)
- show them prototypes; use Trojan horses
- have a good list of use cases

questions, thoughts, suggestions

Federico Caboni
federico.caboni@crs4.it
http://www.crs4.it