

Electronic Healthcare Records Forum 2012

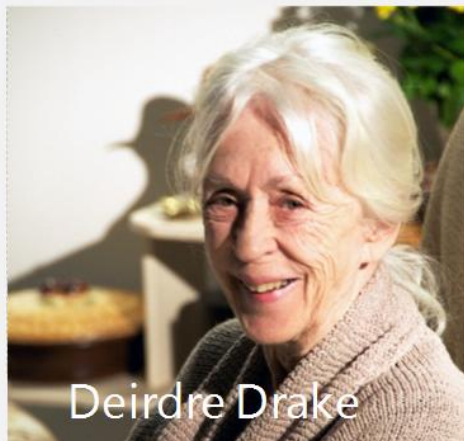
A Next Generation Cloud- based Health Care Platform

Prof Bill Buchanan, Dr Lu Fan, Prof Christoph Thuemmler, Dr Elias Ekonomou, Owen Lo, and Alistair Lawson, Edinburgh Napier University.



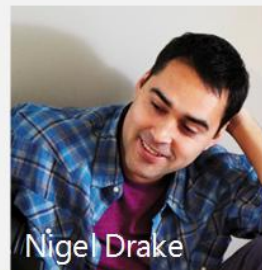
Nurse Kate

- Healthcare Professional.
- Invited user



Deirdre Drake

- Care Subject
- 82 years old
- House bound
- COPD (Chronic Obstructive Pulmonary Disease)



Nigel Drake

- Invited user

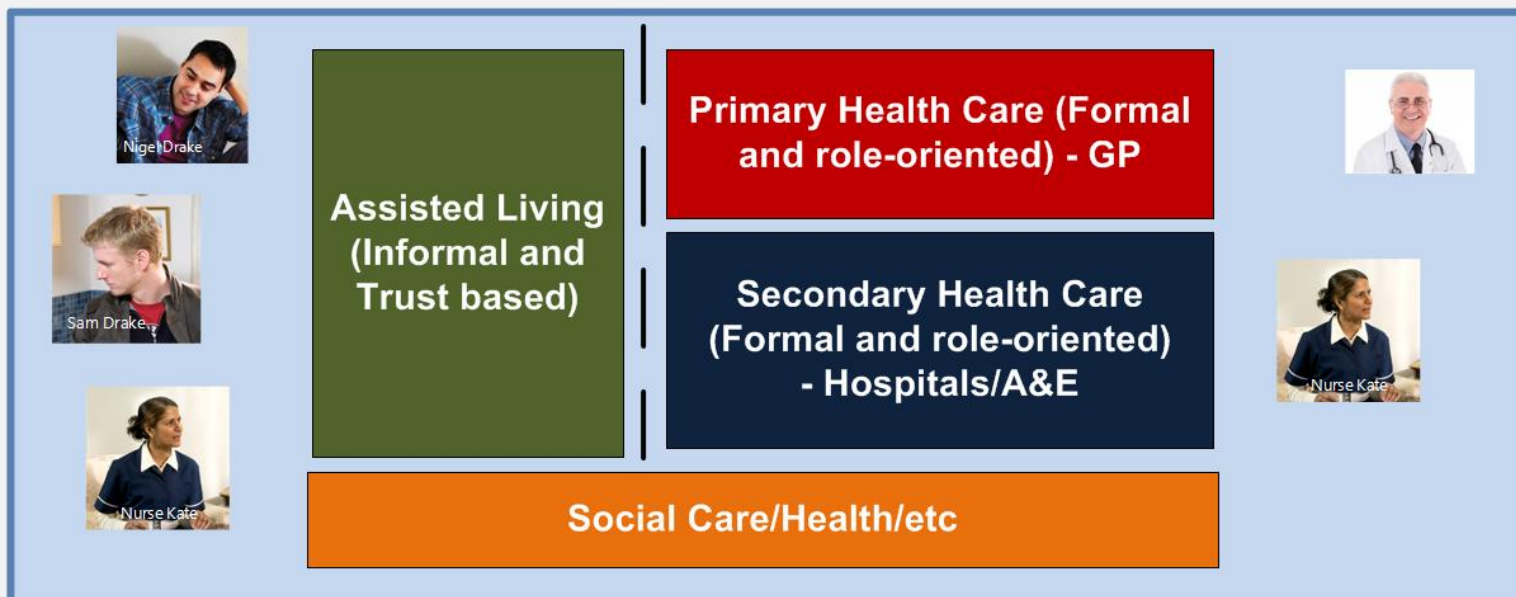


- GP.
- Invited user

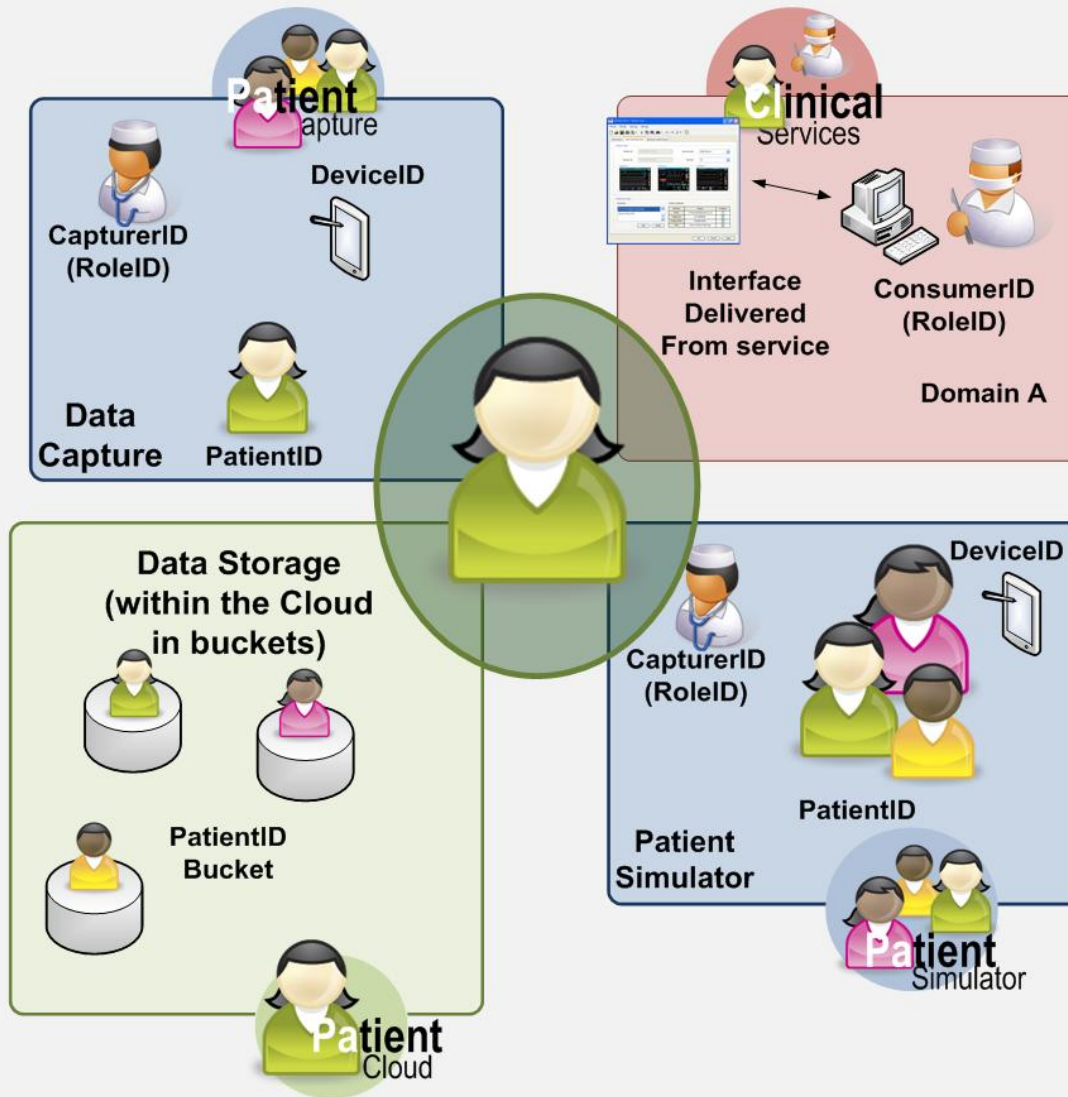


Sam Drake

- Site Creator
- Primary Carer



Introduction/ Context



Deirdre





DACAR e-Health Platform

Trusted Services 

Chelsea and Westminster Hospital **NHS**
NHS Foundation Trust

Edinburgh Napier UNIVERSITY 

kodit

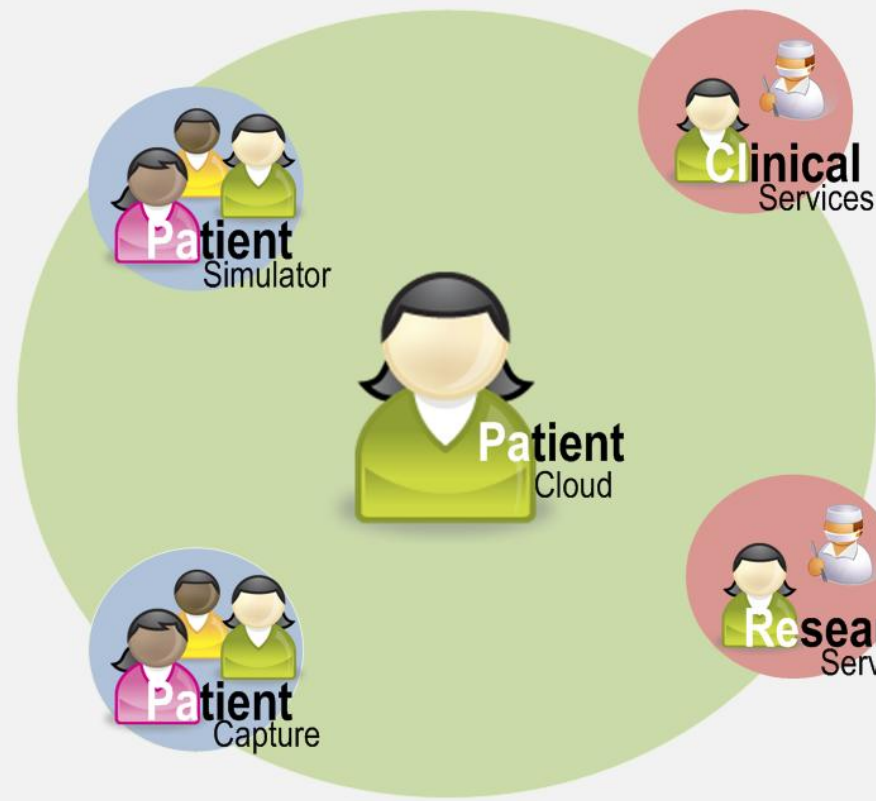
Imperial College London

CIPIER LAB

GS1
UK

Technology Strategy Board
Driving Innovation

EPSRC
Pioneering research and skills



Microsoft

HöIP

Edinburgh Napier UNIVERSITY 

Societal

Technical

Lack of integration between assisted living, primary and secondary care

Patient records are often static

Aging population

Different systems/formatting used for data

Lack of information sharing across the public sector

Limited/difficult access methods ... typically Government infrastructures ... lack of trust

Strong demand to consume health care data

Poor access control to data

Lack of integration with careers and trusted people

Data often aggregated and context is often lost



**Digital
Trust**

Rights

**Clinical
Services**

**Human
Trust**

Identity



Strong

Governance

Infinite

possibilities

Translation of rights
Translation of identities

Strong Governance
Policy



**Assisted Living
(Informal and Trust
based)**

**Primary Health Care (Formal
and role-oriented)**

**Secondary Health Care
(Formal and role-oriented)**

Manager might ask: What's difference in length-of-stay between different age categories for June?

Consultant might ask: How does the Early Warning Score affect the length-of-stay?

Family friend might ask: In which ward is Deirdre?

PatientID



Static Patient Record

- Often localised
- Different systems/formats
- Poor access control
- Poor identity verification
- Cannot be aggregated
- Etc.



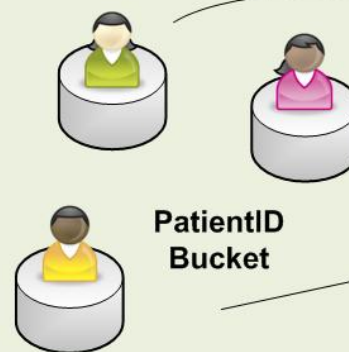
Clinical Services



ConsumerID (RoleID)

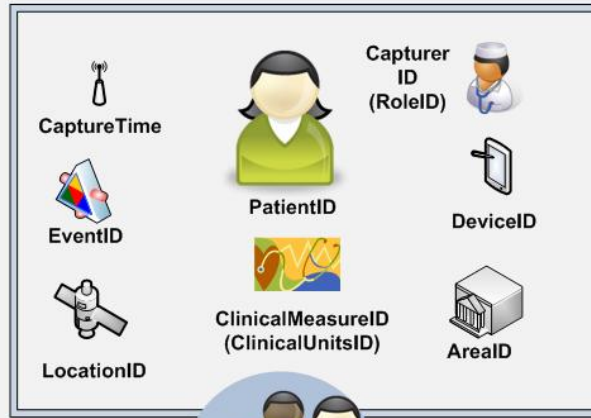
Domain A

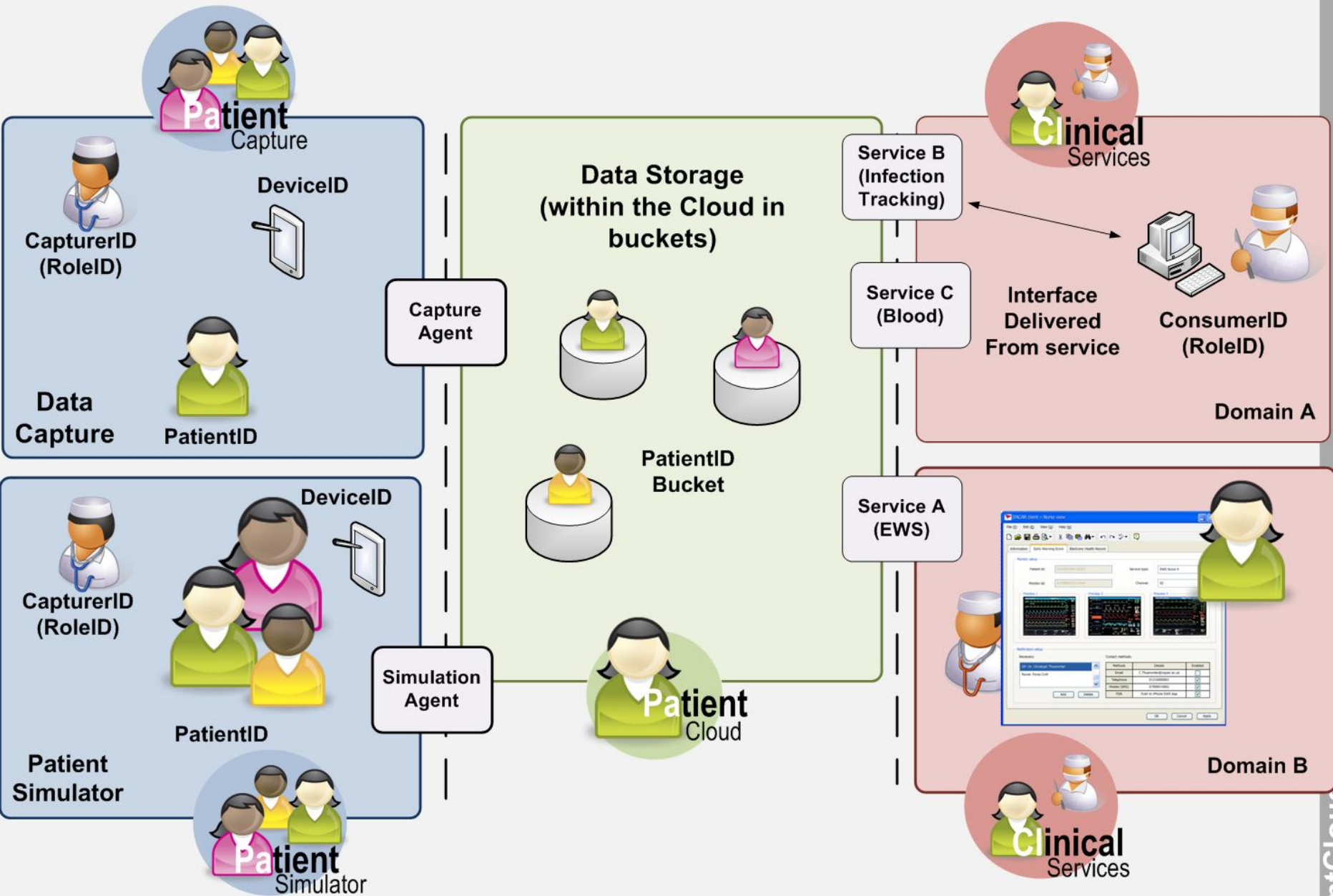
Data Storage (within the Cloud in buckets)

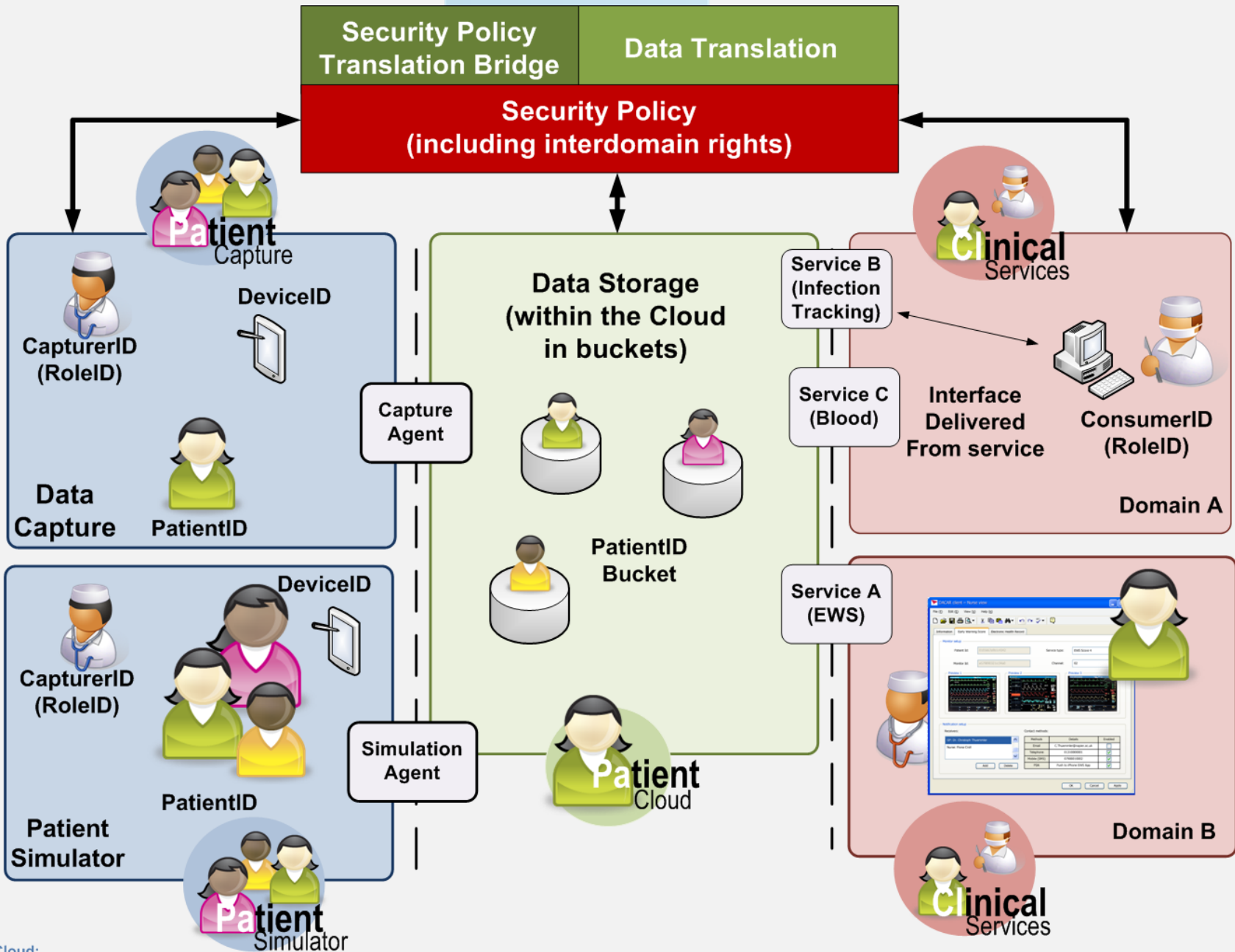


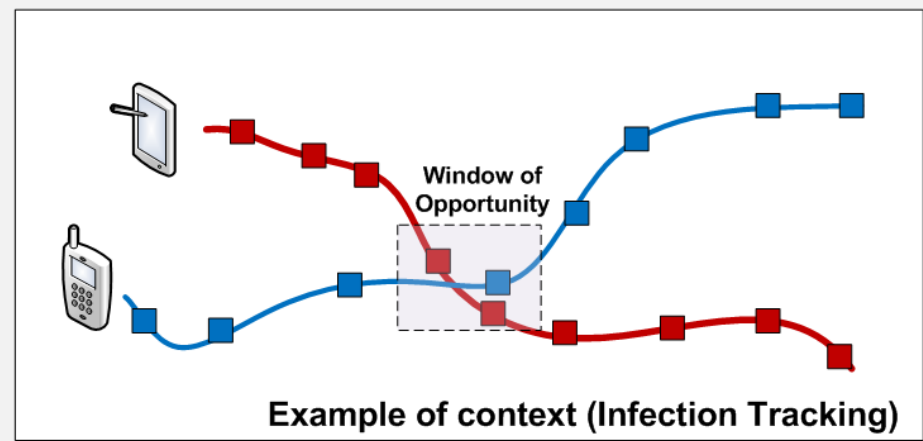
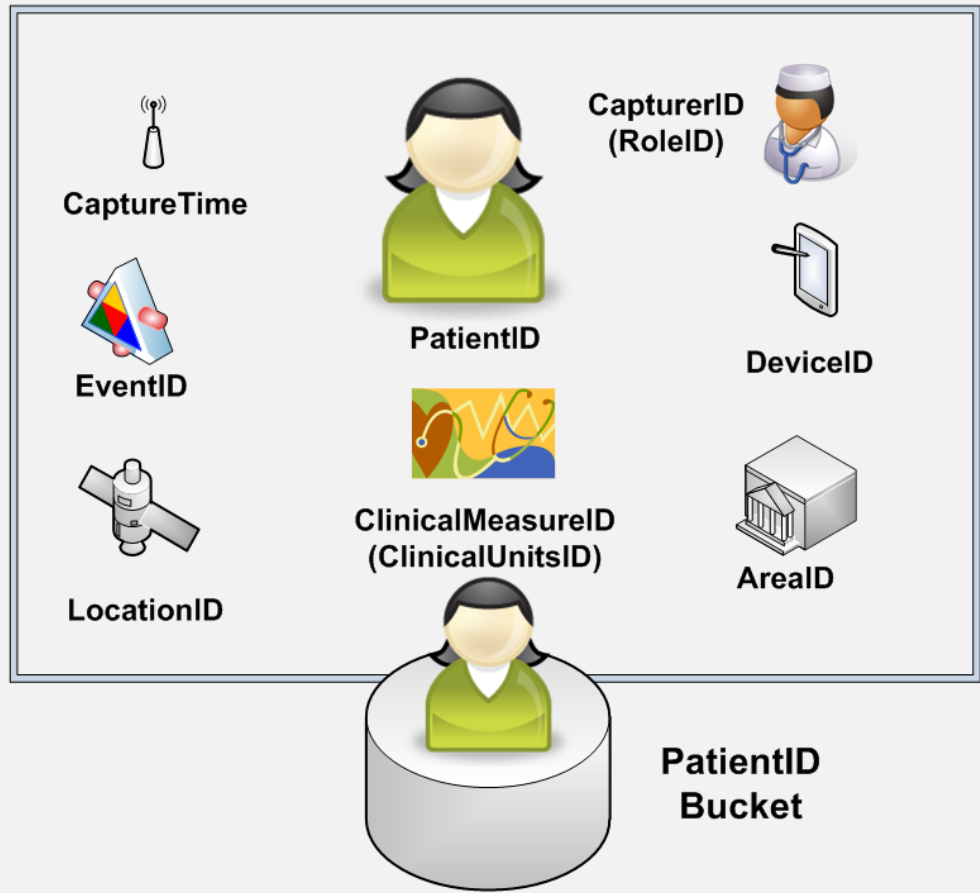
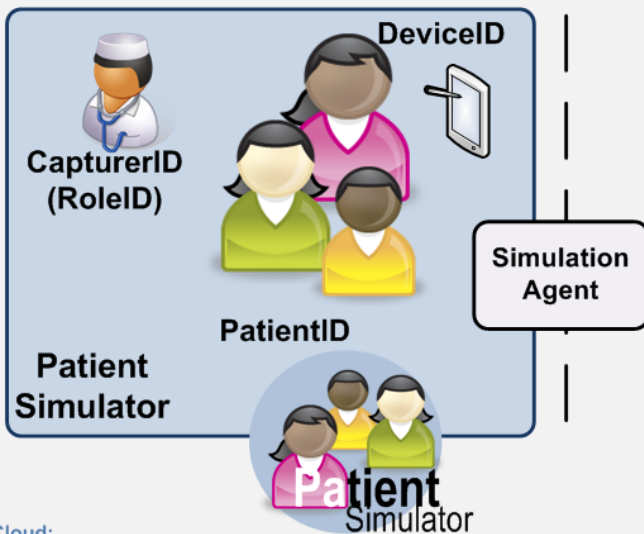
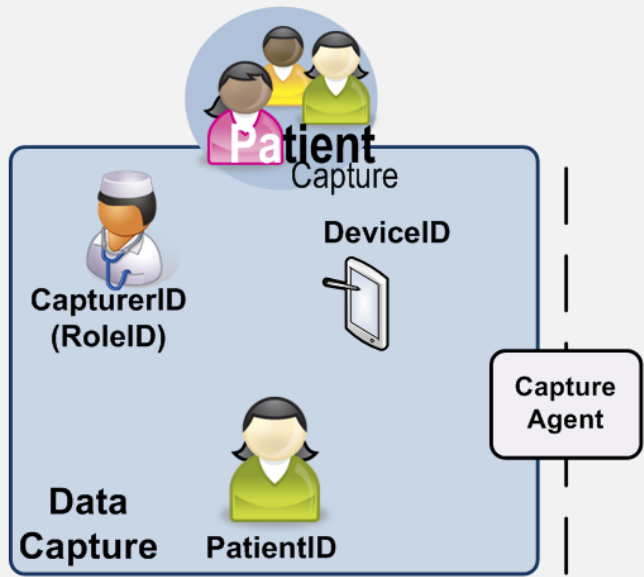
Dynamic Patient Records

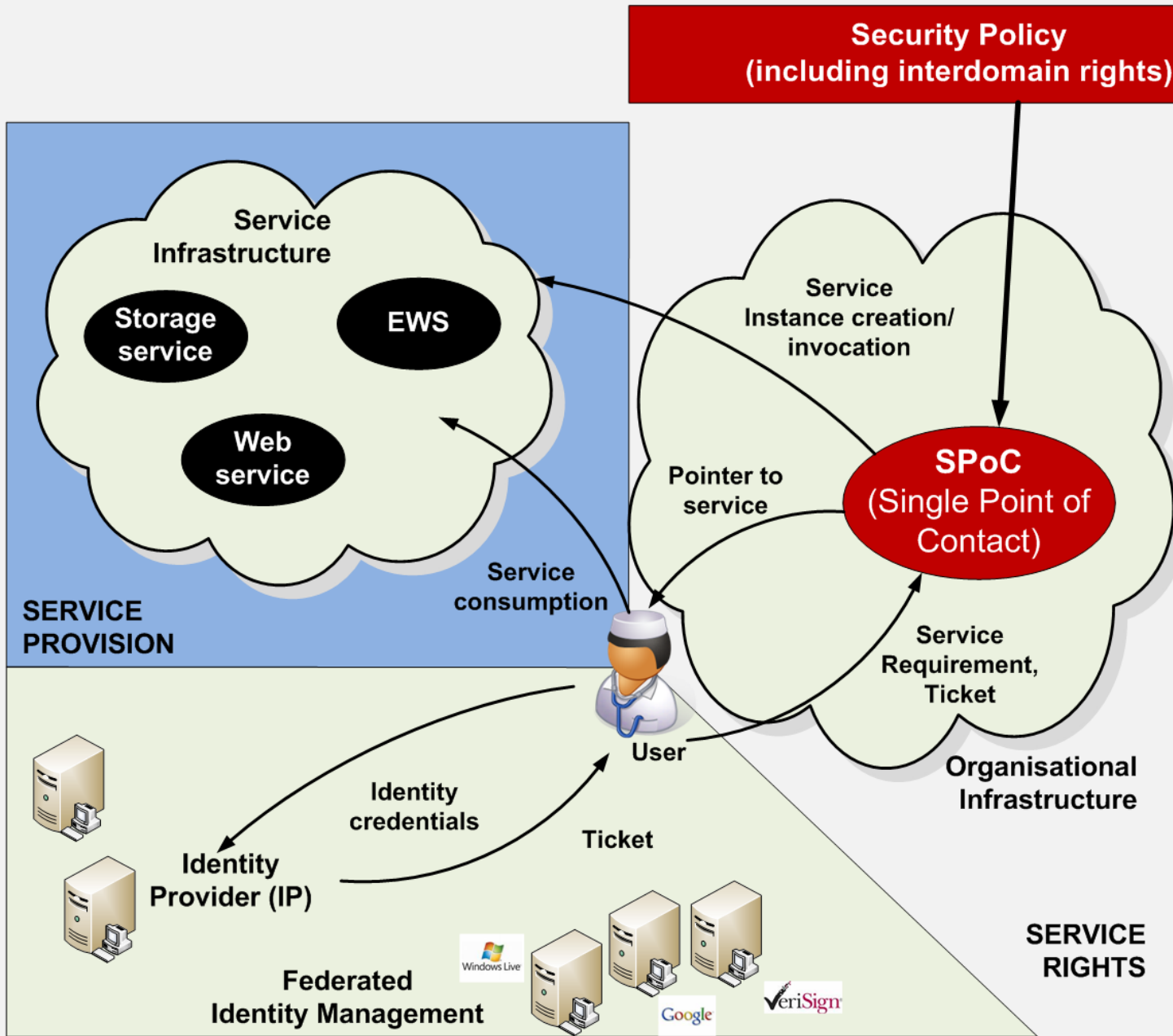
Security Policy (including interdomain rights)

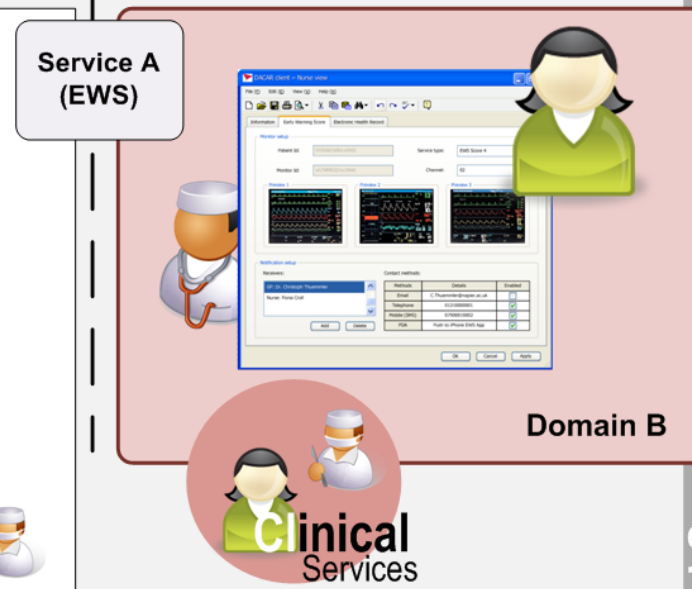
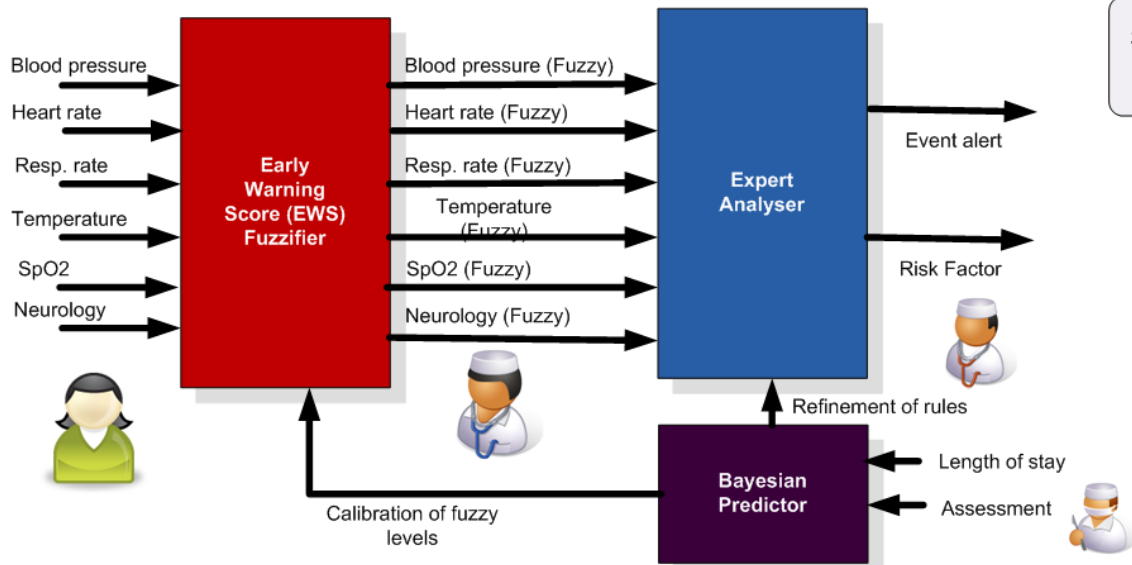
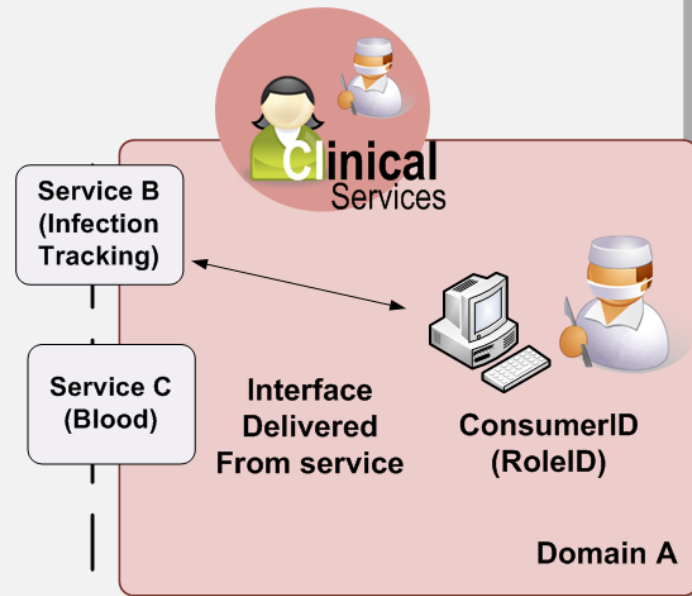
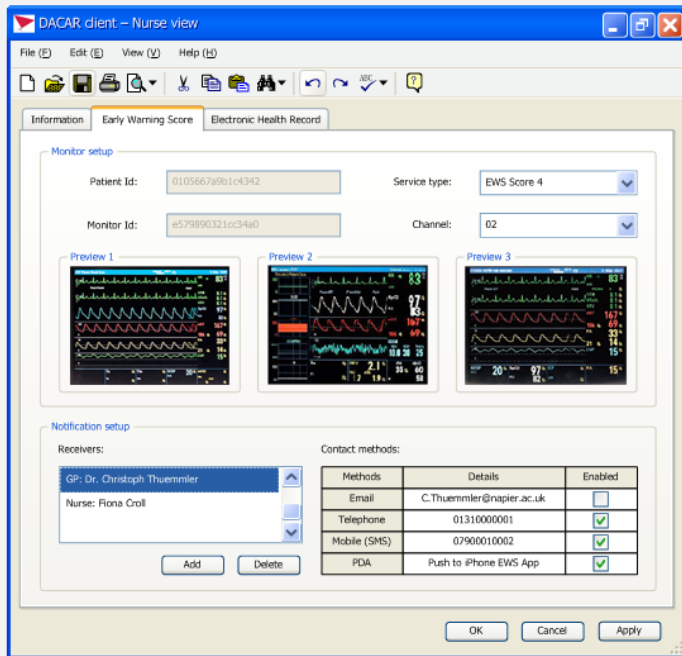
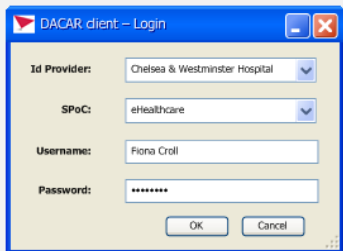




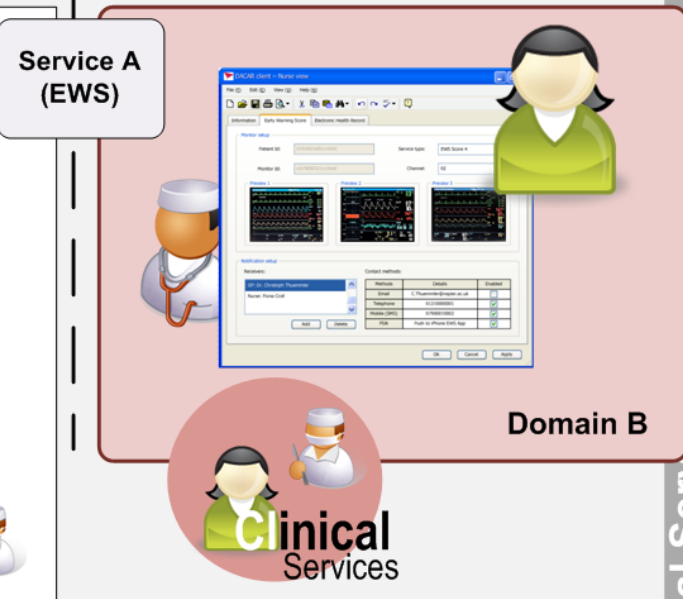
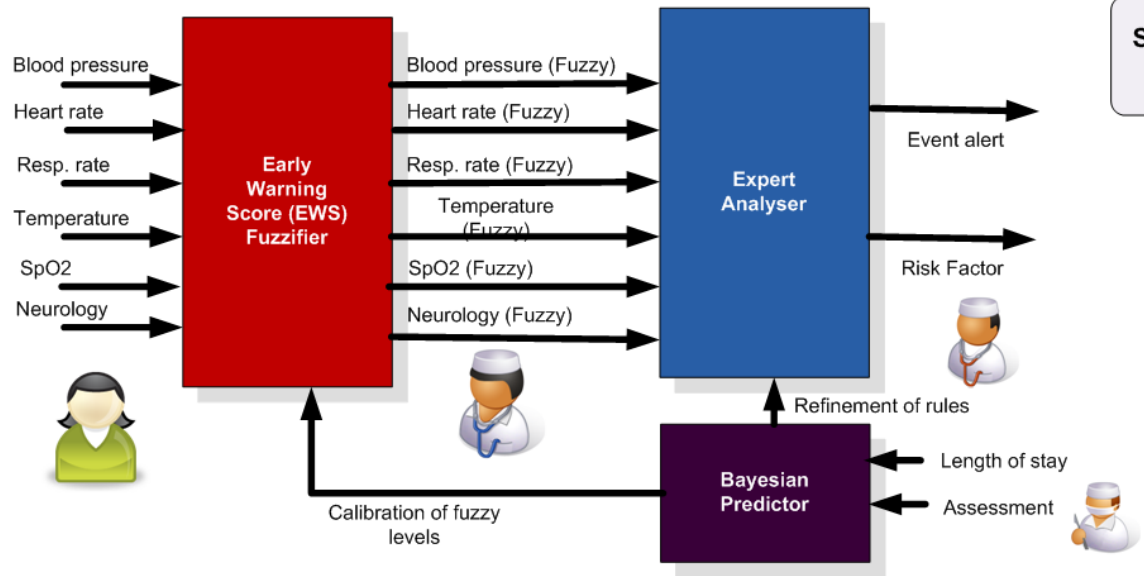
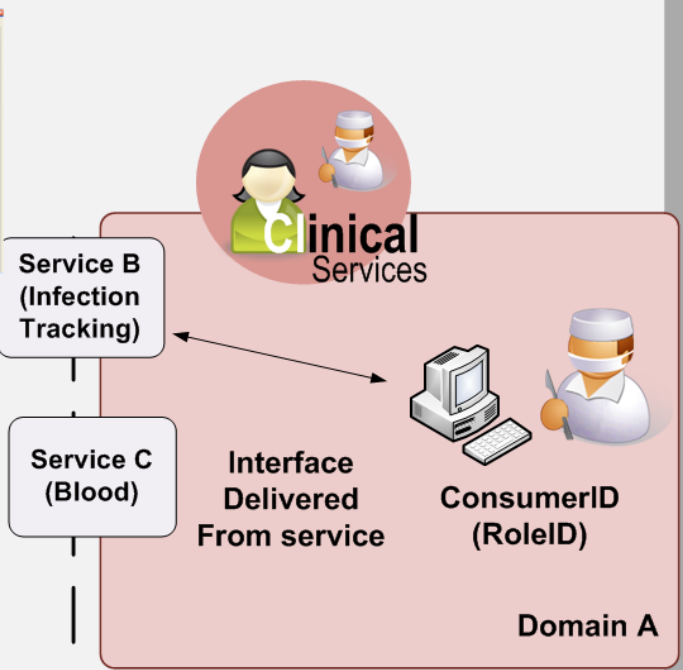




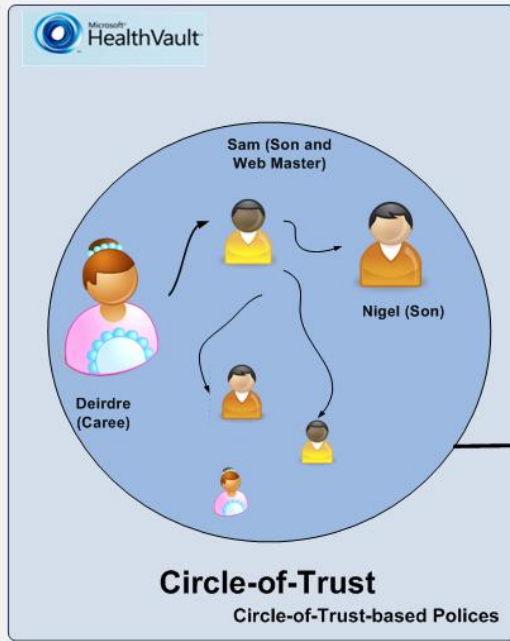




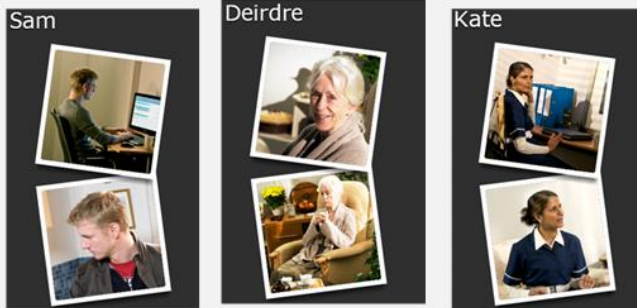
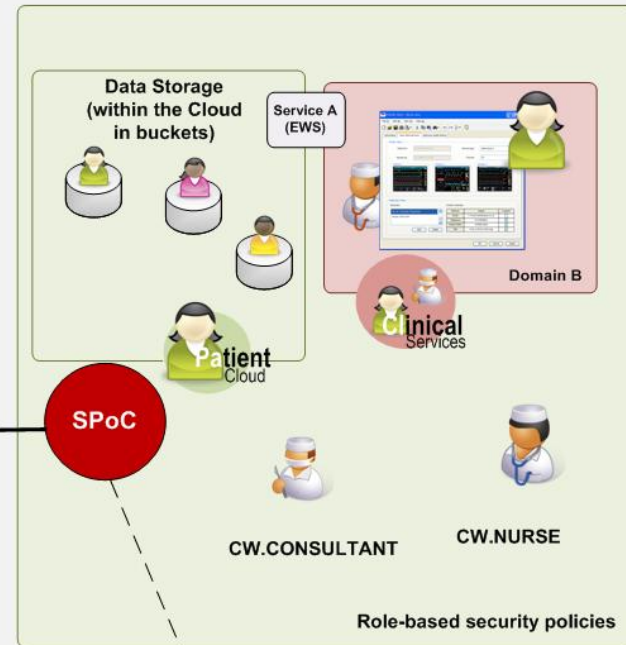
Clinical Services



Assisted Living



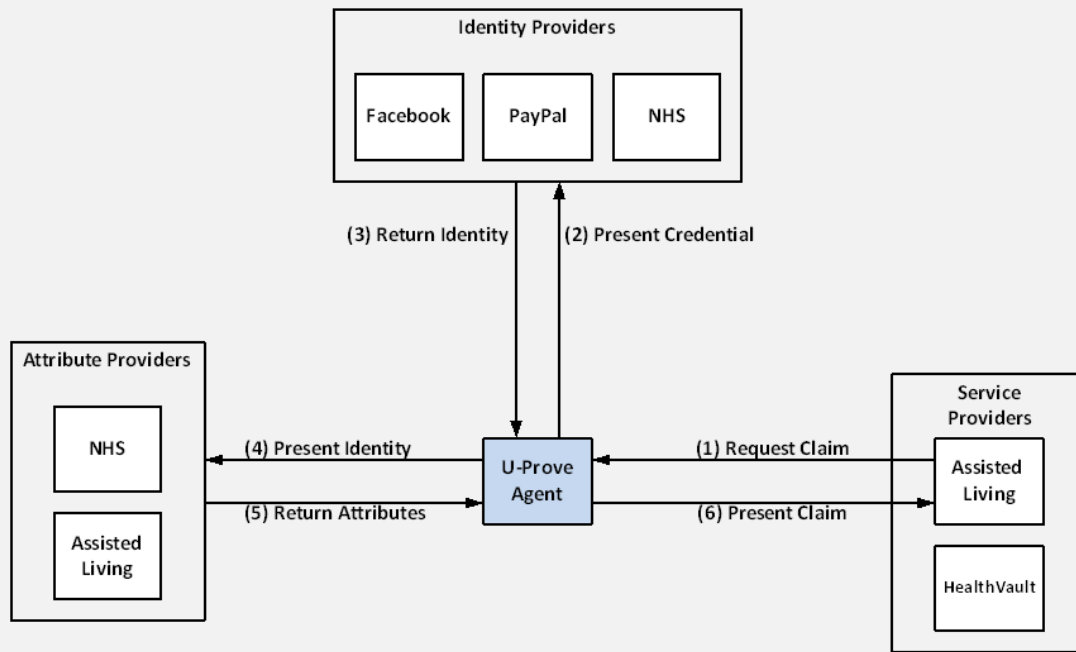
Primary/Secondary Care



```
[permit] [C&w.NURSE] [C | R] [Temp | SpO2 | HR | BP | RR | Pain] of [Patient26078] with [EWS] from [Chelsea & Westminster Hospital] for [*] records in [P2010-12-30T00:00:00] using [Data Protection Act]
```

```
[permit | deny] [Requester] [C | R | U | D] [Attribute] of [Object] with [Context] from [Owner] for [N] records in [Time window] using [Compliance]
```

Governance Policy

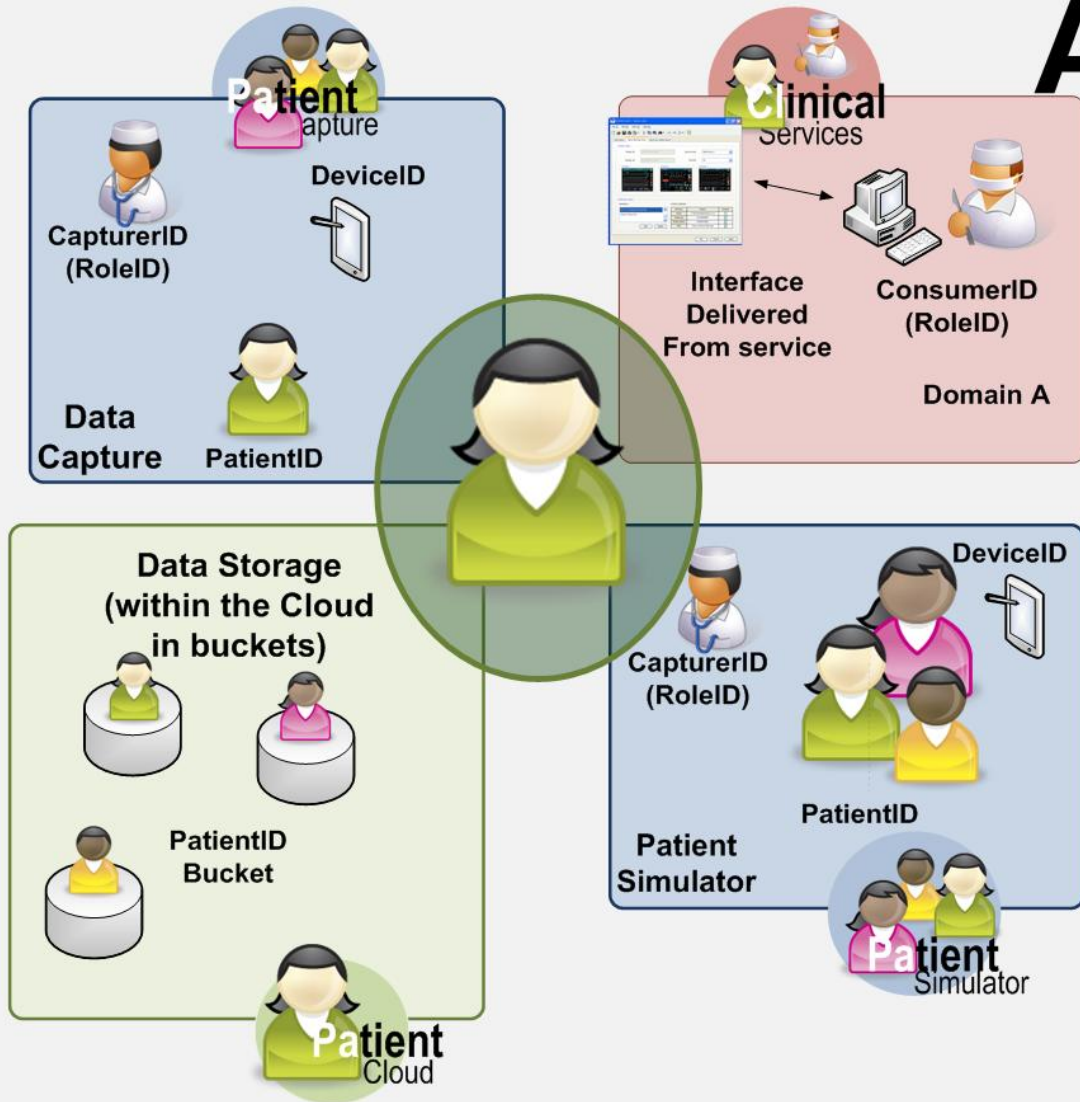


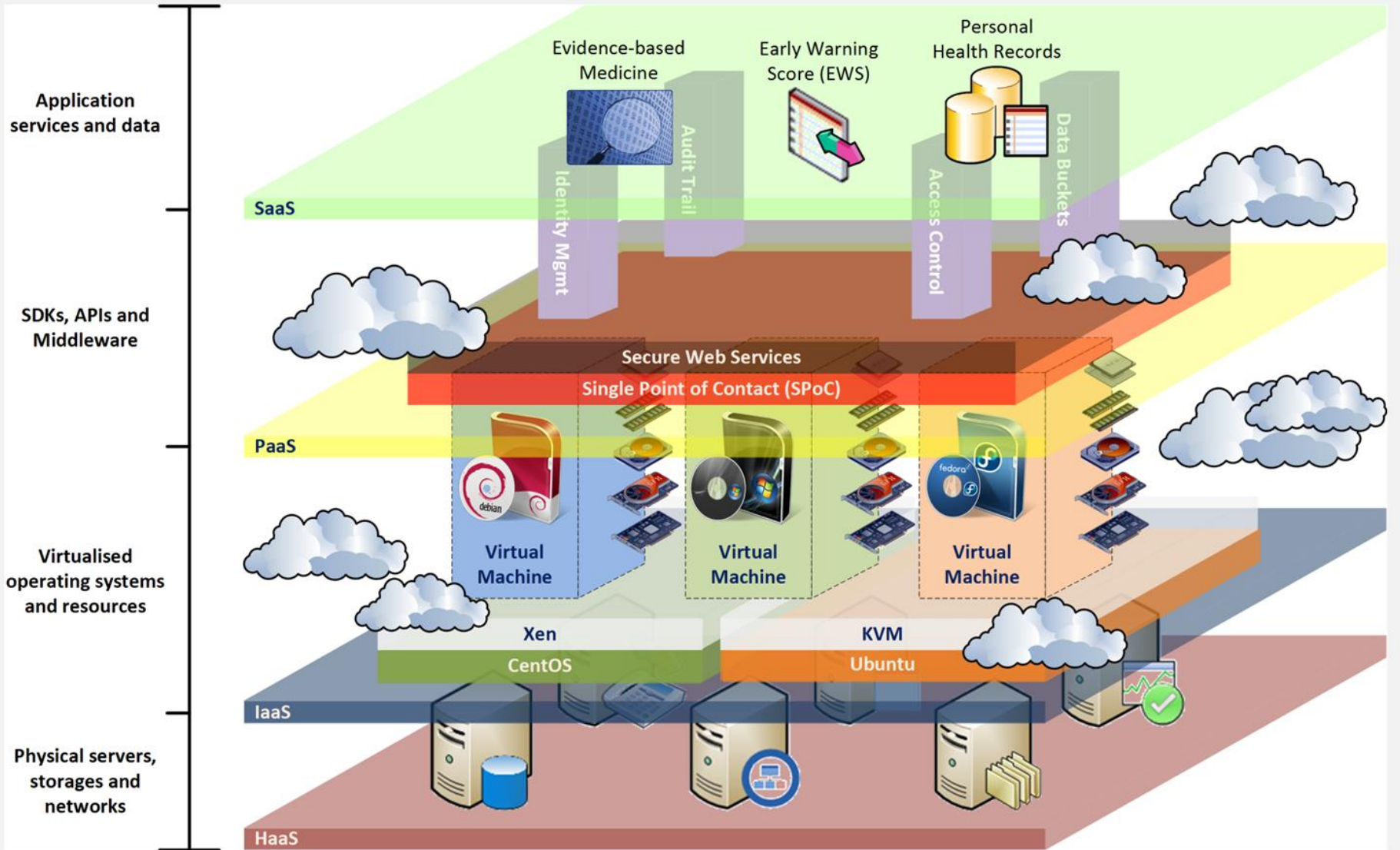
CW.CONSULTANT



CW.NURSE

SPoC Architecture



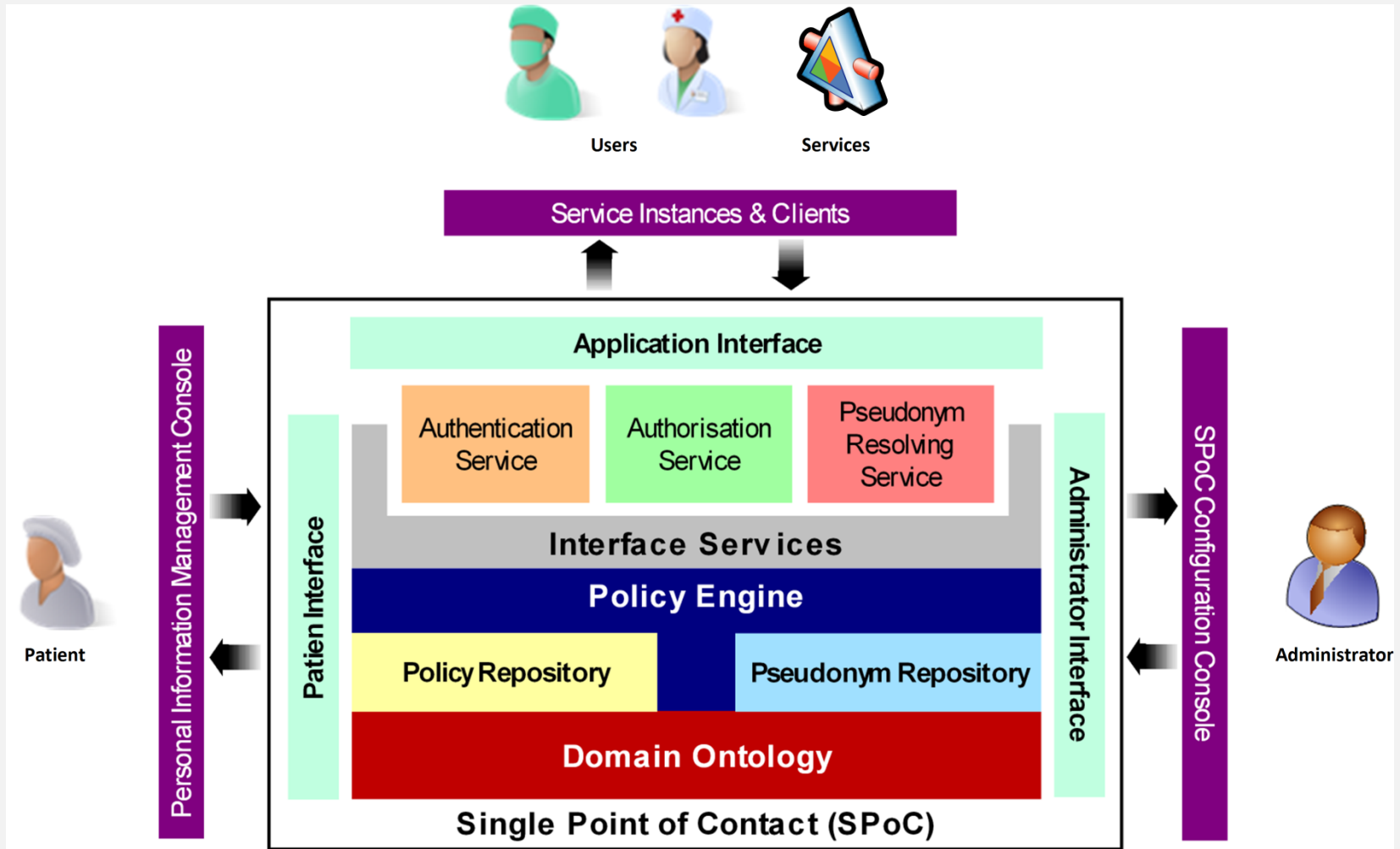


Single Point of Contact (SPoC)

- A security authority with the following functions
 - Authentication
 - Authorisation
 - Federation
- Claim-based identity management & access control
 - User & Client
 - Claim
 - Security Token Service (STS)
 - Resource Security Token Service (R-STS)
 - Relying Party (RP)

- Authentication
 - Internal users
 - A SPoC may serve as a **STS**
 - A SPoC may be a **RP** of Federated ID Providers
 - External users
 - Each SPoC serves as a **R-STS** in a *SPoCs Federation*
- Authorisation
 - Service authorisation
 - Role- or individual-based access to e-Health services
 - A SPoC issues a *Service Ticket* to an authorised client
 - Data authorisation
 - Role- or individual-based *CRUD* over medical attributes
 - A SPoC issues a *Data Ticket* to an authorised client

SPoC Architecture



Policy Syntax

```
[permit] [Medical Staff] [C | R] [Temp | SpO2 | HR | BP | RR | Pain] of  
[Patient26078] with [EWS] from [Chelsea & Westminster Hospital] for [*] records  
in [P2010-12-30T00:00:00] using [Data Protection Act]
```

```
[permit | deny] [Requester] [C | R | U | D] [Attribute] of [Object] with  
[Context] from [Owner] for [N] records in [Time Window] using [Compliance].
```

A similar syntax is also applied to the request messages:

```
[Requester] [C | R | U | D] [Attribute] of [Object] with [Context] from [Owner]  
within [Start] to [End]
```

- { [permit | deny] This is part of the rule syntax which indicates the action of the rule. This defines whether a request meeting the rule criteria will be permitted or denied access.
- { [Requester] This identifies a request sender's role, e.g. GP, or pseudonym, e.g. 10420, or a combination of the two, e.g. GP10420.
- { [C | R | U | D] This defines detailed permissions for a requester to create, read, update and delete certain information.
- { [Attribute] This is a unit of information describing an object. An attribute may be a primitive data type, e.g. the pseudonym of an object as a string, or a complex data type, e.g. a person's ECG record for 45 seconds.
- { [Object] This is part of DACAR's system model. It refers to any entities in a healthcare scenario, about which information is held.
- { [Context] This identifies the reason why the information is being shared. The context governs the level of access and permissions associated with information exchange, and hence defines the priority accorded to information requests.
- { [Owner] This species a role with sufficient privileges to manage all aspects of an information source. The owner has the authority to allow or deny access to an information element, as required by legislation and defines responsibilities.
- { [N] records in [Time Window] This defines the number of records permitted over a period of time, where N can be any positive integer.
- { [Compliance] This refers to legislative requirements that support the exchange of information, such as the Data Protection Act, the Human Rights Act, the Freedom of Information Act and so on.
- { [Start] and [End] These identify the start and end of the date/time period over which information shown.

SPoC User Console v0.1.10102011

My Registration | My Services | My Policies | My Circle of Trust | More...

Available Services

Service Provider: Chelsea & Westminster Hospital

Service Category: [Empty]

Service Name: Early Warning S

Service Details

Service Description & End-user's Liscense Agreement (EULA):

The Early Warning Score (EWS) service constantly monitors a patient's 6 vital sign parameters in real-time, and notifies medical staff when the patient is evaluated to be at risk.

Dependent Attributes: [Empty]

Subscription Status: [Empty]

SPoC User Console v0.1.10102011

My Registration | My Services | My Policies | My Circle of Trust | More...

Policy Selector

Policies set up by myself Policies set up by the SPoC Administrator

Refresh New

Policy Editor

Purpose: Permit Denial

Class: Role-based Individual-based

Managed Attributes: Hospital.VITAL SIGN.SpO2

Available Grantees: Westminster Hospital.ROLE.Critical, Westminster Hospital.ROLE.Nurse, Westminster Hospital.ROLE.Service

Managed Grantees: Westminster Hospital.ROLE.GP

2012 to: 23/02/2012

Add Update Delete

SPoC User Console v0.1.10102011

My Registration | My Services | My Policies | My Circle of Trust | More...

Policy Selector

Policies set up by myself Policies set up by the SPoC Administrator

Refresh New

```
[class="RULE";type="PROTECTED";object="b8f2544b-9696-4ee9-928e-cf1d54cb8928";role=["320a9658-7cbc-4a50-8470-2cbf9dbf7d2f","1c
[class="RULE";type="PROTECTED";object="b8f2544b-9696-4ee9-928e-cf1d54cb8928";role=["320a9658-7cbc-4a50-8470-2cbf9dbf7d2f","1c
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[class="RULE";type="PROTECTED";object="b8f2544b-9696-4ee9-928e-cf1d54cb8928";role=["320a9658-7cbc-4a50-8470-2cbf9dbf7d2f"];ps
```

Policy Editor

Purpose: Permit Denial

Class: Role-based Individual-based

Available Attributes: Westminster Hospital.VITAL SIGN.Pain, Westminster Hospital.VITAL SIGN.Hea, Westminster Hospital.VITAL SIGN.Bloc, Westminster Hospital.VITAL SIGN.Tem, Westminster Hospital.VITAL SIGN.RES, Westminster Hospital.MEDICAL INFO.I

Managed Attributes: Hospital.VITAL SIGN.SpO2

Available Grantees: Westminster Hospital.ROLE.Critical, Westminster Hospital.ROLE.Nurse, Westminster Hospital.ROLE.Service

Managed Grantees: Westminster Hospital.ROLE.GP

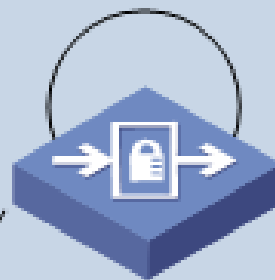
Valid from: 23/01/2012 to: 23/02/2012

Add Update Delete

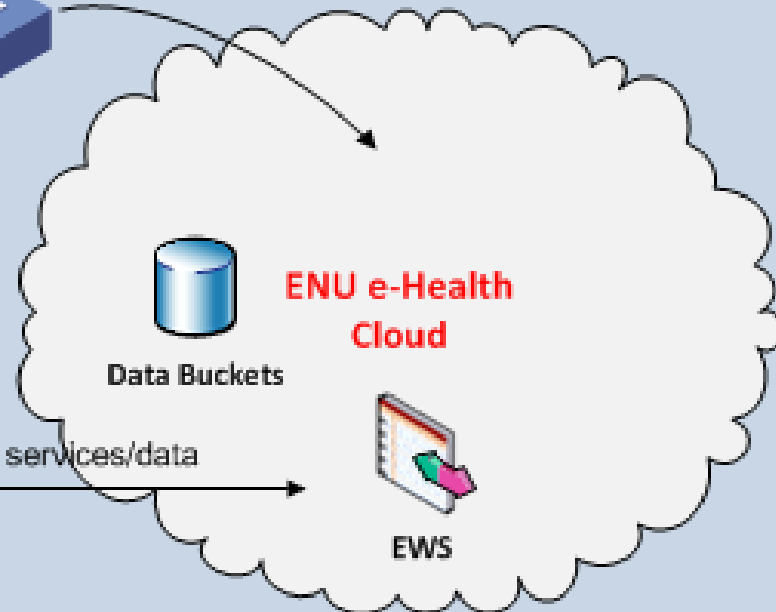
Policy Categories

- Service Authorisation
 - To allow or deny certain roles or individuals to consume an e-Health service
- Service Subscription
 - To allow a service to access or modify a set of a patient's medical data in order to perform its functionalities
- Specific Consent
 - To allow or deny certain roles or individuals to access or modify a patient's data in a fine-grained manner
- General Consent
 - To express a patient's willingness to share anonymised medical data in a certain application context

Step4: Analyse policies



Step5: Locate/initialise service instances



Step3: Present claims & request for service/data

Step6: Issue service/data ticket

Step7: Establish secure sessions to consume services/data

Step2: Issue claims

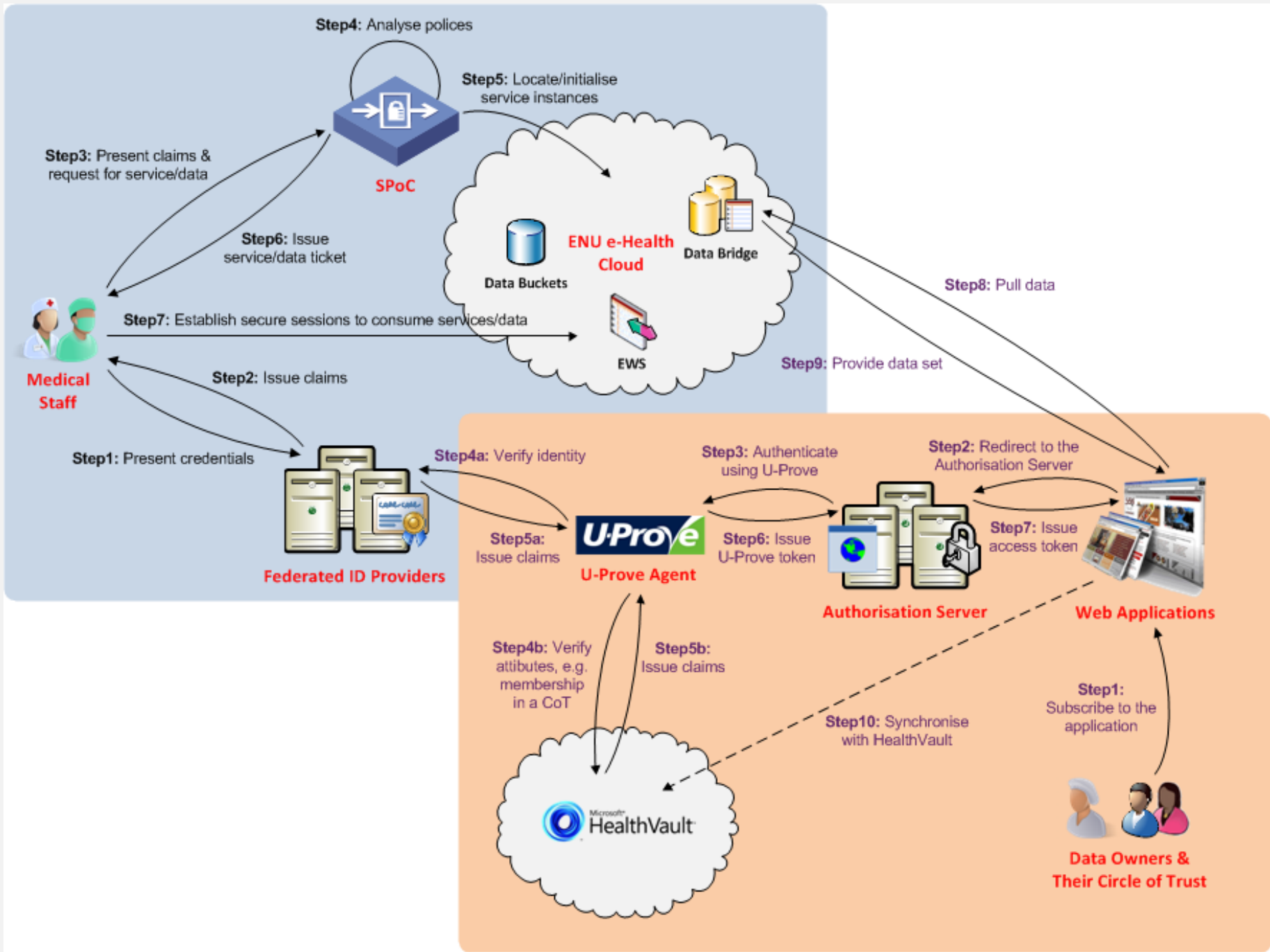
Step1: Present credentials



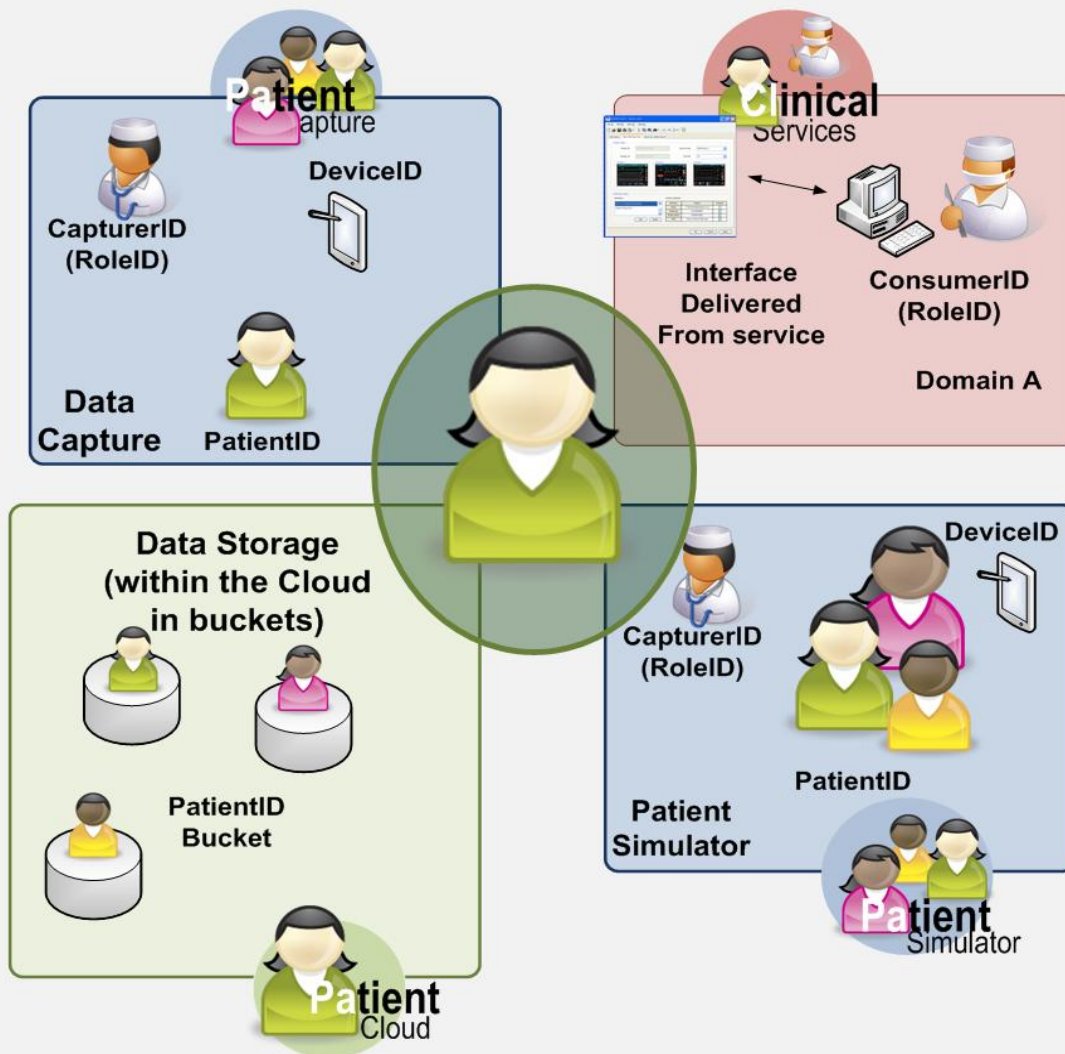
Medical Staff



Federated ID Providers



Patient Simulator



Deirdre



Patient Simulator

Edinburgh Napier UNIVERSITY

Patient List

- Daniel Smith (61980f5d-e9cc-4a9f-b7b6-7fb8fc17140)
- James Mondella (12616ff5-fbe4-4665-bca6-dcf0f0defef3)
- Scott Freeman (b8f2544b-9696-4ee9-928e-cf1d54cb8928)

Early Warning Score Service

Edinburgh Napier UNIVERSITY

Patient List

- Daniel Smith (61980f5d-e9cc-4a9f-b7b6-7fb8fc17140)
- James Mondella (12616ff5-fbe4-4665-bca6-dcf0f0defef3)
- Scott Freeman (b8f2544b-9696-4ee9-928e-cf1d54cb8928)

61980f5d-e9cc-4a9f-b7b6-7fb8fc17140

Patient Details

Update Details

Date of Birth: 23/06/1978
 Gender: Female
 Blood Type: AB
 Address: Edinburgh

Vital Sign Parameters

HR: 80 Temp: 36.8
 BP (Systolic): 120 Respiration: 12

Simulation Visualisation

ECG | BP (Plot) | TEMP (Plot) | RR (Plot) | SpO2 (Plot)

Simulation Output

HR	BP	TEMP	RR	SpO2
79 BPM	120 mmHG	36.8 °C	11.9 BF	98 %

Simulation Control

Start: 23/01/2012 08:36:42
 Stop: 24/01/2012 08:36:42

61980f5d-e9cc-4a9f-b7b6-7fb8fc17140

Patient Details

Title: Miss
 Fomame(s): Daniel
 Surname: Smith

Patient Status:

DATE	TIME	STATUS
23/01/2012	08:37:36	No Risk Detected
23/01/2012	08:37:42	No Risk Detected

Early Warning Score:

Value	HR	BP	TEMP	RR	SPO2
0	79	118	36.8	11.7	98

RISK SCORE: 0

Monitoring...

61980f5d-e9cc-4a9f-b7b6-7fb8fc17140

Patient Details

Update Details

Date of Birth: 23/06/1978
 Gender: Female
 Blood Type: AB
 Address: Edinburgh

Vital Sign Parameters

HR: 80 Temp: 36.8
 BP (Systolic): 120 Respiration: 12
 SpO2: 98 Scenario: Stroke

Simulation Visualisation

ECG | BP (Plot) | TEMP (Plot) | RR (Plot) | SpO2 (Plot)

Simulation Output

HR	BP	TEMP	RR	SpO2
60 BPM	219 mmHG	37.0 °C	11.8 BF	97 %

Simulation Control

Start: 23/01/2012 08:36:42
 Stop: 24/01/2012 08:36:42

Simulating...

61980f5d-e9cc-4a9f-b7b6-7fb8fc17140

Patient Details

Title: Miss
 Fomame(s): Daniel
 Surname: Smith

Patient Status:

DATE	TIME	STATUS
23/01/2012	08:37:57	Low Risk Detected
23/01/2012	08:38:02	Low Risk Detected
23/01/2012	08:38:04	Low Risk Detected
23/01/2012	08:38:06	Low Risk Detected
23/01/2012	08:38:09	Low Risk Detected
23/01/2012	08:38:11	Low Risk Detected
23/01/2012	08:38:15	Low Risk Detected

Early Warning Score:

Value	HR	BP	TEMP	RR	SPO2
2	118	157	37.0	11.6	96

RISK SCORE: 2

Monitoring...

Electronic Healthcare Records Forum 2012

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Prof Bill Buchanan, Dr Lu Fan, Prof Christoph Thuemmler, Dr Elias Ekonomou, Owen Lo, and Alistair Lawson, Edinburgh Napier University.



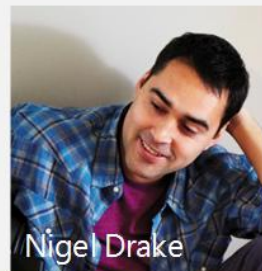
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- Healthcare Professional.
- Invited user



Deirdre Drake

- Care Subject
- 82 years old
- House bound
- COPD (Chronic Obstructive Pulmonary Disease)



Nigel Drake

- Invited user



- GP.
- Invited user



Sam Drake

- Site Creator
- Primary Carer

