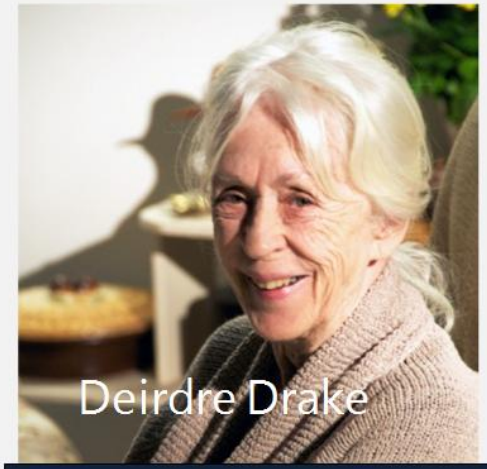
A Next Generation Cloud-based Health Care Platform – Towards Trust and an Infinite Possiblities

- Outline some of issues in current systems.
- Define some of the key principles for future systems.
- Define an overall architecture for Cloud infrastructures in health care.
- Provide an example of the Governance/Security Policy.
- Provide an overview of the e-Health Platform.
- Example of a clinical service.

Prof Bill Buchanan

- Healthcare Professional.
- Invited user



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

- Site Creator
- Primary Carer

- Invited user

PatientCloud:
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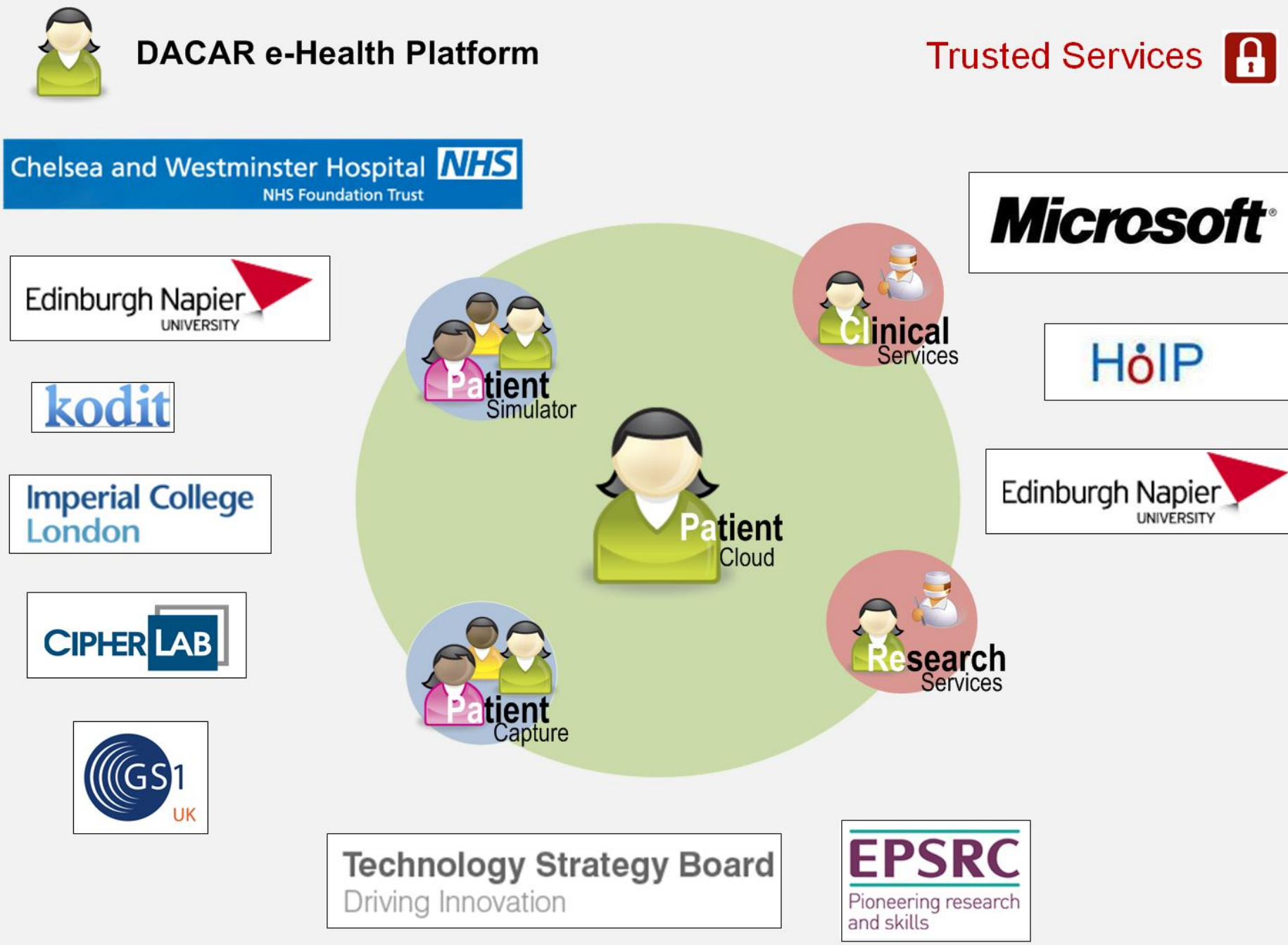
DACAR e-Health Platform

Trusted Services



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

Some key issues

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Rights

Clinical Services

Digital Trust

Human Trust

Strong Governance

Identity

Infinite possiblities

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?

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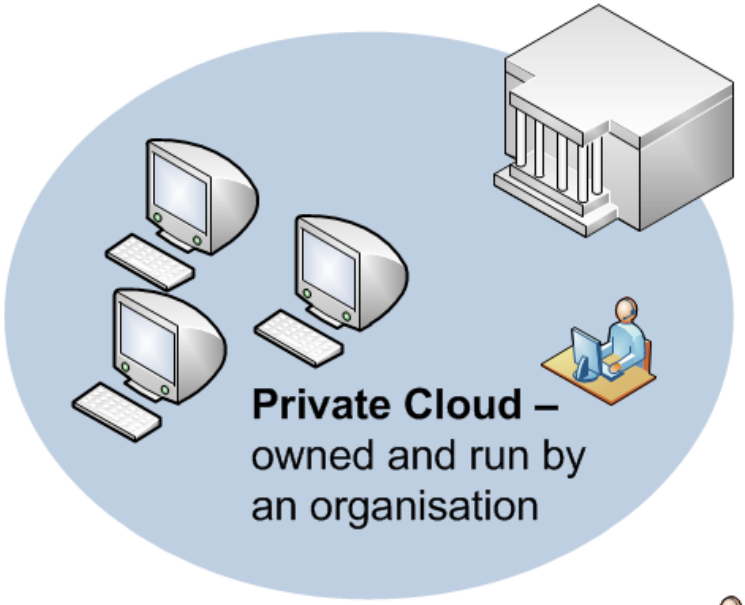
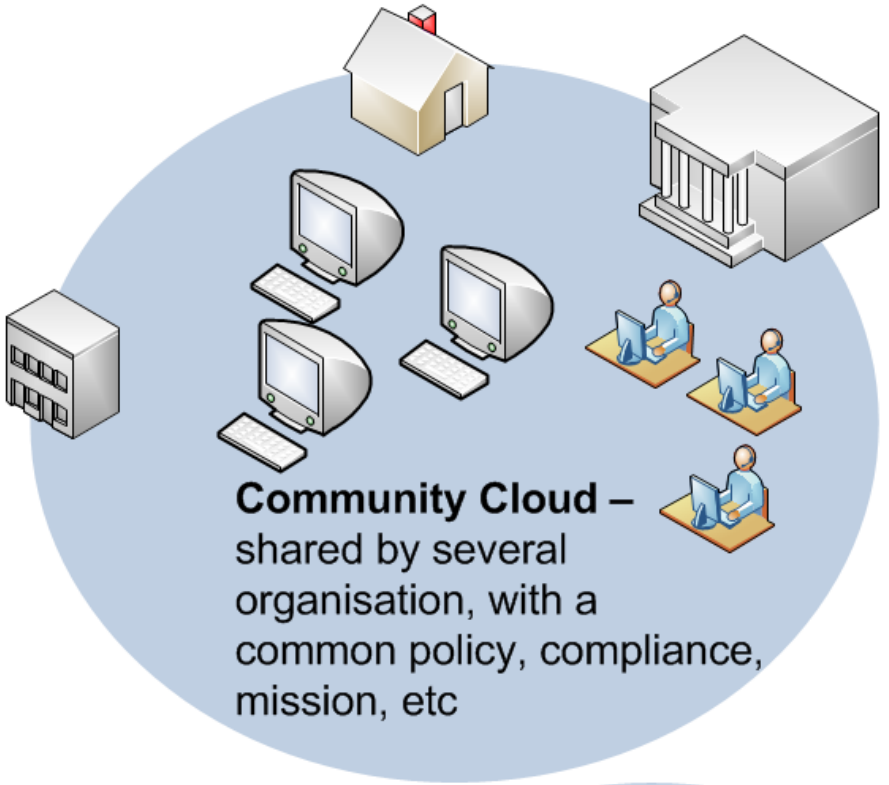
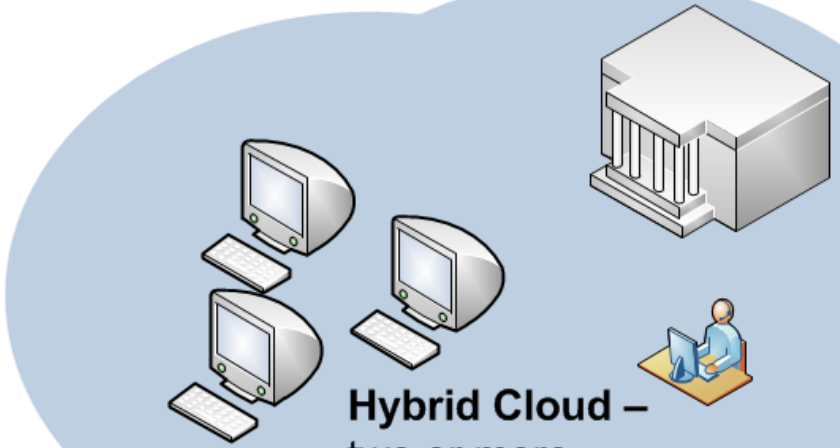


Private Cloud – owned and run by an organisation

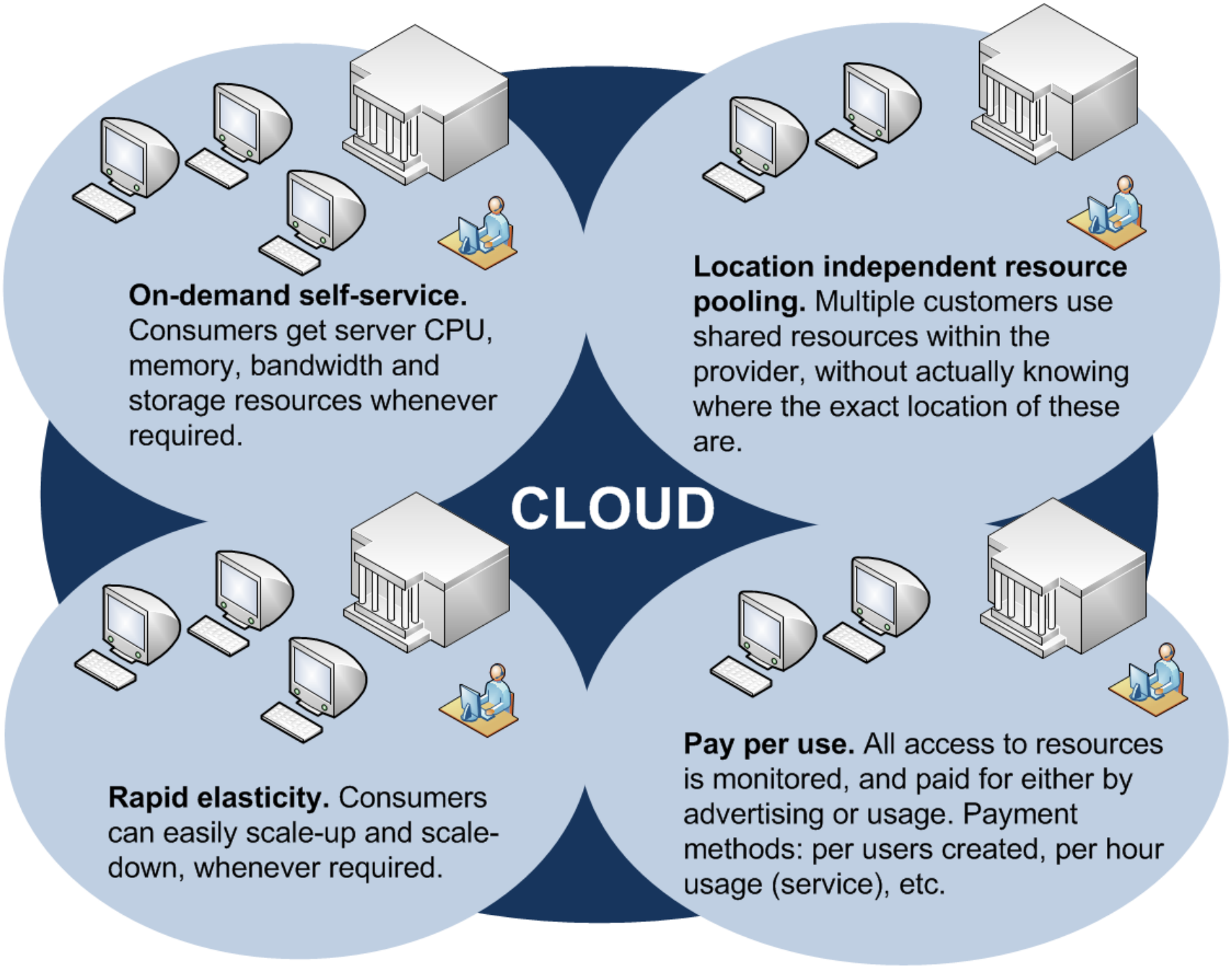


Community Cloud – shared by several organisation, with a common policy, compliance, mission, etc

Public Cloud – owned by an organisation selling a cloud infrastructure



Hybrid Cloud – two or more clouds


CLOUD
On-demand self-service. Consumers get server CPU, memory, bandwidth and storage resources whenever required.
Location independent resource pooling. Multiple customers use shared resources within the provider, without actually knowing where the exact location of these are.
Rapid elasticity. Consumers can easily scale-up and scale-down, whenever required.
Pay per use. All access to resources is monitored, and paid for either by advertising or usage. Payment methods: per users created, per hour usage (service), etc.

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)

PatientID Bucket

Dynamic Patient Records

Security Policy (including interdomain rights)

CaptureTime

EventID

LocationID

PatientID

Capturer ID (RoleID)

DeviceID

ClinicalMeasureID (ClinicalUnitsID)

AreaID

Patient Capture

Patient Cloud

Why?

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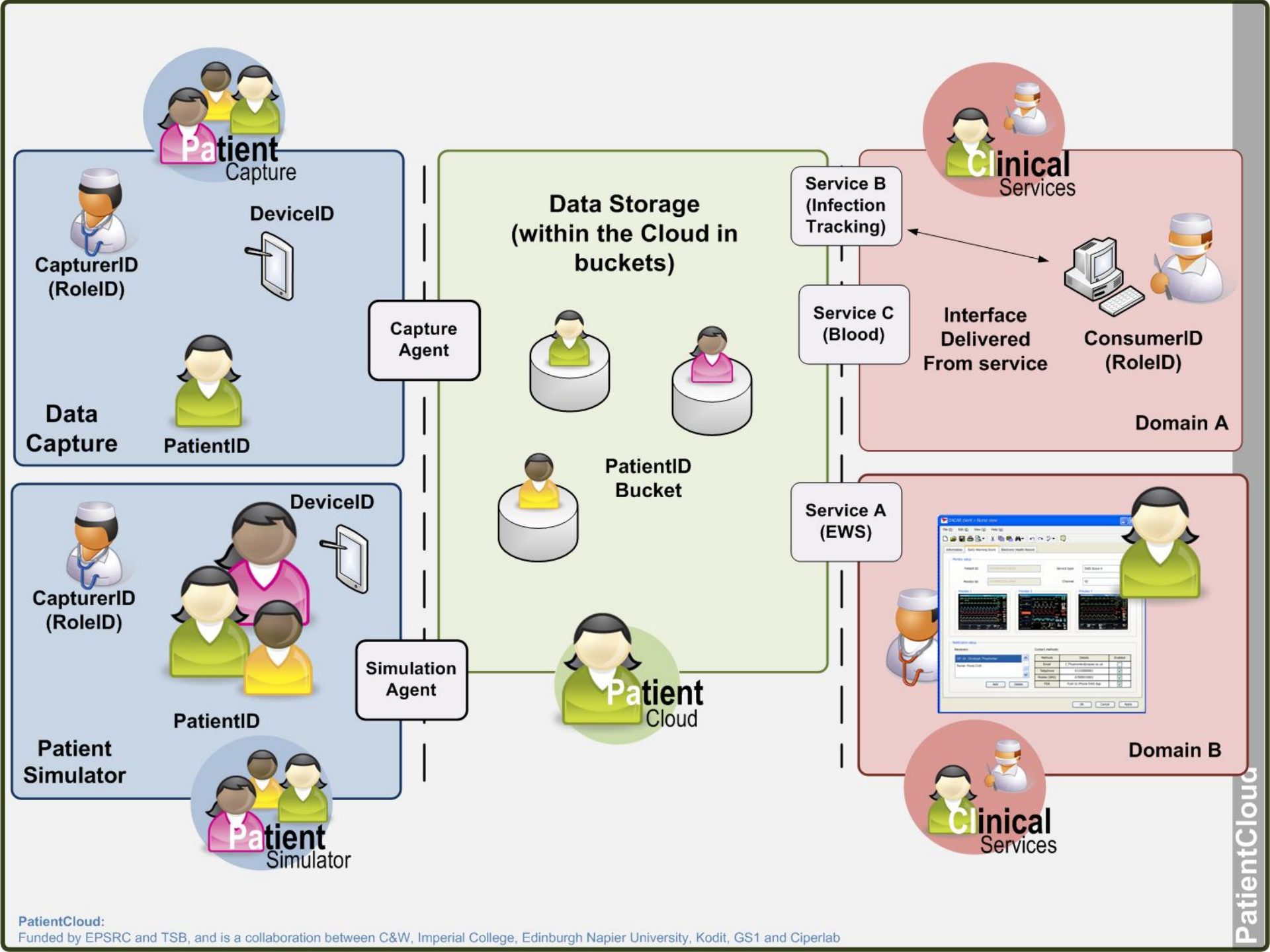

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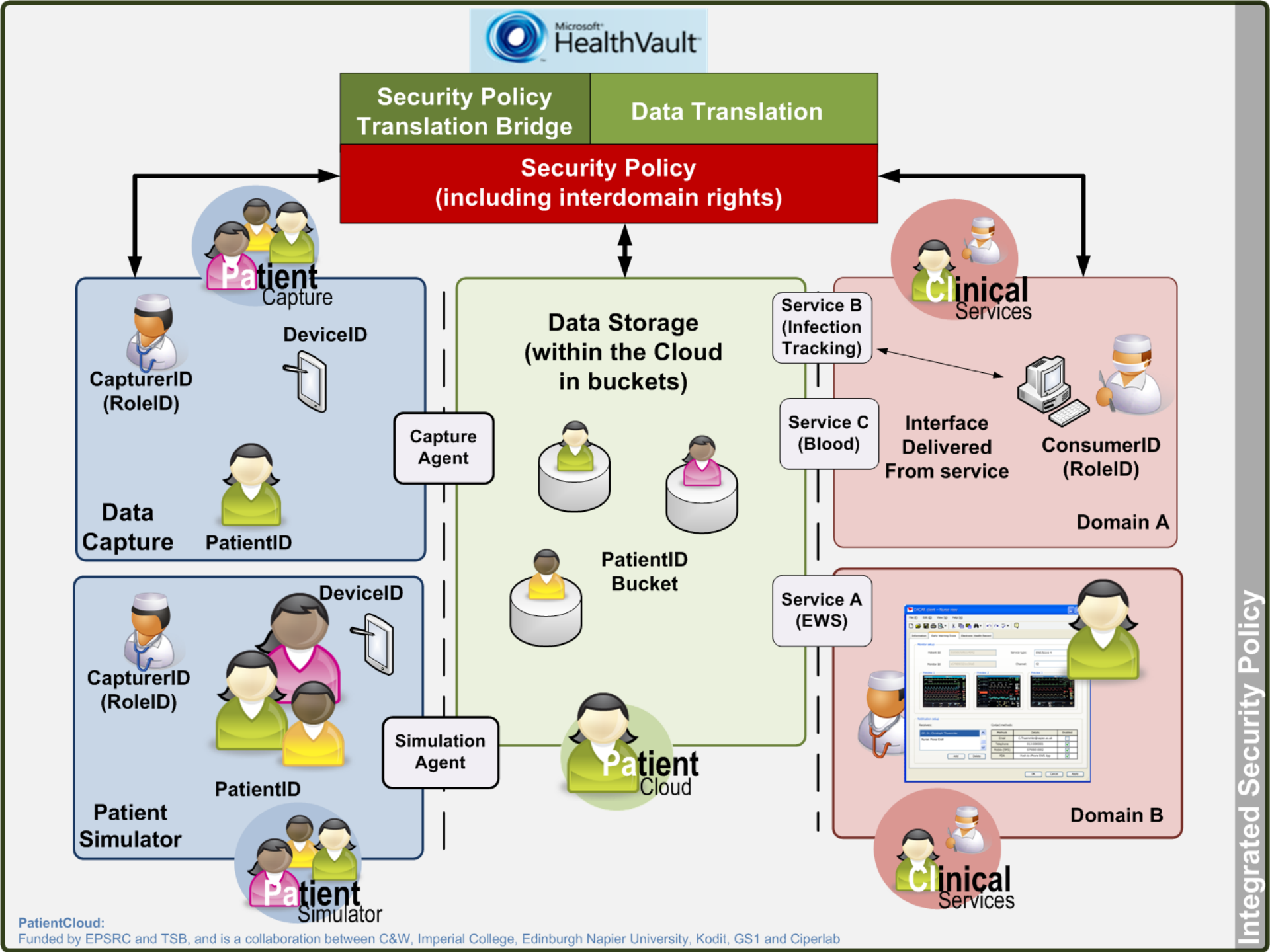

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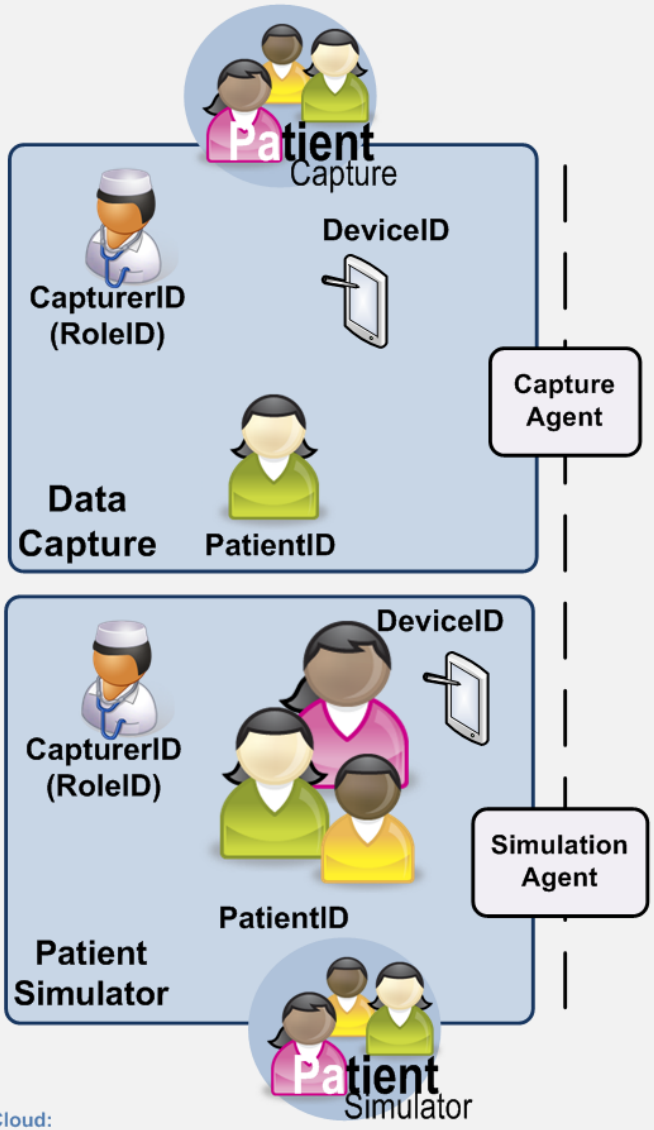

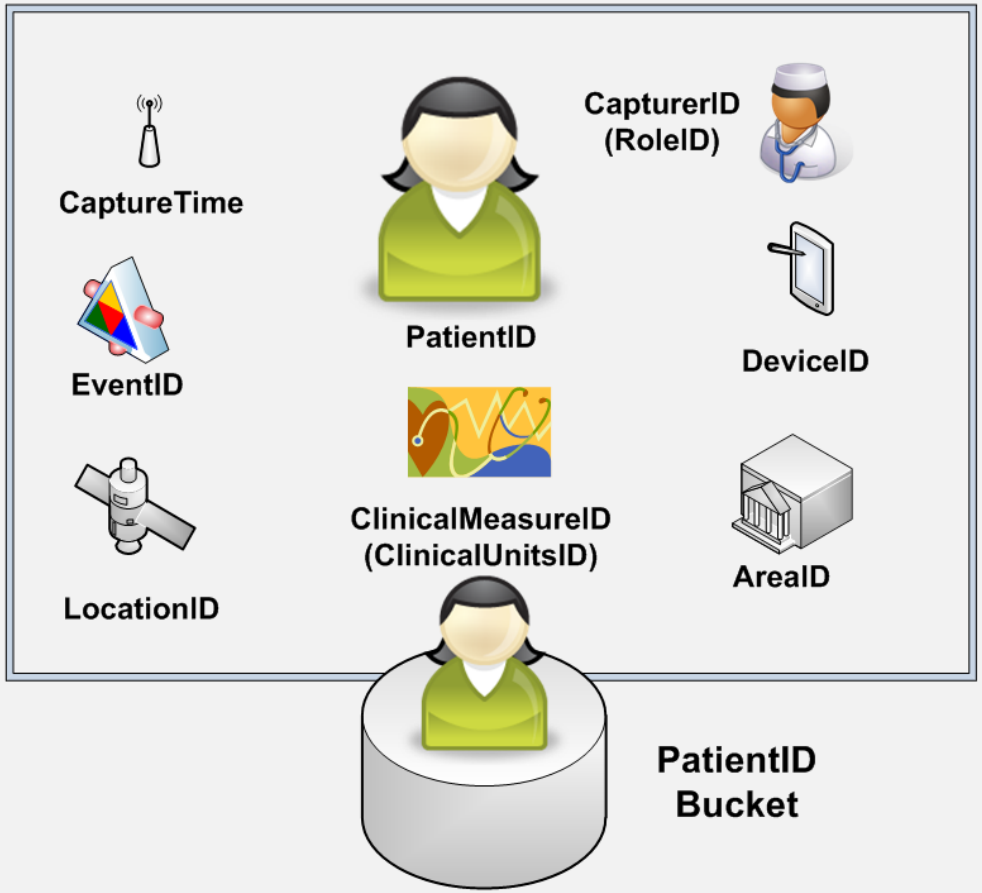

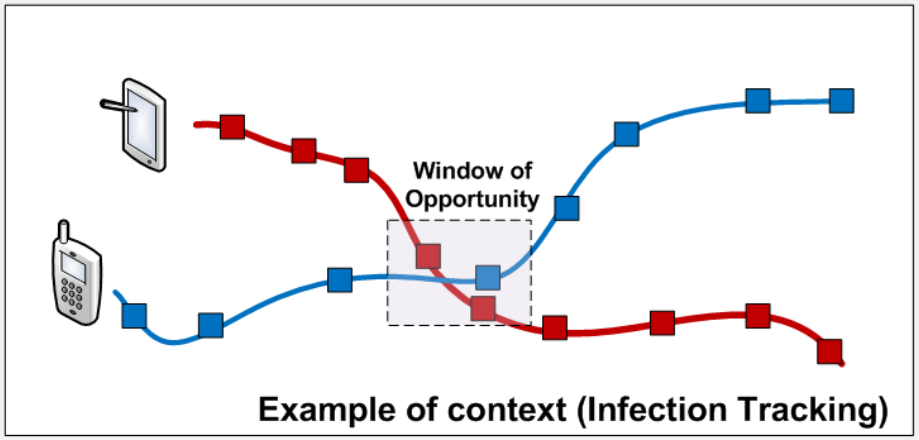

Data Capture Element

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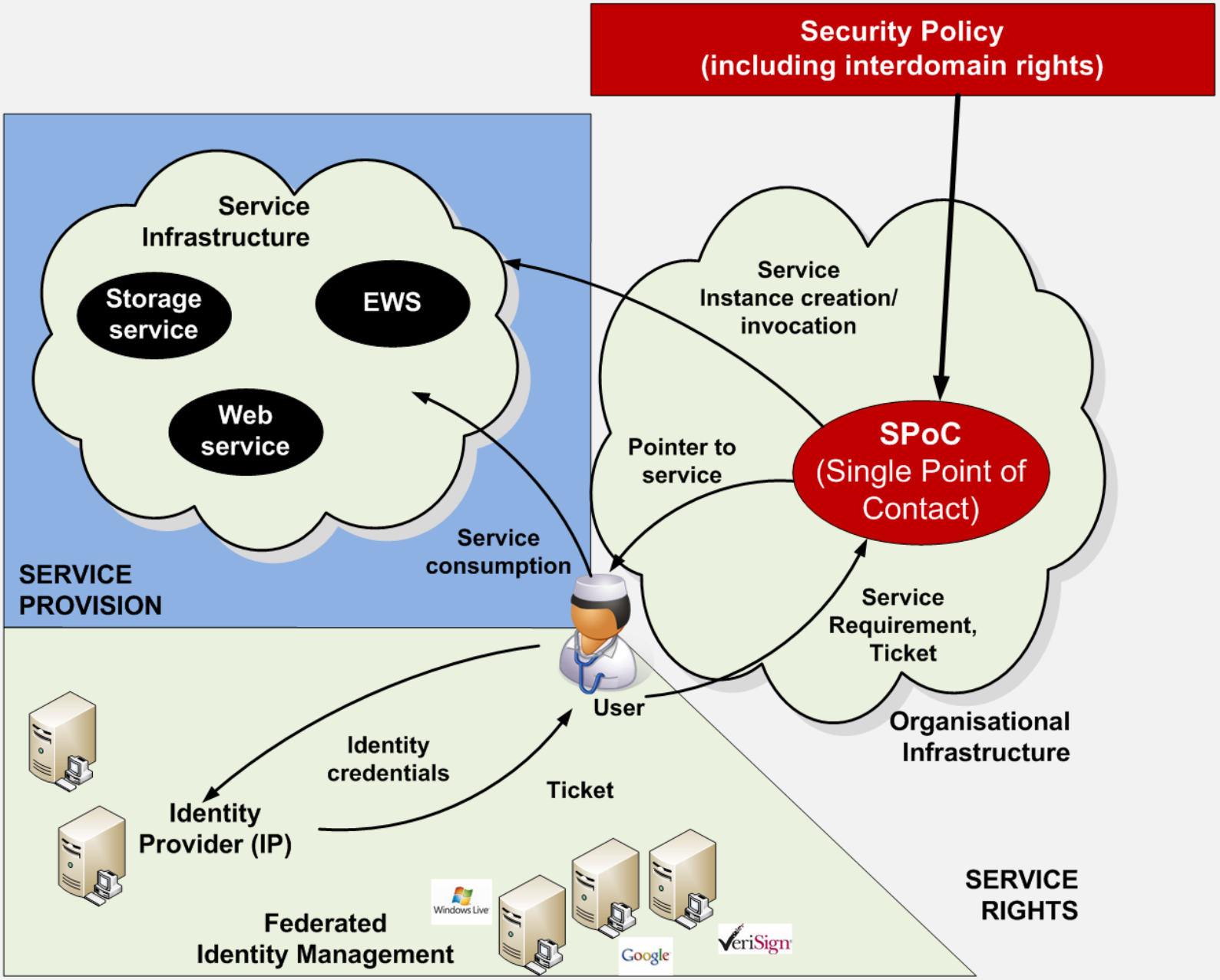

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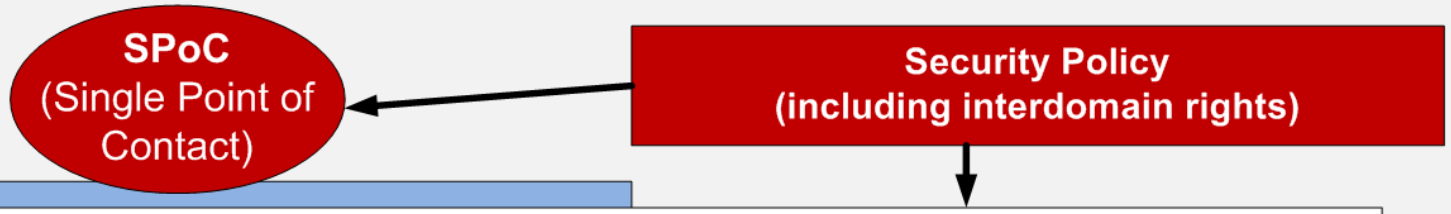


```
[permit] [Medical Staff] [C | R] [Temp | SpO2 | HR | BP | RR | Pain] of [Patient26078] with
[EWS] from [Chelsea & Westminster Hospital] for [*] records in [P2010-12-30T00:00:00] using
[Data Protection Act]

[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.

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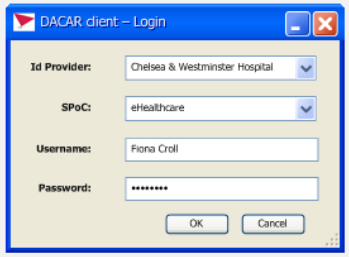

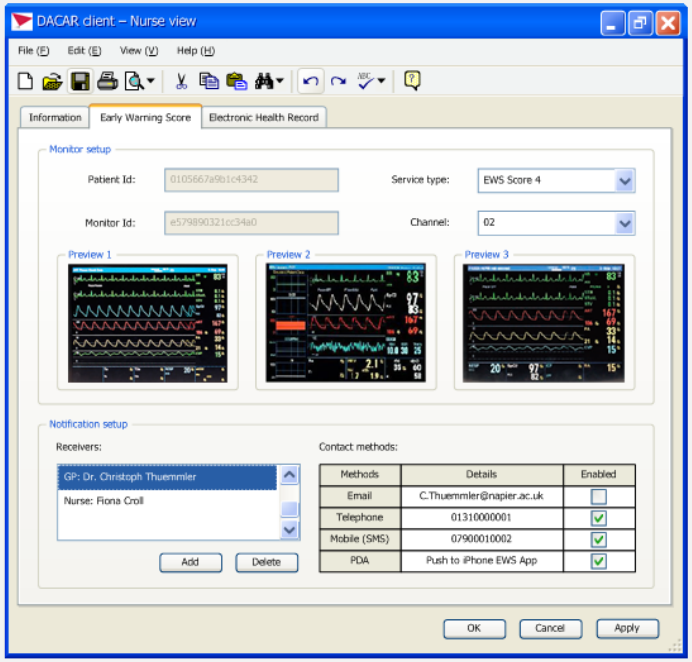

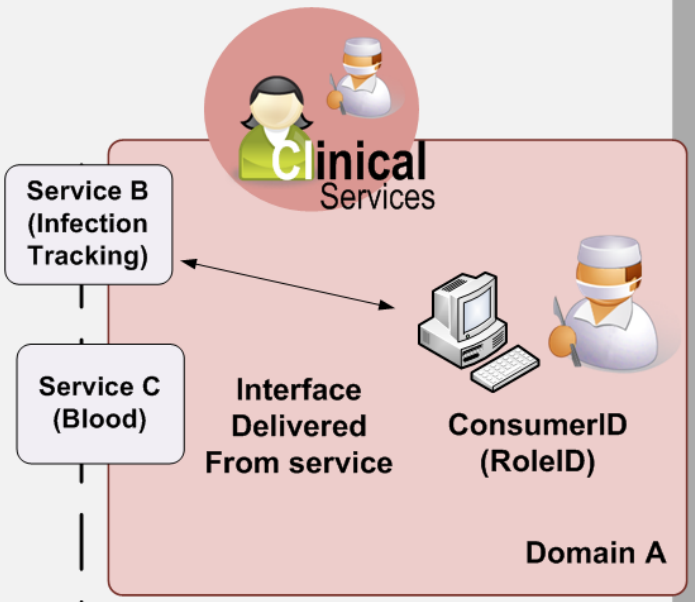

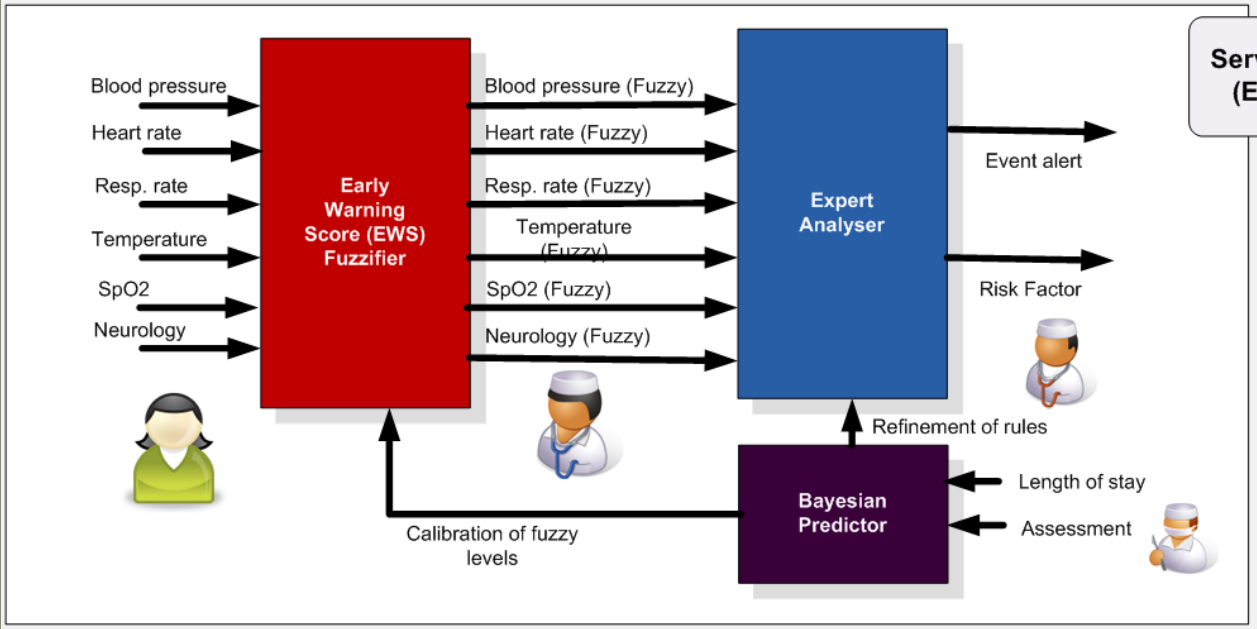

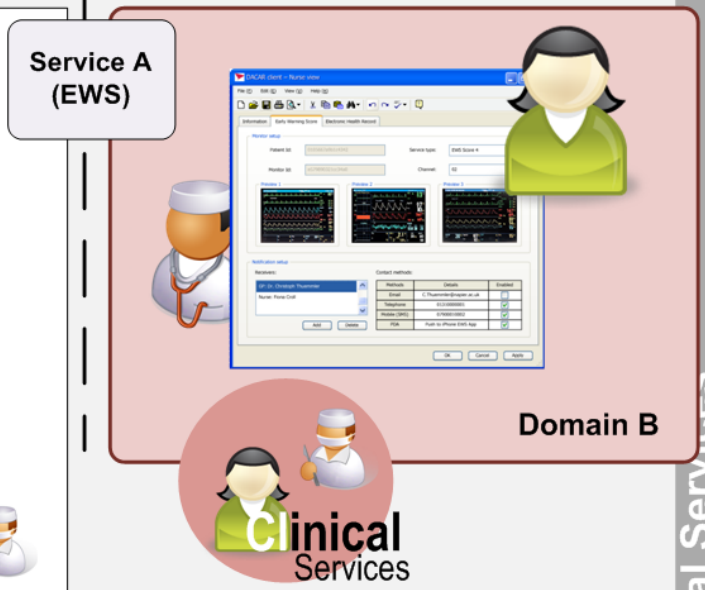

Clinical Services

PatientCloud:
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Patient Simulator

Clinical Services

Service B (Infection Tracking)

Service C (Blood)

Interface Delivered From service

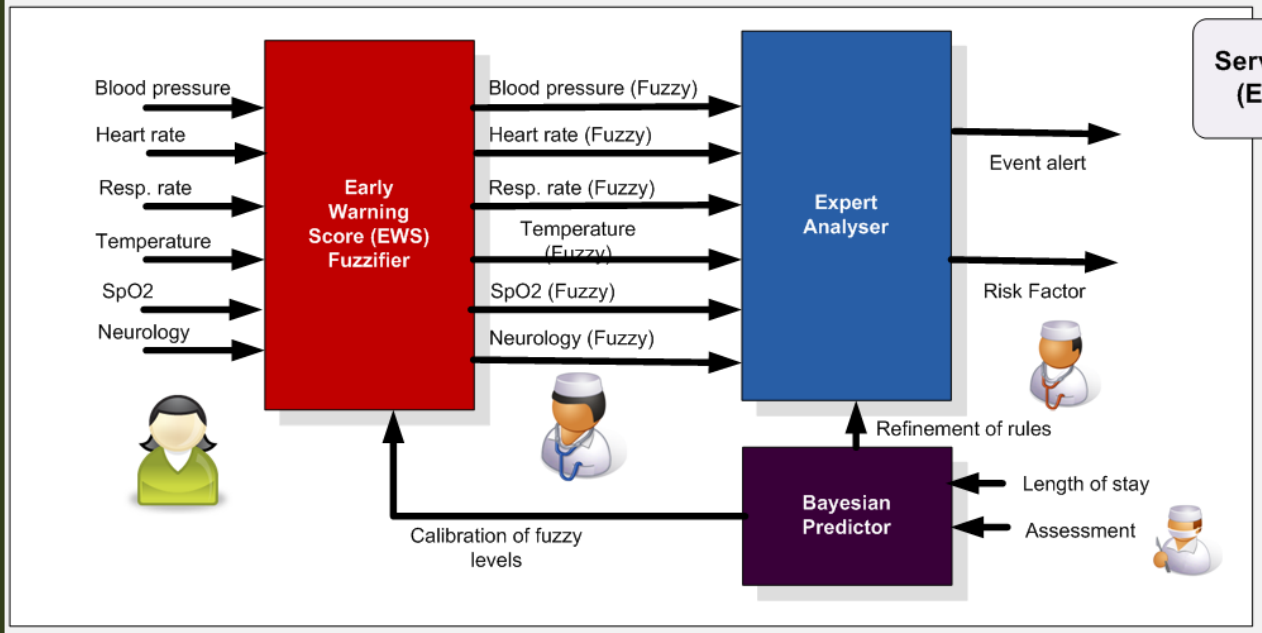
ConsumerID (RoleID)

Domain A

Service A (EWS)

Domain B

Clinical Services



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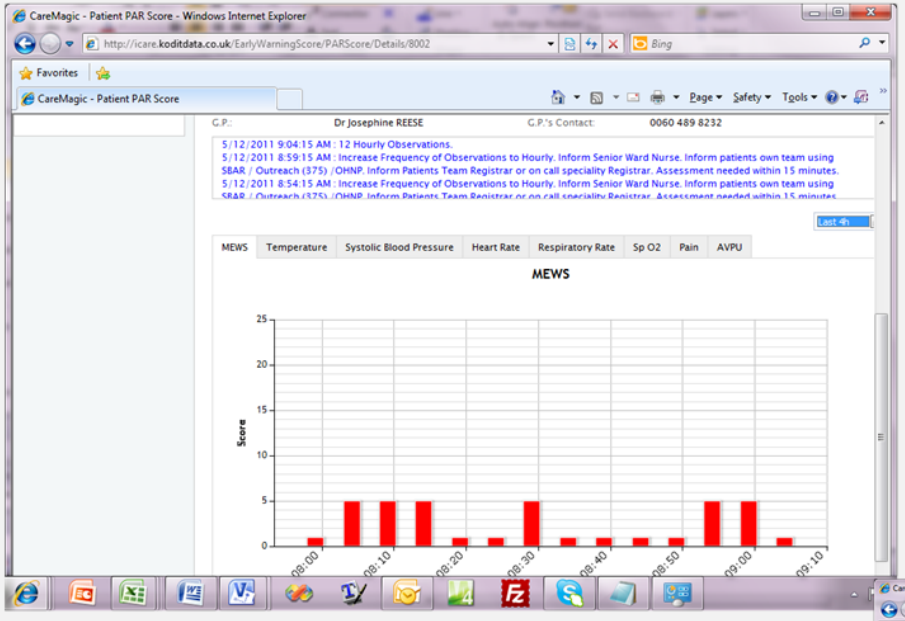

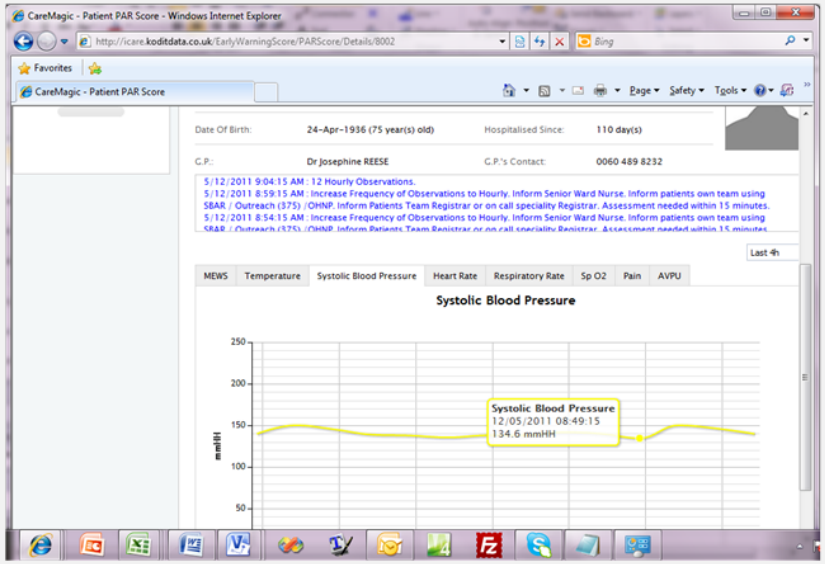

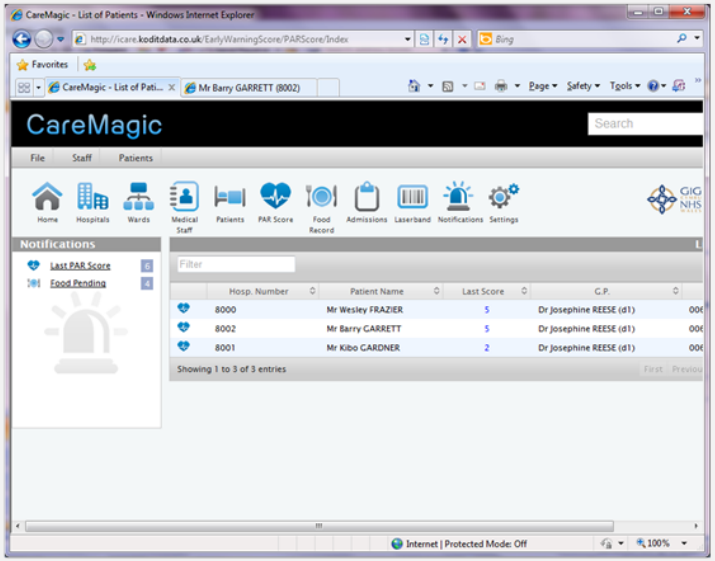

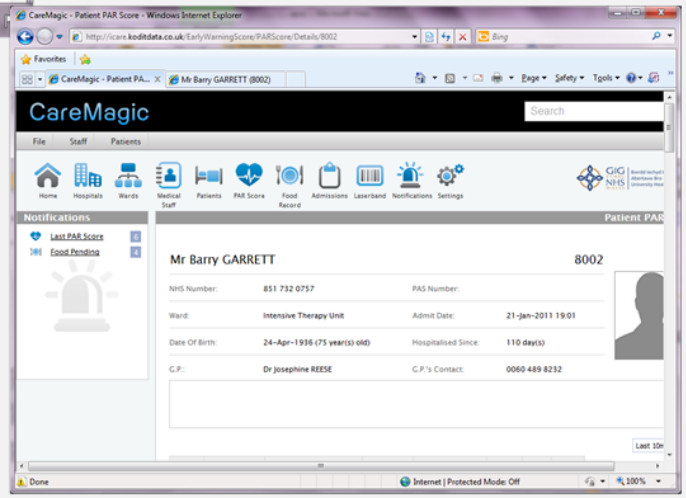

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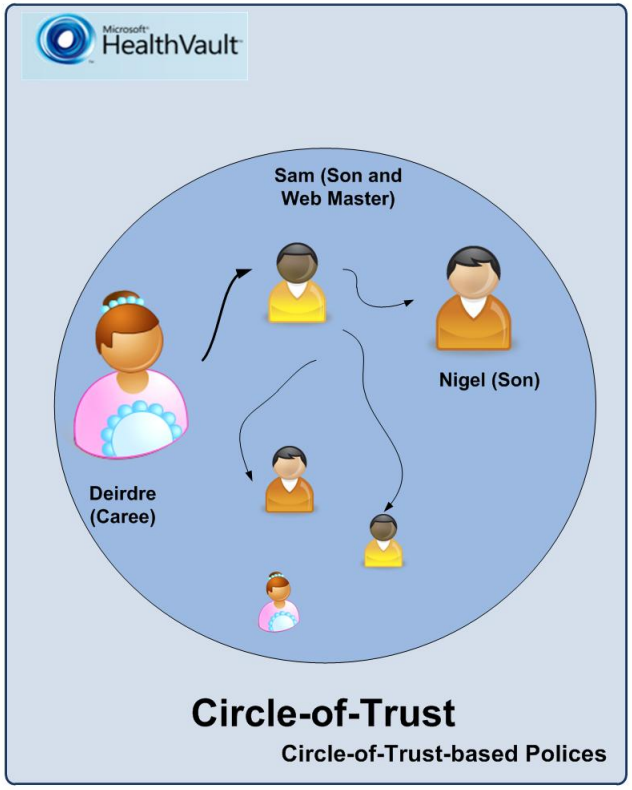
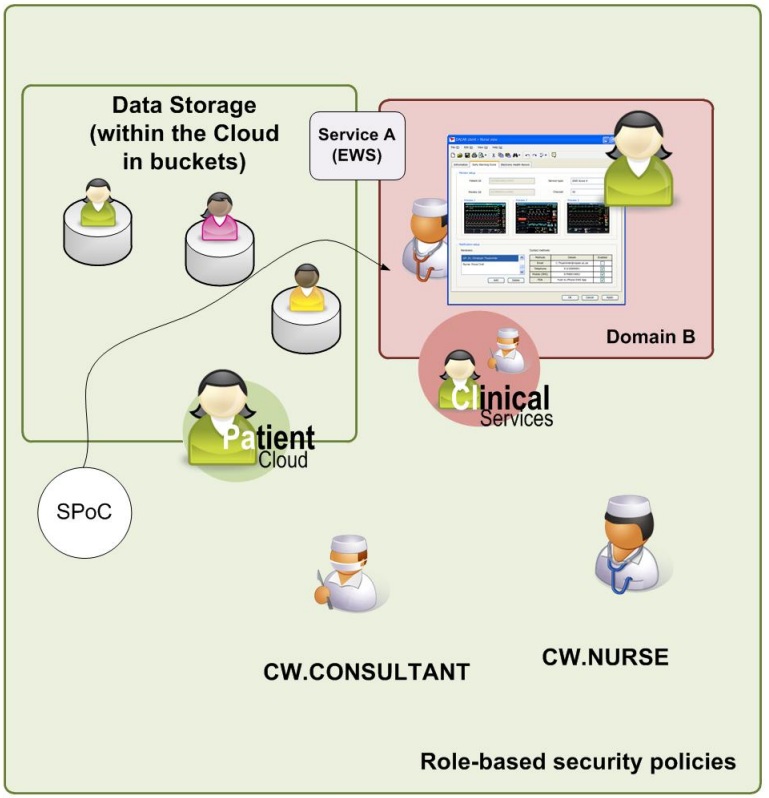
Some screenshots

Assisted Living



Translation Gateway (Security Policy/ ID Mapping)

Primary/Secondary Care



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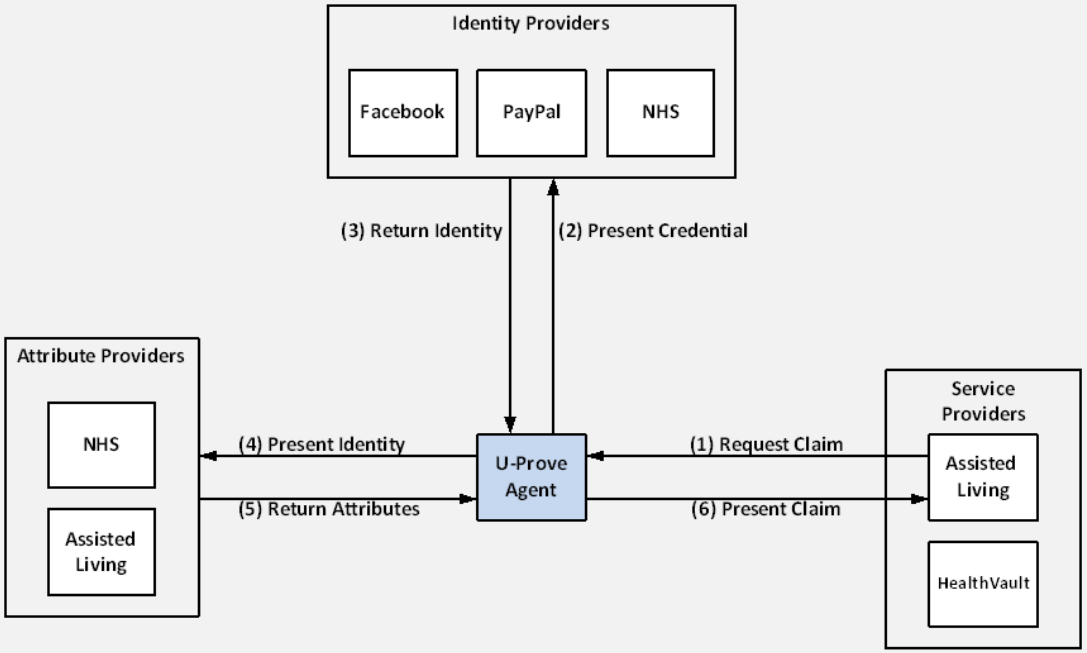

HealthVault

E-Health Platform

CW.CONSULTANT

CW.NURSE

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Technology Strategy Board
Driving Innovation

Alan Bennett

EPSRC
Pioneering research and skills

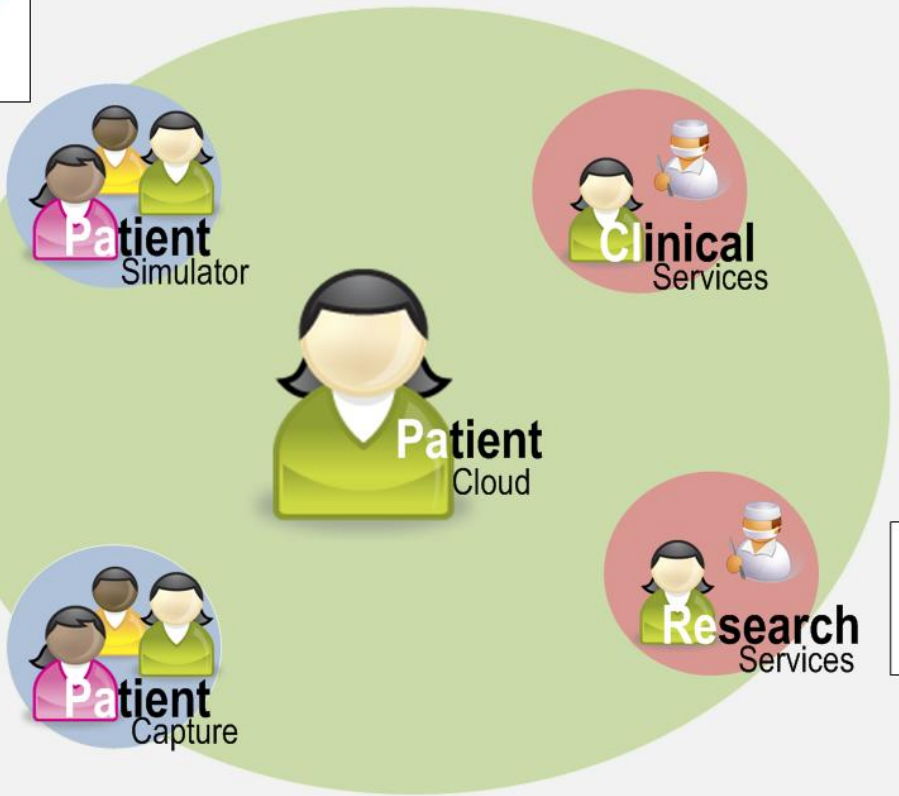
Edinburgh Napier UNIVERSITY

Dr Christoph Thuemmler

Prof Bill Buchanan

Dr Lu Fan

Owen Lo



GS1 UK

Roger Lamb

kodit

Craig Story

Sofyane Khedim

CIPHER LAB

Altaf Sadique

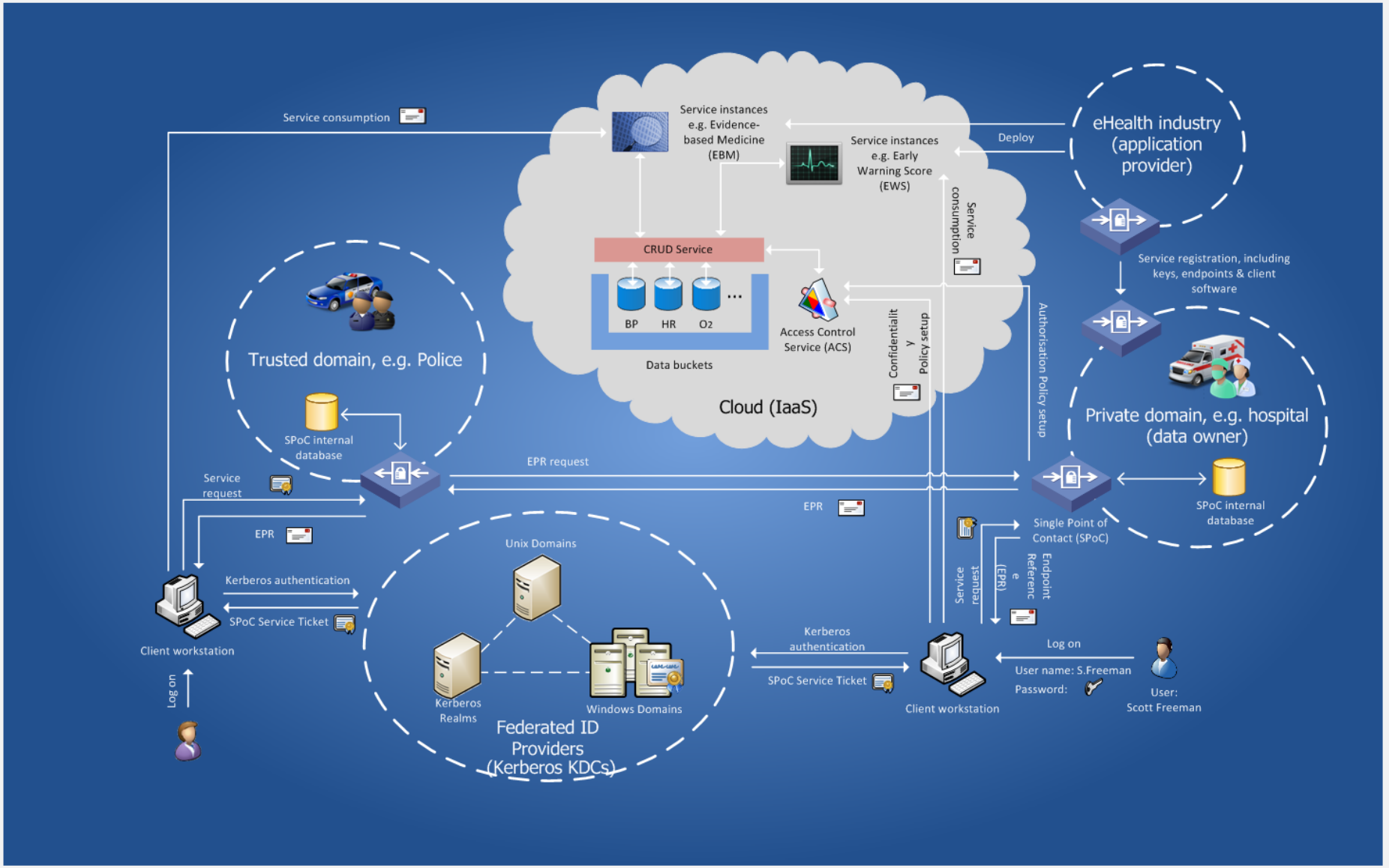
Imperial College London

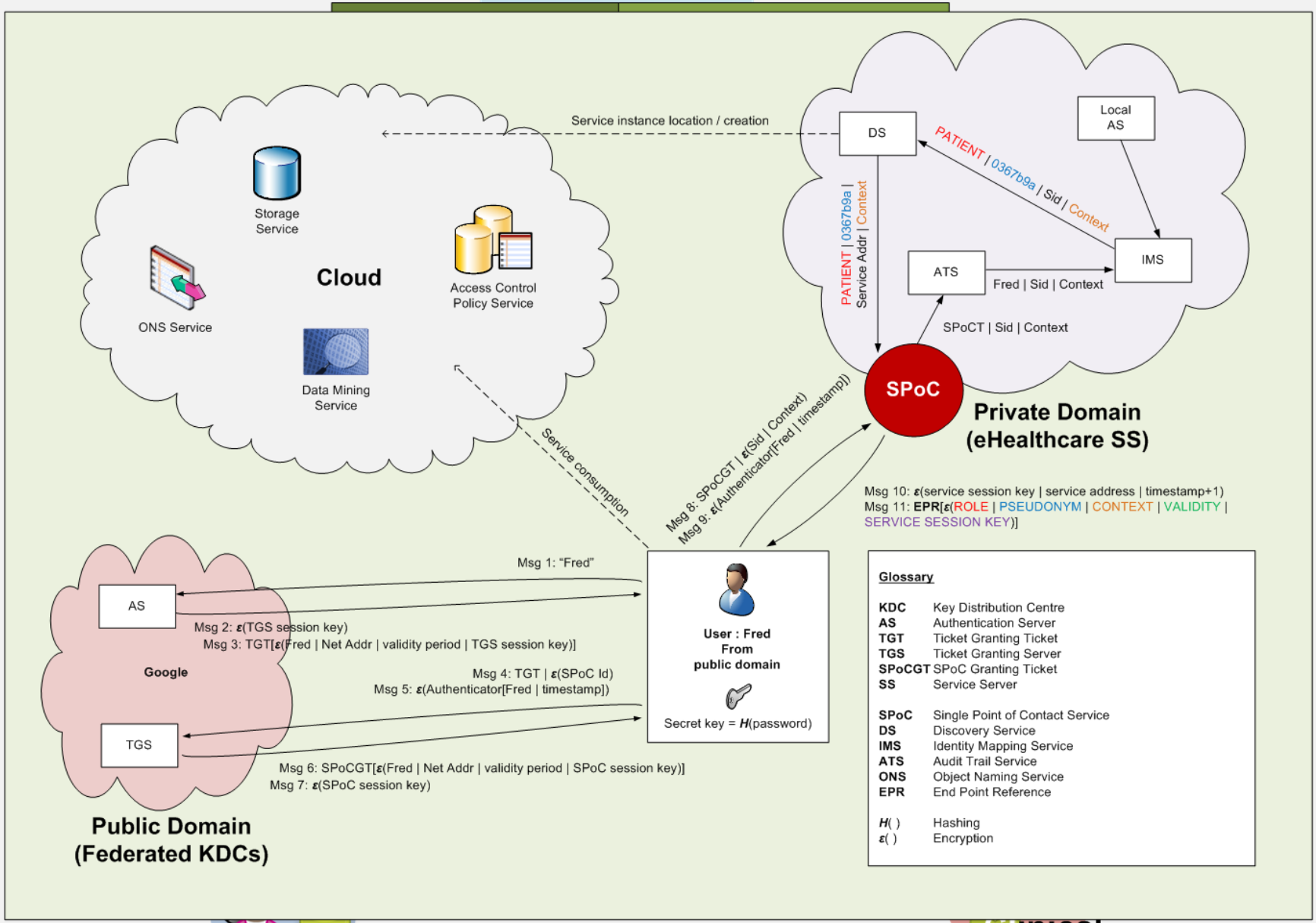
Prof Derek Bell

Ganesh Sathyamoorthy

Chelsea and Westminster Hospital NHS
NHS Foundation Trust

Prof Derek Bell
Tajumal Malik


Service consumption
Service instances e.g. Evidence-based Medicine (EBM)
Service instances e.g. Early Warning Score (EWS)
Deploy
eHealth industry (application provider)
Service consumption
CRUD Service
BP
HR
O2
Data buckets
Access Control Service (ACS)
Confidentiality Policy setup
Authorisation Policy setup
Cloud (IaaS)
Service registration, including keys, endpoints & client software
Trusted domain, e.g. Police
SPoC internal database
Private domain, e.g. hospital (data owner)
SPoC internal database
Service request
EPR request
EPR
EPR
Single Point of Contact (SPoC)
Service request
Endpoint Reference (EPR)
Unix Domains
Kerberos authentication
SPoC Service Ticket
Client workstation
Log on
Kerberos Realms
Windows Domains
Federated ID Providers (Kerberos KDCs)
Kerberos authentication
SPoC Service Ticket
Client workstation
Log on
User name: S.Freeman
Password:
User: Scott Freeman



Patient Simulator

Clinical Services

Integrated Security Policy

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