careful

# CAREFUL: Service Definition

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# Overview

CAREFUL is a digital health solution that supports clinical coordination and allows healthcare teams to deliver patient care through improved communication and collaboration.

The platform brings together real-time messaging, structured handover documentation, patient flow management, and task coordination in a single integrated system. Clinical teams can communicate securely, track patient information across transitions of care, and ensure critical tasks are completed safely.

CAREFUL is supported by AI-powered Ambient Voice Technology that converts clinical conversations into structured documentation, reducing administrative burden and improving the accuracy and completeness of clinical handovers.

## What CAREFUL Does

CAREFUL replaces informal mechanisms of clinical coordination such as conversations, phone calls, emails, spreadsheets and messaging groups. It replaces all of these ubiquitous mechanisms with a secure, reliable, auditable and NHS-compliant clinical communications platform.

It then links this to existing legacy systems to capture previously unaudited or invisible information about patients

The system supports:

| Feature | Description |
|---|---|
| Clinical handover | Between shifts, teams, and locations |
| Secure team messaging | For clinical discussions |
| Patient flow management | Tracking patients through their care journey |
| Referrals and transfers | Between specialties and departments |
| Task management | Ensuring actions are completed and tracked |
| Voice-to-text documentation and task management | Using ambient AI technology |

## Benefits

| Feature | Description |
|---|---|
| Improved safety | Through structured handover and complete audit trails |
| Time savings | 30-60 minutes per clinician per shift |
| Better patient flow | Real-time visibility of patient location and status |
| Reduced administrative burden | Through voice-powered documentation |
| Enhanced collaboration | Across multidisciplinary teams |
| Regulatory compliance | DCB0129, DSPT, Cyber Essentials Plus |

# Capabilities

## Clinical Communications

### Secure Team Chat

Messaging within clinical teams:

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| Real-time push notifications to on-duty staff |
| User mentions (@) and patient references (!) |
| Read receipts and message timestamps |
| Full audit trail of all communications |
| Search and filter capabilities |
| No patient data stored on devices |

### Team-to-Team Referrals

Structured referral workflow replacing phone calls and bleeps:

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| Any team member can create a referral |
| All members of sending and receiving teams can view and participate |
| Accept/reject functionality with audit trail |
| Threaded conversation for discussion |
| Automatic notifications to on-duty clinicians |
| Complete history accessible via activity log |

### Voice-Powered Documentation

AI-powered Ambient Voice Technology (AVT):

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| Listens to clinical conversations during handover |
| Converts speech to structured text in real-time |
| Identifies individual speakers (speaker diarisation) |
| Generates structured SBAR documentation automatically |
| Extracts and creates action items from discussion |
| Reduces handover documentation time by 90% |
| Maintains accuracy through clinician review and editing |

# Patient Information Management

## Dynamic Patient Lists

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|---|
| Real-time patient lists for each team |
| Automatic updates via HL7 ADT feeds from PAS |
| Manual patient search and addition (NHS number, hospital number, name) |
| Patients can belong to multiple teams simultaneously |
| Filters by status, location, time on list |
| Export capabilities for reporting |

## Handover Information

Configurable data fields specific to each team's needs:

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|---|
| Form-based structured data capture |
| SBAR framework support |
| Team-specific clinical indicators |
| Cross-team visibility of handover information |
| Historical record of all changes |
| Integration with EPR where available |

## Patient Status Tracking

Organisation-level status indicators showing patient journey:

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| Configurable status options (e.g., "Ready for discharge", "Awaiting scan") |
| Any team member can update status |
| Real-time visibility to all teams |
| Supports bed management and patient flow |
| Historical status tracking |

## Organisational Fields

Custom fields that follow the patient across teams:

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| Text fields for additional information |
| Switch flags (e.g., DNACPR, infection risk) |
| Risk levels (Red, Amber Green) with reasons |
| Configurable by administrators |
| Visible to all teams caring for patient |
| Supports cohort identification |

## Task & Action Management

### Task Assignment and Tracking

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| Specific task allocation to named individuals |
| Tasks transfer with handover process |
| Real-time visibility of outstanding actions |
| Completion tracking with timestamps |
| Reassignment capabilities |
| Notification on assignment and completion |
| Tasks visible across teams for continuity |

### The Handover Process

Formal transfer of responsibility between clinicians:

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| Outgoing clinician hands over patients and tasks |
| Incoming clinician accepts responsibility |
| All tasks and visible responsibility transferred to new clinician |
| Prevents loss of critical actions at shift change |
| Complete audit of handover transaction |

# Clinical Governance support

## Comprehensive Audit Trail

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|---|
| Every transaction logged with timestamp and user attribution |
| Activity log visible at patient, team, and organisation level |
| Immutable record for incident investigation |
| Supports clinical governance and quality improvement |
| Compliance with NHS record-keeping standards |

## Notes and Clinical Documentation

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|---|
| Timestamped clinical observations and decisions |
| 15-minute edit window for corrections |
| All subsequent changes tracked in audit log |
| Two-way synchronisation with EPR where configured |
| Supports contemporaneous documentation requirements |

# Technical Architecture

## Cloud Infrastructure

CAREFUL runs by default on Microsoft Azure Kubernetes Service (AKS) in Azure UK South datacenter. Other public and private cloud providers can be provisioned as required.

### Architecture Layers

| Feature | Description |
|---|---|
| Protection Layer | Azure Front Door with WAF, DDoS protection, Azure Standard Load Balancer, NGINX Ingress with TLS termination and rate limiting |
| Compute Layer | Microservices for API, Web, Notifications, Real-time messaging, integration and caching |
| Messaging Layer | MQ service Bus for managed message queuing with dedicated queues for API, chat, integrations, and notifications |
| Data Layer | Primary database and subsidiary data stores; zone-redundant HA, automatic backups,  file storage |

### High Availability

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| Deployment across three Availability Zones in UK South |
| Kubernetes health probes every 10 seconds |
| Automatic container restart on failure (typically <30 seconds) |
| Azure SQL and PostgreSQL with zone redundancy |
| 99.95% uptime SLA from Azure |

### Auto-Scaling

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| 3 nodes minimum, expanding to 11 nodes at 50% utilisation |
| Independent scaling per microservice |
| Managed by Kubernetes horizontal pod autoscaling |

## Disaster Recovery

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| Automatic backups with point-in-time recovery |
| Immutable event log allows reconstruction |
| Cross-region backup for business continuity |

# Security

## Defence-in-Depth (Five Layers)

| Feature | Description |
|---|---|
| Edge Protection | TLS encryption and WAF at Azure Front Door |
| Network Security | Private pod networking with service isolation |
| Identity & Access | Kubernetes RBAC with Azure Managed Identity (no stored credentials) |
| Secrets Management | Azure Key Vault with automatic synchronisation |
| Data Protection | Encryption at rest, SSL-enforced database connections |

## Data Residency

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|---|
| All data processed and stored exclusively in UK datacenters |
| No data transfer outside UK jurisdiction |
| Compliant with UK GDPR and NHS data requirements |

## Monitoring & Response

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| Azure Monitor and Container Insights |
| Log Analytics for infrastructure observability |
| Sentry.io for application error tracking |
| Prometheus for Kubernetes health monitoring |
| Health alerts integrated into Slack for rapid response |

# Integration Capabilities

CAREFUL uses MIRTH Connect, a widely-deployed open-source healthcare integration platform supporting HL7v2 and FHIR for direct and loss-free integration via secure messaging,, including for ADT and medication alerts.

## Integration Architecture

| Feature | Description |
|---|---|
| Inbound ADT Feed | Trust PAS sends HL7 ADT messages (A01 admit, A02 transfer, A03 discharge, A08 update) to MIRTH Connect via secure VPN |
| MIRTH Rules Engine | Parses each message and applies configurable routing rules. Location-to-team mapping maintained in MIRTH lookup tables |
| CAREFUL API Calls | MIRTH calls CAREFUL REST API to add/remove patients from teams |
| RabbitMQ Queuing | Ensures no messages lost during high-volume periods |
| Manual Patient Lookup | Direct API lookup to PAS for patients not admitted via ADT (outpatients, quality follow-up cohorts) |

## EPR Integration

CAREFUL has established relationships with EPR vendors to support:

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| Direct integration within EPR interface |
| Single sign-on via ADFS/Microsoft Entra ID |
| Two-way synchronisation of clinical notes |
| Context-aware patient selection |

## Direct API Access

RESTful API via suitably secure VPN available by authenticated systems for:

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|---|
| Data extract for Business Intelligence teams |
| Integration with local systems |
| Custom reporting and analytics |
| Export formats: JSON, XML, SQL |
| Available to qualified IT departments through Level 2/3 support |