HSCN Quality of Service (QoS) Policy

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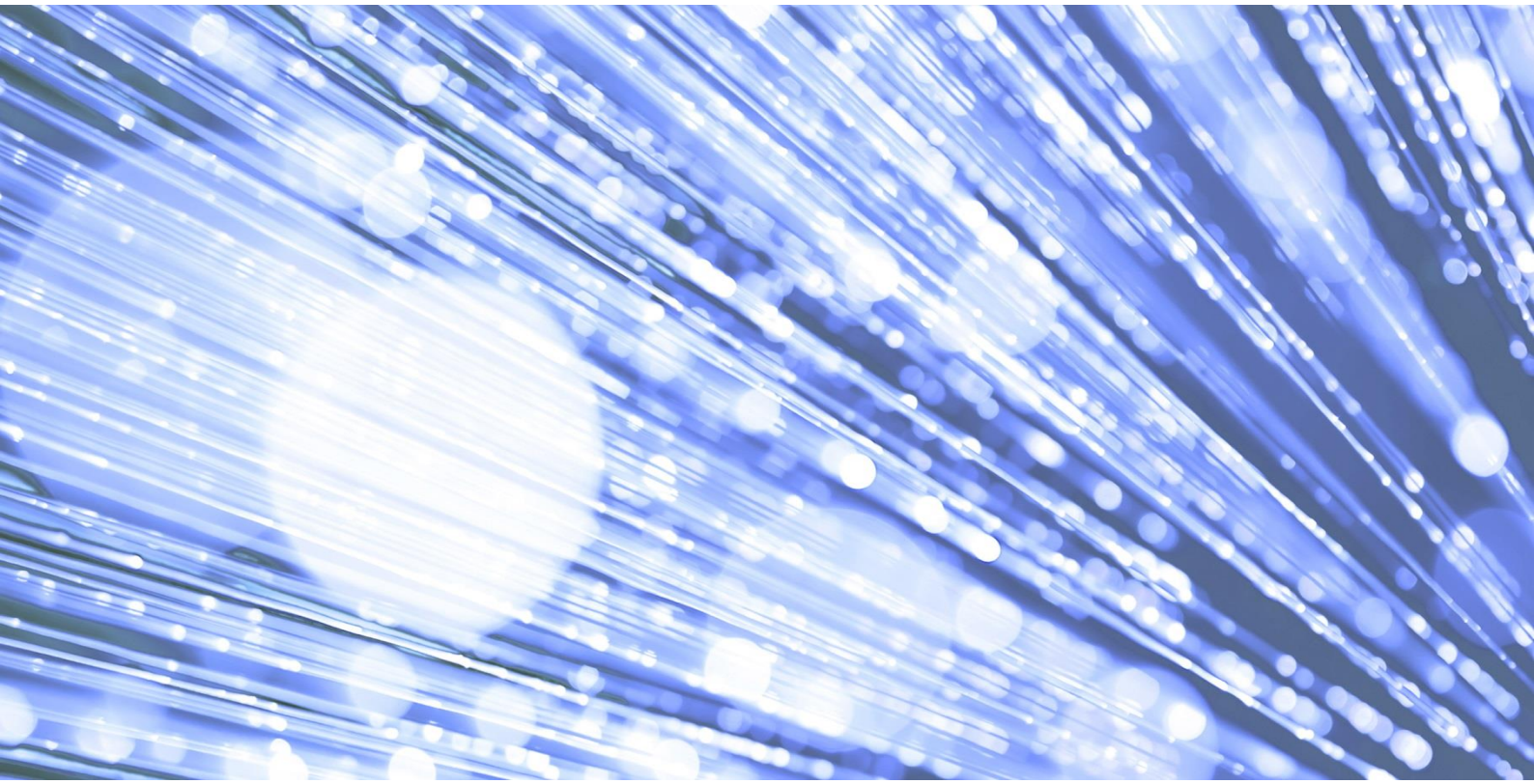

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1 Introduction

1.1 About this document

This document sets out the Quality of Service (QoS) policy for the Health and Social Care Network[1] (HSCN), including the Transition Network (TN) service.

This QoS Policy shall be adopted by:

- All HSCN network service providers;
- All providers of applications services hosted on the HSCN, including providers of local as well as national applications;
- All consumers of HSCN network connectivity services and local or national applications.

This is to ensure that network traffic is marked and correctly end-to-end and 'protected' in the event of network congestion. Please refer to the section on QoS Configuration Change Requests for details of the overall process and responsibilities of stakeholders in ensuring that the QoS Policy is applied.

1.2 Overview

The HSCN Programme delivers new and significantly different network services for health and social care as part of its remit to provide successor services to the N3 network. Essentially, HSCN creates the effect of a single network across health and social care providers and their partners. All health and social care organisations in England are within scope of the HSCN solution, which supports the enablement of an integrated care delivery service.

The TN provides a platform for continuation of services previously contracted under the N3 agreement. This service is managed as part of the HSCN Programme and is delivered by BT. The TN will be managed

[1] HSCN Overview: https://digital.nhs.uk/health-social-care-network

as a ‘run-down’ service and will be provided for the minimum period required to migrate services to HSCN.

The HSCN QoS policy and operational processes ensure that the main structure of traffic flows and services/applications that require protected throughput via QoS are maintained and follow current guidelines.

2 Principles and Design of HSCN QoS

2.1 Differentiated Service (Diffserv)

The Internet Engineering Task Force (IETF) recognised the need for a:

“*Relatively simple and coarse methods of providing differentiated classes of service for Internet traffic, to support various types of applications, and specific business requirements. The differentiated services approach to providing quality of service in networks employs a small, well-defined set of building blocks from which a variety of aggregate behaviours may be built”*[2]

The Policy mandates that the HSCN and the TN suppliers adopt the IETF standards-based ‘*diffserv*’ model[3] to optimise use of bandwidth. This model does not reserve bandwidth for specific applications on demand between points in the network, but instead it acts by aggregating traffic of similar character.

[2] IETF Differential Services Charter - https://datatracker.ietf.org/doc/charter-ietf-diffserv/
[3] IETF RFC2474 and RFC2475

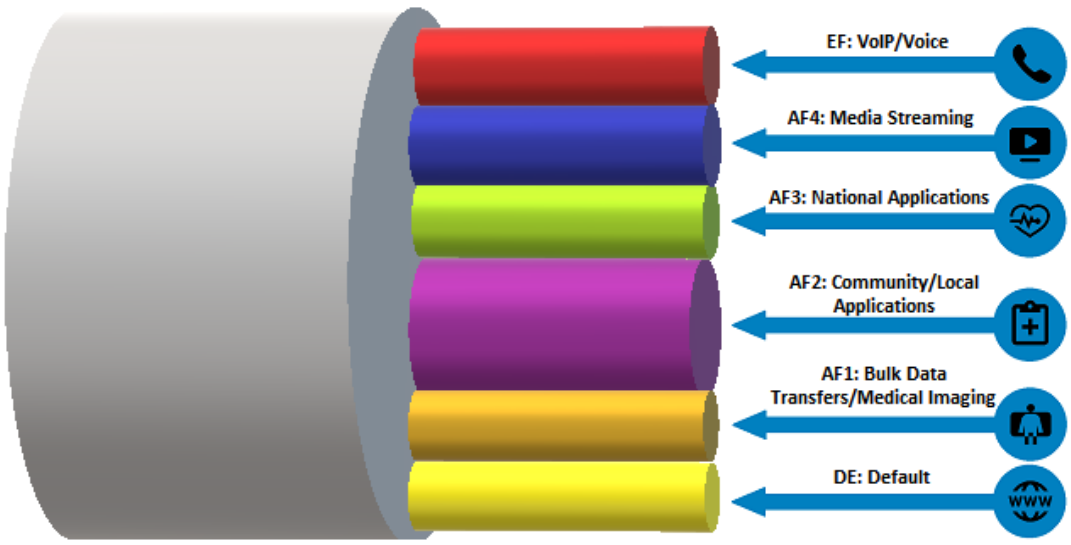

Figure 1 – Graphical representation of how QoS classes are configured for HSCN

- A specified group of applications can be guaranteed a minimum throughput, in the event of network congestion;
- Using appropriate router queuing mechanisms it is possible to guarantee real-time traffic (such as VoIP) low-latency across the network; and
- Aggregating flows from a number of devices gives an optimal benefit in application-level performance at minimum router overhead.

Fundamentally *diffserv* operates by segmenting traffic into a number of classes. At each point in the network a 'Per Hop Behaviour' (PHB) is applied to the data traffic. There will be a small number of these behaviours defined at each point in the network.

Diffserv uses the following nomenclature to describe the three different kinds of PHBs:

- Expedited Forwarding (EF) is used for traffic which requires a low latency through the network. This is typically used for real time applications, such as Voice over IP (VoIP)
    - The HSCN QoS policy (i.e. 6 layer QoS – based on Diffserv Expedited Forwarding) is complaint with industry QoS standards;

- Assured Forwarding (AF) is used to give a minimum guaranteed bandwidth to an application (or group of applications). This is typically used for business applications which need a guaranteed throughput to function correctly; and
- Discard Eligible (DE), also known as Best Effort (BE), is used to carry applications not allocated to EF or AF classes, and is the default PHB.

2.2 End-to-end QoS and HSCN multiple network providers

Given the multi-supplier model under which the HSCN is provided it is important that all network suppliers adhere to the requirements of this policy to ensure application traffic is protected appropriately in both directions. For QoS to operate effectively and 'end-to-end', QoS markings need to be applied to traffic (packets) by the routers at the communicating end nodes e.g. the application provider site, data centre etc., and the end-user, customer site. Moreover, the QoS markings need to be 'honoured' (e.g. recognised and put in to effect) at all appropriate points in between the communicating end nodes to ensure that the application traffic is protected in the event of network congestion.

This Policy mandates that all network providers (CN-SPs and TN-SP) configure end node CPEs appropriately and apply the required per-hop behaviour to packets at all points in the network.

3 QoS Policy Guidelines

3.1 CPE QoS Deployment Model

3.1.1 Traffic Classification

Unless negotiated separately, the TN-SP and HSCN CN-SP's will classify traffic based on:-

- Source and/or destination IP address or

- Source and/or destination IP address and TCP or UDP Port Number

In particular, IP addresses or ranges will be used. It is the responsibility of the application service providers to maintain, and provide via the appropriate change control mechanism, an exhaustive list of IP address ranges and TCP, UDP port numbers to the TN supplier and HSCN CN-SPs for all traffic that requires allocation to QoS classes other than DE.

3.1.2 Per-Class Bandwidth

The HSCN QoS model uses ‘percentage based policing’ to determine the minimum guaranteed bandwidth for each QoS class in the event of network congestion. This provides the ability to configure traffic policing and traffic shaping on the basis of a percentage of the total bandwidth available on an interface.

The six-layer QoS model for HSCN will initially adopt the per-class percentages previously contracted under the N3 agreement. The per-class percentages are shown in the table below. Note that this is under review and may be subject to change.

Class	% of CDR
EF	10%
AF1	5%
AF2	7.5%
AF3	30%
AF4	7.5%
DE	39%
Management	1%

3.1.3 Applications in multiple QoS Classes

In some cases the QoS policy allocates specific applications to two or more classes depending on transaction type, e.g. applications that are both transactional and require bulk transfer. It is the responsibility of the application service providers to develop solutions that enable the TN-SP and HSCN CN-SPs to identify traffic by transaction type for these applications. Traffic for these applications that cannot be correctly identified will be allocated to the DE class.

3.1.4 QoS for backup connections

Where customers purchase secondary (back-up) links, the TN-SP and HSCN CN-SPs will apply the same six layer QoS configuration on the secondary link as the primary link.

3.1.5 DSCP traffic mappings for TN and HSCN traffic

The TN-SP and HSCN CN-SPs will use the standard Differentiated Service Code Point (DSCP[4]) mappings. It will implement a single EF queue, four AF queues and a single Default DE queue. The queues will be assigned as follows:

EF is used solely to transport **VoIP** traffic.

AF4 is used for Internal **Media Streaming Applications** and for VoIP signalling.

AF3 is used for **National Transactional Applications**. National Applications are centrally hosted and/or contracted by NHS Digital. The term transactional refers to the way in which the application operates, for example, transaction-orientated applications are typically used for data entry and retrieval transaction processing on a database management system or similar software application.

AF2 is used for **Community/Local Transactional Applications**.

AF1 is used for applications that perform **Bulk File Transfers**.

3.1.6 QoS Reporting

The CN-SP's solution shall be capable of reporting traffic utilisation per Class of Service and logical connection.

4 QoS Configuration Change Requests

This section details the processes to be followed by consumers of TN and HSCN services and National Application providers to request a change to a QoS configuration. The majority of requests for changes to QoS configurations will relate to a particular application and the source/destination IP addresses and/or the 'TCP/UDP Port Numbers' used to assign traffic to a specific QoS layer. This Policy document and supporting guidance and forms refer to these requests as 'QoS Application Change Requests'. Such change requests may include:

- Add new IP addresses and/or port numbers to a specific QoS Class of Service for a new or existing application/service
- Remove or make changes to existing IP addresses and/or port numbers for an application

[4] DSCP is defined in IETF RFC 2474

- Re-assign an application (IP address and/or port number) to a different Class of Service

4.1 QoS Application Change Requests

4.1.1 AF3

The AF3 Class of Service is reserved for national transactional applications. National applications are those that are centrally hosted and/or contracted by NHS Digital. The term transactional refers to the way in which the application operates, for example, transaction-orientated applications are typically used for data entry and retrieval transaction processing on a database management system or similar software application.

All QoS Application Change Requests to the AF3 class of service must be submitted to NHS Digital via the formal process defined on the HSCN Technical Guidance web pages.

4.1.2 National Applications

National applications are those that are centrally hosted and/or contracted by NHS Digital. There are a number of national applications that make use of QoS classes other than AF3.
All QoS Application Change Requests from national application providers, applicable to any class of service, must be submitted to NHS Digital through the formal process defined on the HSCN Technical Guidance web pages.

4.1.3 EF and non-protected AF QoS classes

The Expedited Forwarding (EF) QoS class is reserved solely for real-time applications and services such as VoIP. The Assured Forwarding QoS classes other than AF3 are designed to be used for different types of applications e.g. AF1 for bulk transfer; AF2 for local/community applications; and AF4 for voice signalling purposes and media streaming applications such as video conferencing.

All QoS Application Change Requests applicable to these classes of service, from organisations that **do not** provide national applications, should be submitted to your network service provider. For HSCN connected customers this will be your CN-SP. TN connected customers should contact the BT Helpdesk, details are published on the HSCN web site.

4.2 Other QoS Change Requests

If you need to request a change to a QoS configuration that is not covered by the sections above please refer to the formal process defined on the HSCN Technical Guidance web pages.

4.3 End-to-end QoS configuration

Following the approval of a QoS Application Change Request there are a number of important steps that the application provider and their customers must follow. This is to ensure that QoS markings are applied correctly to traffic originating at both the provider and customer end points. Therefore, data packets will be marked correctly and the required minimum bandwidth for traffic in both directions will be guaranteed in the event of network congestion.

4.3.1 National Application Providers and their customers

Following the approval, by NHS Digital, of a QoS Application Change Request from a national application provider the following steps must be completed:

- The national application provider must submit a request to their CN-SP (or TN-SP) for the change to be applied to the CPE at the site(s) at which the application is hosted (e.g. data centre)
- The national application provider must inform all customers that the QoS configuration change has been actioned and provide details of that new configuration
- Customer organisations are responsible for submitting a QoS Application Change Request to the network service provider for all sites at which users of the particular application are located. This is to ensure that the required QoS markings are applied to traffic from the end-user sites
- NHS Digital will maintain a ‘master’ list of national application QoS configurations and upon approval of a change request this list will be updated and shared with all network service providers. The master list must be used by network service providers to configure their systems to honour/preserve QoS markings applied to traffic that passes between provider networks

4.3.2 Other Application Providers and their customers

This section applies to change requests to classes other than AF3 (EF and non-protected AF QoS classes) from application suppliers and

organisations that provide ‘local’ or regional applications. For these changes, the requesting organisation must submit the QoS Application Change Request directly to their network service provider. Once this has been approved by the network service provider, the requester organisation must:

- Inform all customer (end-user) organisations that the QoS configuration change has been actioned and provide details of that new configuration
- Customer organisations are responsible for submitting a QoS Application Change Request to the network service provider for all sites at which users of the particular application are located. This is to ensure that the required QoS markings are applied to traffic from the end-user sites

Glossary of Terms

Term / Abbreviation	What it stands for
AF	Assured Forwarding. Described in IETF RFC 2474.
CN-SP	Central Network Service Provider – a supplier of HSCN services.
CoS	Class of Service - Provides relative performance across a network.
CPE	Customer Premises Equipment. CPE is telecommunications hardware located at the customer premises.
DE	Discard Eligible. Also known as 'Best Effort'. Described in IETF RFC 2474.
DSCP	Differentiated Service Code Point. Described in IETF RFC 2474.
EF	Expedited Forwarding. Described in IETF RFC 2474.
HSCN	Health and Social Care Network. The successor service to the N3 network.
IETF	Internet Engineering Task Force. Not for profit organization established by the Internet community.
PHB	Per Hop Behavior. Described in IETF RFC 2474.
PoP	Point of Presence - Geographical network access point that connects to core network services or ISP.
PSN	Public Services Network - The PSN is the government's high-performance network, which helps public sector organisations work together, reduce duplication and share resources.
QoS	Quality of Service – QoS refers to the capability of a network to provide better service to selected network traffic.
TN	Transition Network - Continuation of services to assist migration to HSCN.
TN-SP	Transition Network Service Provider.
VPN	Virtual Private Network.

VoIP	Voice over IP (Internet Protocol).