

# CUDB Deployment Guide

## User Guide

## **Copyright**

© Ericsson AB 2016-2018. All rights reserved. No part of this document may be reproduced in any form without the written permission of the copyright owner.

## **Disclaimer**

The contents of this document are subject to revision without notice due to continued progress in methodology, design and manufacturing. Ericsson shall have no liability for any error or damage of any kind resulting from the use of this document.

## **Trademark List**

All trademarks mentioned herein are the property of their respective owners. These are shown in the document *Trademark Information*.



# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Purpose and Scope	1
1.2	Target Groups	1
1.3	Revision Information	1
1.4	Typographic Conventions	3
<b>2</b>	<b>Overview</b>	<b>4</b>
<b>3</b>	<b>Deployment Considerations</b>	<b>5</b>
3.1	IP Transport Network Considerations	5
3.2	Geographical Redundancy Considerations	5
3.3	CUDB Site and Node Number Considerations	6
3.4	CUDB Node Distance Considerations	8
3.5	Virtual Deployment Considerations	9
<b>4</b>	<b>CUDB Deployment Examples</b>	<b>10</b>
4.1	Example Networks Dimensioned with 5 DSGs	10
4.2	Example Networks Dimensioned with 15 DSGs	13
4.3	Example Networks Dimensioned with 30 DSGs	16
4.4	Example Networks Dimensioned with 44 DSGs	19
	<b>Glossary Information</b>	<b>0</b>
	<b>Reference List</b>	<b>22</b>





# 1 Introduction

This document describes reference network configurations to help designing the deployment of an Ericsson Centralized User Database (CUDB) system on operator networks.

## 1.1 Purpose and Scope

The document covers and describes the following:

- Considerations of CUDB deployments.
- Good practice recommendations and CUDB deployment strategies.
- Examples of CUDB deployment configurations.

## 1.2 Target Groups

This document is intended for Ericsson technical sales support personnel who help customers with designing the appropriate infrastructure deployment for a CUDB system.

## 1.3 Revision Information

### Rev. A

This document is based on 2/1553-HDA 104 03/9 with the following changes:

- Terminology updates throughout the document because of virtualized deployment support.
- [Target Groups](#) on page 1, [Overview](#) on page 4, and [CUDB Deployment Examples](#) on page 10: Added virtualization information.
- [Geographical Redundancy Considerations](#) on page 5: Updated Triple Geographical Redundancy requirements. Added new consideration on virtual deployments.
- [Virtual Deployment Considerations](#) on page 9: Added as new section on virtual deployment considerations.
- [CUDB Deployment Examples](#) on page 10: Updated deployment examples.
- [Example Network with Double Geographical Redundancy](#) on page 10: Removed obsolete information from the captions of [Table 1](#) and [Figure 4](#).



## Rev. B

Other than editorial changes, this document has been revised as follows:

- Updated virtualization terminology throughout the document.

## Rev. C

Other than editorial changes, this document has been revised as follows:

- [Virtual Deployment Considerations](#) on page 9: Updated information and added figure showing the availability zones distribution matrix.

## Rev. D

Editorial changes only.

## Rev. E

Editorial changes only.

## Rev. F

Other than editorial changes, this document has been revised as follows:

- [CUDB Deployment Examples](#) on page 10: Updated basic proposal for network size.

## Rev. G

Other than editorial changes, this document has been revised as follows:

- [CUDB Deployment Examples](#) on page 10: Updated description with GEP7L.
- [Virtual Deployment Considerations](#) on page 9: Updated description with GEP7L where GEP5 is referred to.

## Rev. H

Other than editorial changes, this document has been revised as follows:

- [CUDB Site and Node Number Considerations](#) on page 6: Updated description.
- [Example Networks Dimensioned with 44 DSGs](#) on page 19, [Example Network with Four Sites and Double Geographical Redundancy](#) on page 19, and [Example Network with Six Sites and Triple Geographical Redundancy](#) on page 20: Added sections.



## 1.4 Typographic Conventions

Typographic Conventions can be found in the following document:

- Typographic Conventions



## 2 Overview

Ericsson evolved its telecom subscriber database used by its mobile circuit switch and packet switch networks, along with its IP Multimedia System (IMS) solution. The development resulted in the physical-logical decoupling of the subscriber data, the application service, and the business logic.

This allows the separate dimensioning of processing and storage resources, as well as the application of the most optimal technology and platform for each layers. The physical-logical decoupling also allows the unification of the specific user data located in the Home Location Register / Authentication Center (HLR/AUC) and the Home Subscriber Server / Subscription Locator Function (HSS/SLF) under a common subscriber profile. This profile is stored in a common database (the CUDB), dramatically reducing the complexity of subscriber data management.

All subscriber-related data is stored and managed in the Data Layer of CUDB, while the logic of the services triggered and executed in the classic HLR/AUC monolithic architecture is performed on the HLR Front End (FE) node. Similarly, the logic of the services provided by the classic HSS/SLF Monolithic Architecture is executed on the HSS/SLF FE node, while the subscriber data is stored in CUDB. The same strategy is applied to other application FEs.

The CUDB system consists of a set of CUDB nodes cooperating to provide CUDB service in the operator network. A CUDB node provides access to the CUDB system services. CUDB nodes can be placed in different locations for distribution and redundancy purposes.

CUDB stores subscriber profiles and provisioned (static) or non-provisioned (dynamic) service data associated to subscribers. As a subscriber-centric database, CUDB also holds the service profiles for the supported applications.

CUDB supports applications such as HLR/AUC, Mobile Number Portability (MNP), HSS/SLF, and Ericsson Authentication, Authorization, and Accounting (AAA). Other applications can also be supported through integration services.

Refer to the [CUDB Technical Product Description](#) for more information about CUDB system functions and architecture.



## 3 Deployment Considerations

The following sections outline some considerations to take into account when deploying a CUDB system.

### 3.1 IP Transport Network Considerations

All CUDB nodes are connected through a backbone infrastructure (but the transport network is not part of the CUDB system). The backbone is equivalent in all the CUDB nodes in the system, so all CUDB nodes in a CUDB system have the same connectivity.

The CUDB system has been designed on the assumption that the transport network is reliable between all the CUDB nodes.

The network requirements depend on which applications store data in CUDB.

Depending on the use of the links, the following security approaches are available:

- Traffic from application FEs can be encrypted using SSL/TLS or SASL.
- Traffic between CUDB nodes (concerning Lightweight Directory Access Protocol (LDAP) proxy and replication) can be encrypted using SSL/TLS.
- CUDB also implements integrity check and symmetric authentication of messages based on electronic signature for monitoring traffic.

For further networking information, refer to [CUDB Node Network Description and CUDB Security and Privacy Management](#).

### 3.2 Geographical Redundancy Considerations

CUDB deployments can be configured to be geographically redundant. The feature allows storing copies of the same data in different CUDB nodes in different sites, providing a high redundancy and resiliency level. This feature is available in the following two configurations:

- Double Geographical Redundancy: This redundancy configuration (also known as 1+1 redundancy) allows two geographical replicas per partition, each one hosted in a different node located in a different site.
- Triple Geographical Redundancy: This redundancy configuration (also known as 1+1+1 redundancy) allows three replicas per partition, each one hosted in a different node, located in a different site.



- Note:**
- Triple Geographical Redundancy can only be used if the Advanced Network Protection Value Package is available.
  - Standalone configuration without geographical redundancy is supported for Customer Trial, Customer Test, and Ericsson Internal systems.
  - During the installation of a virtualized CUDB system, do not to deploy nodes belonging to different CUDB sites in the same cloud infrastructure zone.

Geographical redundancy is one of the key features ensuring the high availability of the CUDB system: higher number of data replicas result in higher availability of the system.

For details, refer to [CUDB Multiple Geographical Areas](#).

### 3.3 CUDB Site and Node Number Considerations

CUDB sites are physical locations where the CUDB nodes of a CUDB system are deployed. The recommended configurations consist of two or three sites. The preferred one is to set up three CUDB sites to reduce the impact of node and IP backbone failures, and to increase the reliability of the entire system. Depending on deployment needs, more than three sites can be deployed (up to a maximum of six sites).

To ensure the simple network design of the CUDB system, deploying the system with symmetrical CUDB nodes (that is, with nodes storing a similar set of Data Store Groups, or DSGs, in terms of DSG allocation) across the CUDB sites of the system is recommended. Depending on the system deployment, this may result in nodes containing a substantial amount of free space for additional Data Store Units (DS), enabling further expansion. However, if system expansion is not considered, the number of CUDB nodes can be reduced by deploying the system with asymmetrical CUDB nodes (that is, with nodes whose DSG allocation differs from each other).

[Figure 1](#) shows an example deployment consisting of symmetrical nodes, configured with double geographical redundancy:

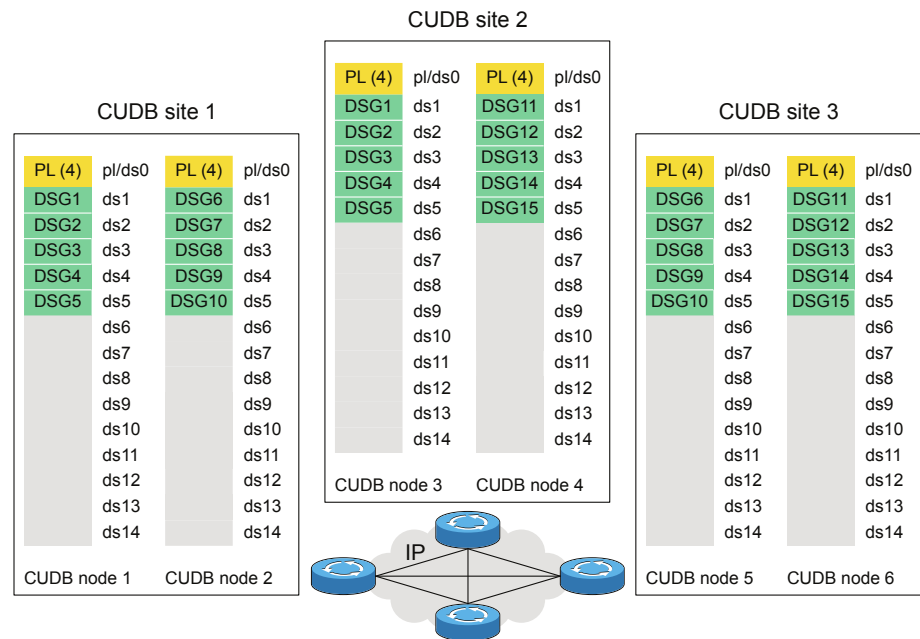


Figure 1 Example CUDB Deployment with Symmetrical CUDB Nodes

The system shown on [Figure 1](#) is deployed with double geographical redundancy, and the nodes are distributed across three CUDB sites. In accordance with the deployment concept described above, the system consists of symmetrical CUDB nodes: Node 1 is symmetrical to Node 3, Node 2 holds a similar set of DSs as Node 5, and so on.

[Figure 2](#) shows a deployment without symmetrical CUDB nodes, but also configured with double geographical redundancy:

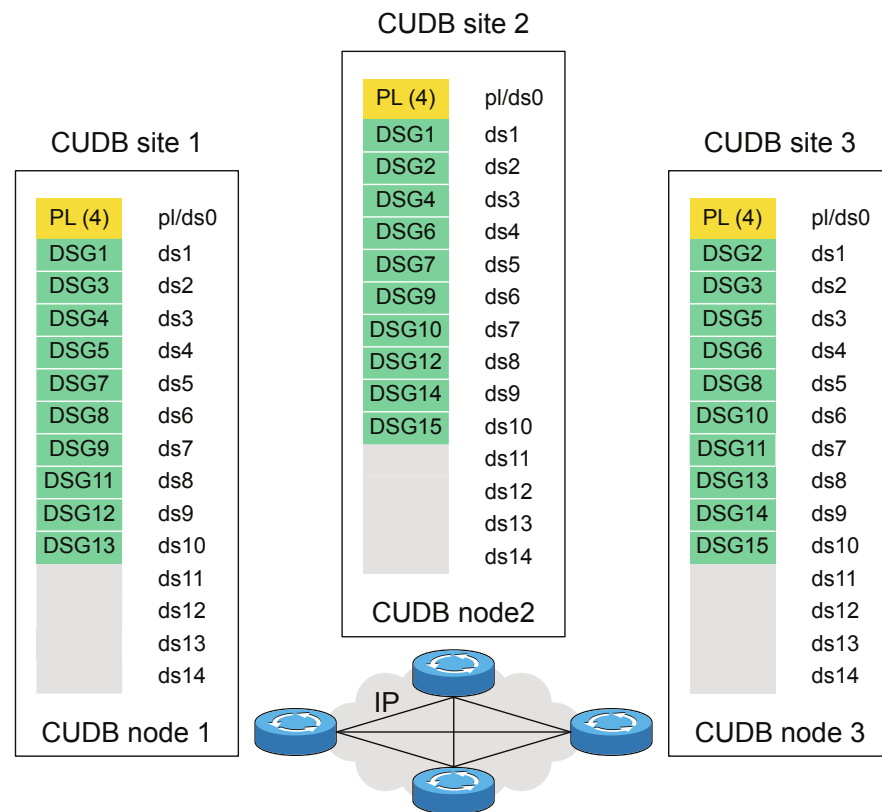


Figure 2 Example CUDB Deployment with Asymmetrical CUDB Nodes

## 3.4 CUDB Node Distance Considerations

CUDB systems are often deployed to cover wide areas, either with complex deployments consisting of a significant number of CUDB nodes, or with smaller systems consisting of less nodes, separated by long distances.

The distance between CUDB nodes greatly affects network latency, which impacts CUDB internal interfaces (that is, the replication traffic between CUDB nodes, the LDAP proxy traffic, and the supervision protocol as well).

### 3.4.1 Network Latency Impacts on LDAP Proxy Traffic

CUDB is a geographically distributed system that provides local single logical points of access for traffic and provisioning. Each CUDB node provides access to the whole subscriber base, regardless of the data distribution across CUDB nodes. In case a CUDB node receives an LDAP query, the system checks if the master of the requested data is allocated in the local CUDB node. If not, then the LDAP query is sent to the CUDB node where the master is allocated. Such queries are considered a proxy operation, and their latency is higher than the latency of local LDAP queries.



High latency or bad quality in the transport network could dramatically affect CUDB performance, especially LDAP proxy traffic.

## 3.5 Virtual Deployment Considerations

Blackboard Coordination (BC) servers of the site must be deployed in a way that a single hardware failure in a cloud system does not result in the loss of the majority of the BC servers in the site.

When creating host aggregates, at least four availability zones need to be defined to get BC servers and System Controller (SC)/Processing Layer (PL) distribution in different compute hosts. Refer to CUDB High Availability for more information, and consider the following:

- If the site contains between 3 and 5 nodes, those nodes host one or two BC servers in the SCs. The host aggregates created for the deployment of SC Virtual Machines (VMs) cannot share compute hosts: such deployment can introduce a single point of failure in the BC cluster of the site.
- If the site contains more than 5 nodes, the information in the previous bullet is valid for the first 5 nodes.

To fulfill these recommendations, follow the distribution shown in [Figure 3](#).

### AVAILABILITY ZONES DISTRIBUTION MATRIX

- › The pattern can be repeated every 4 VNFs
- › The use of 4 AZs as minimum does not prevent definition of additional zones if available.

	AZ1	AZ2	AZ3	AZ4
VNF1	SC_1	SC_2	PL_2_odd	PL_2_even
VNF2	PL_2_even	SC_1	SC_2	PL_2_odd
VNF3	PL_2_odd	PL_2_even	SC_1	SC_2
VNF4	SC_2	PL_2_odd	PL_2_even	SC_1
VNF5	SC_1	SC_2	PL_2_odd	PL_2_even
VNF6	PL_2_even	SC_1	SC_2	PL_2_odd
VNF7	PL_2_odd	PL_2_even	SC_1	SC_2

Figure 3 Availability Zones Distribution Matrix

**Note:** The considerations in this section are not valid for a virtualized CUDB system deployment on Ericsson's Cloud Execution Environment (CEE), on BSP 8100 hardware with GEP5 and Generic Ericsson Processor version 7, Low Power (GEP7L) blades, using vCUDB\_16CPU\_47GB flavors for SCs and PLs (it is not possible to collocate VMs on the compute hosts).



## 4 CUDB Deployment Examples

This section describes the basic proposals of CUDB deployments regarding network size (in number of DSGs).

The number of CUDB nodes needed for hosting the amount of subscribers on each reference deployment has been estimated by basic dimensioning.

A CUDB node can have up to 36 blades or VMs, the Processing Layer Database (PLDB) consists of 4-16 PLDB blades in BSP 8100 with Generic Ericsson Processor version 3 (GEP3) blades, 2-16 PLDB blades in BSP 8100 with Generic Ericsson Processor version 5 or 7 (GEP5 or GEP7L) blades, or 2-16 VMs in a virtualized CUDB. The more PLDB blades or VMs are defined, the less DSGs can be configured.

Refer to [CUDB Technical Product Description](#) for more details on supported hardware.

**Note:** For CUDB systems deployed on native BSP 8100 (GEP5), when the "BSP Capturing Unit Option" is used, the subrack capacity is decreased by two blades. Refer to the BSP 8100 CPI for more information.

The CUDB configurations described in the following sections are reference deployments only, and therefore must be interpreted as guidelines, not actual CUDB configurations. Make sure that the recommendations on system robustness and resiliency described in [Deployment Considerations](#) on page 5 are followed when planning the deployment.

Actual deployments delivered to operators are configured according to the appropriate dimensioning exercises performed for specific cases, though the general recommendations included in this guide apply to actual deployments as well.

### 4.1 Example Networks Dimensioned with 5 DSGs

This section describes two example CUDB deployments with 5 DSGs.

#### 4.1.1 Example Network with Double Geographical Redundancy

This example describes a reference deployment with double geographical (or 1+1) redundancy, based on the In Service Performance (ISP) requirements.

[Table 1](#) and [Figure 4](#) show and describe an example deployment with the following configuration settings:

- Each piece of data stored in the system has two copies.



- The system consists of two sites.
- The sites consist of symmetrical CUDB nodes.

Table 1 CUDB System Deployment with 5 DSGs and Double Geographical Redundancy

Location	Number of CUDB Nodes
Site 1	1
Site 2	1

Figure 4 depicts the deployment scenario.

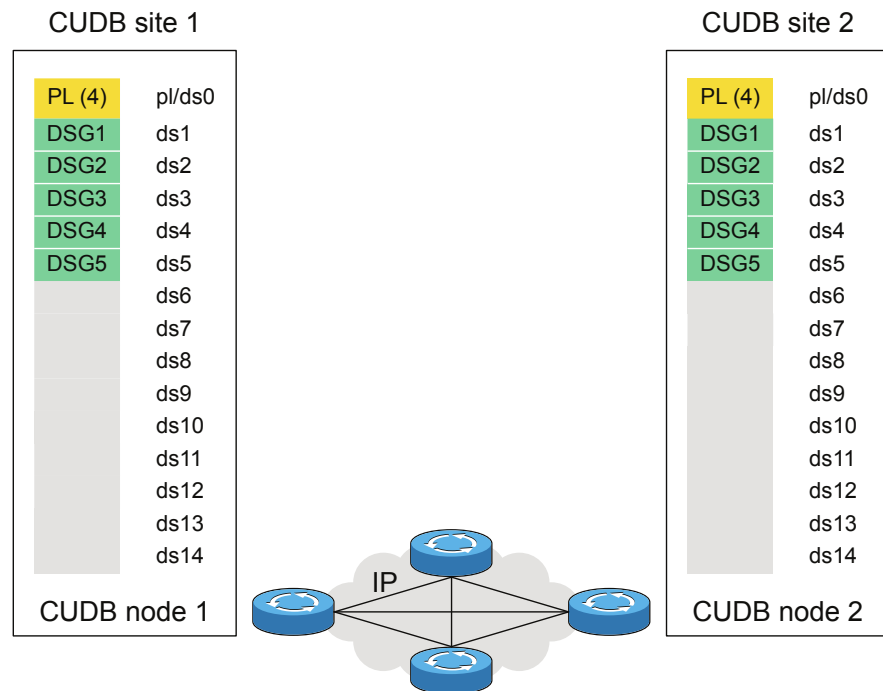


Figure 4 CUDB System Deployment with 5 DSGs and Double Geographical Redundancy

The picture shows that there are nine 'empty' slots (from DS6 to DS14) in all the nodes, as the demanded capacity is already reached with the first five DS Units.

All subscriber partitions from DSG1 to DSG5 are replicated in the second the CUDB node is located in the other site.



#### 4.1.2 Example Network with Triple Geographical Redundancy

This scenario is similar to the example shown in [Example Network with Double Geographical Redundancy](#) on page 10, with the exception that an additional site and CUDB node is required to achieve the selected redundancy level.

[Table 2](#) and [Figure 5](#) show and describe an example deployment with the following configuration settings:

- Each piece of data stored in the system has three copies.
- The system consists of three sites.
- The sites consist of symmetrical CUDB nodes.

Table 2 CUDB System Deployment with 5 DSGs and Triple Geographical Redundancy

Location	Number of CUDB Nodes
Site 1	1
Site 2	1
Site 3	1

[Figure 5](#) depicts the deployment scenario.

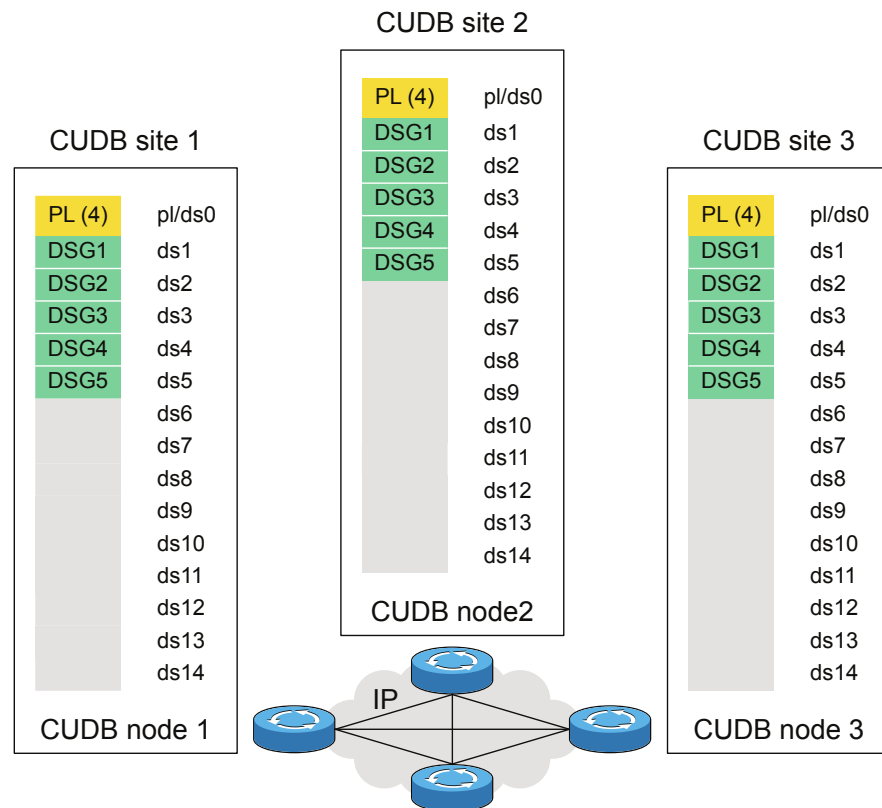


Figure 5 CUDB System Deployment with 5 DSGs and Triple Geographical Redundancy

The picture shows how all CUDB nodes hold a copy of each subscriber partition.

## 4.2 Example Networks Dimensioned with 15 DSGs

This section describes three example CUDB deployments with 15 DSGs.

### 4.2.1 Example Networks with Double Geographical Redundancy

This example describes a reference deployment with double geographical (or 1+1) redundancy, based on the ISP requirements.

configuring the system with triple geographical (1+1+1) redundancy is recommended to ensure deployment robustness.

[Table 3](#) and [Figure 6](#) show and describe an example deployment with the following configuration settings: Although CUDB systems handling 15 DSGs can be deployed with double geographical redundancy,

- Each piece of data stored in the system has two copies.



- The system consists of two sites.
- The sites consist of symmetrical CUDB nodes.

Table 3 Although CUDB systems handling 15 DSGs can be deployed with double geographical redundancy,CUDB System Deployment with 15 DSGs, Two Sites and Double Geographical Redundancy

Location	Number of CUDB Nodes
Site 1	2
Site 2	2

Figure 6 depicts the deployment scenario.

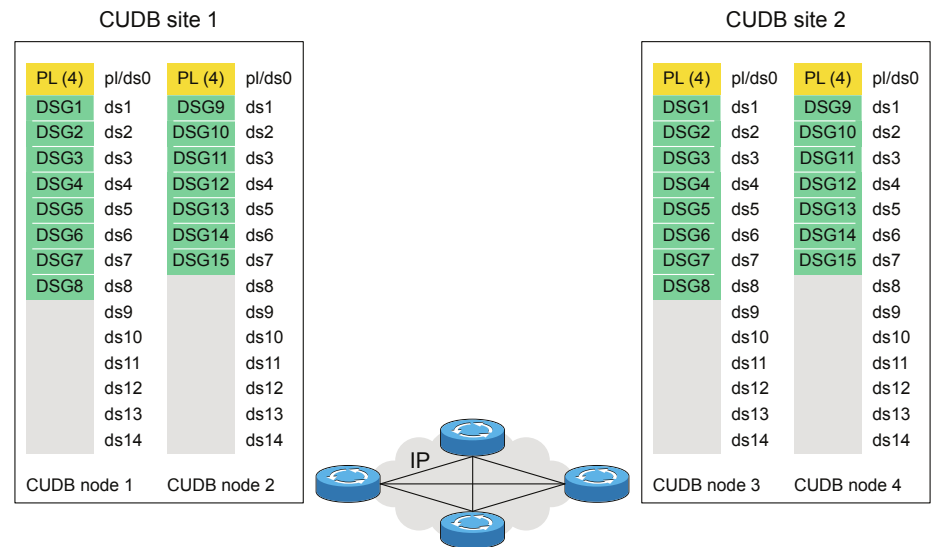


Figure 6 CUDB System Deployment with 15 DSGs, Two Sites and Double Geographical Redundancy

Table 4 and Figure 7 show and describe an example deployment with the following configuration settings:

- Each piece of data stored in the system has two copies.
- The system consists of three sites.
- The sites consist of asymmetrical CUDB nodes.



Table 4 CUDB System Deployment with 15 DSGs, Three Sites and Double Geographical Redundancy

Location	Number of CUDB Nodes
Site 1	1
Site 2	1
Site 3	1

Figure 7 depicts the deployment scenario.

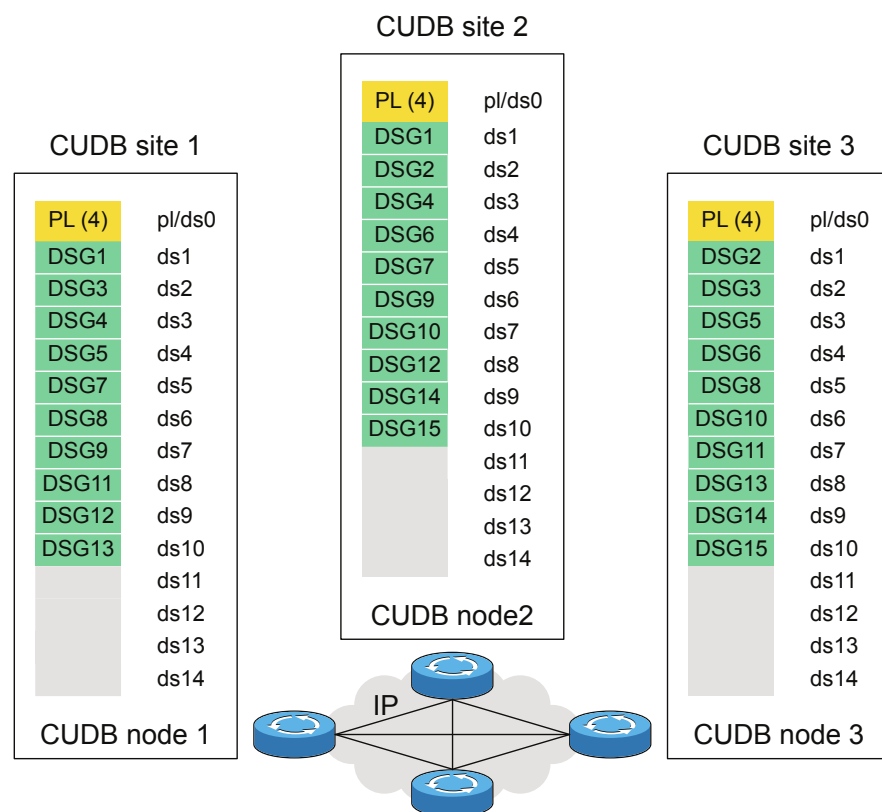


Figure 7 CUDB System Deployment with 15 DSGs, Three Sites and Double Geographical Redundancy

#### 4.2.2

#### Example Network with Triple Geographical Redundancy

This example describes a reference deployment with triple geographical (or 1+1+1) redundancy.

Table 5 and Figure 8 show and describe an example deployment with the following configuration settings:

- Each piece of data stored in the system has three copies.



- The system consists of three sites.
- The sites consist of symmetrical CUDB nodes.

Table 5 CUDB System Deployment with 15 DSGs and Triple Geographical Redundancy

Location	CUDB Nodes
Site 1	2
Site 2	2
Site 3	2

Figure 8 depicts the deployment scenario.

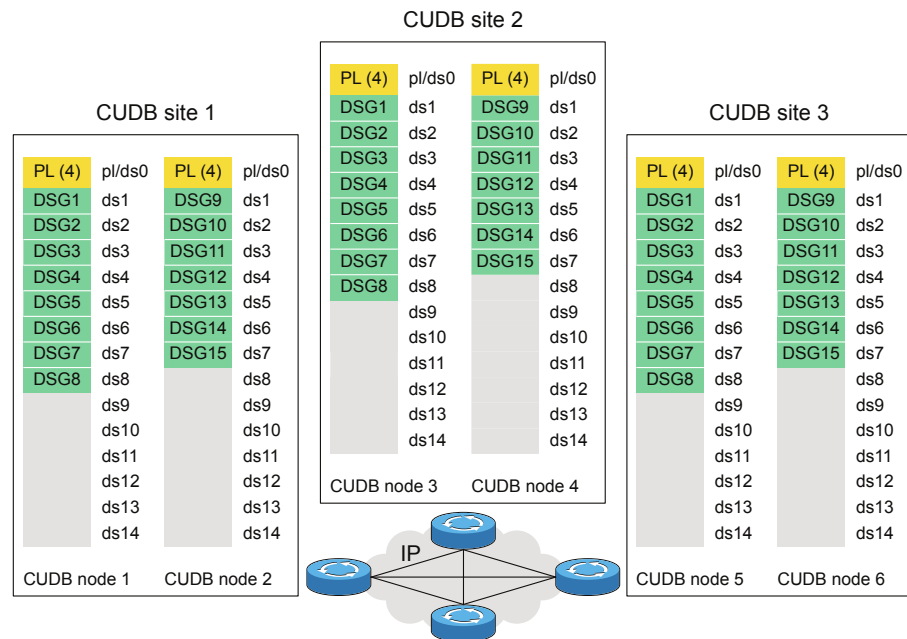


Figure 8 CUDB System Deployment with 15 DSGs and Triple Geographical Redundancy.

## 4.3 Example Networks Dimensioned with 30 DSGs

This section describes two example CUDB deployments with 30 DSGs.

### 4.3.1 Example Network with Double Geographical Redundancy

This example describes a reference deployment with double geographical (1+1) redundancy, based on the ISP requirements.



Although CUDB systems handling 30 DSGs can be deployed with double geographical redundancy, configuring the system with triple geographical (1+1+1) redundancy is recommended to ensure deployment robustness.

Table 6 and Figure 9 show and describe an example deployment with the following configuration settings:

- Each piece of data stored in the system has two copies.
- The system consists of three sites.
- The sites consist of asymmetrical CUDB nodes.

Table 6 CUDB System Deployment with 30 DSGs, Three Sites and Double Geographical Redundancy

Location	Number of CUDB Nodes
Site 1	2
Site 2	2
Site 3	2

Figure 9 depicts the deployment scenario.

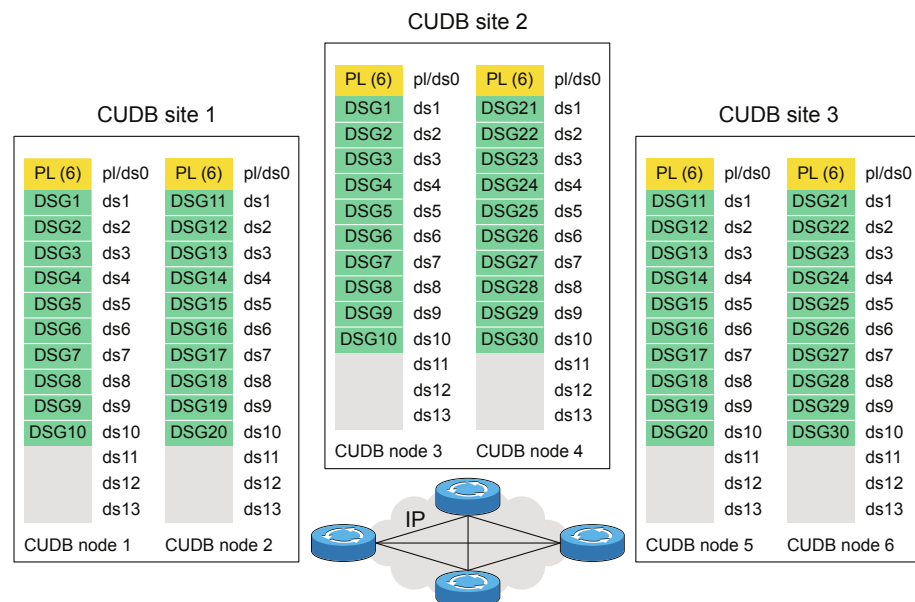


Figure 9 CUDB System Deployment with 30 DSGs, Three Sites and Double Geographical Redundancy.



### 4.3.2 Example Network with Triple Geographical Redundancy

This example describes a reference deployment with triple geographical (1+1+1) redundancy.

[Table 7](#) and [Figure 10](#) show and describe an example deployment with the following configuration settings:

- Each piece of data stored in the system has three copies.
- The system consists of three sites.
- The sites consist of symmetrical CUDB nodes.

Table 7 CUDB System Deployment with 30 DSGs, Three Sites and Triple Geographical Redundancy

Location	Number of CUDB Nodes
Site 1	3
Site 2	3
Site 3	3

[Figure 10](#) depicts the deployment scenario.

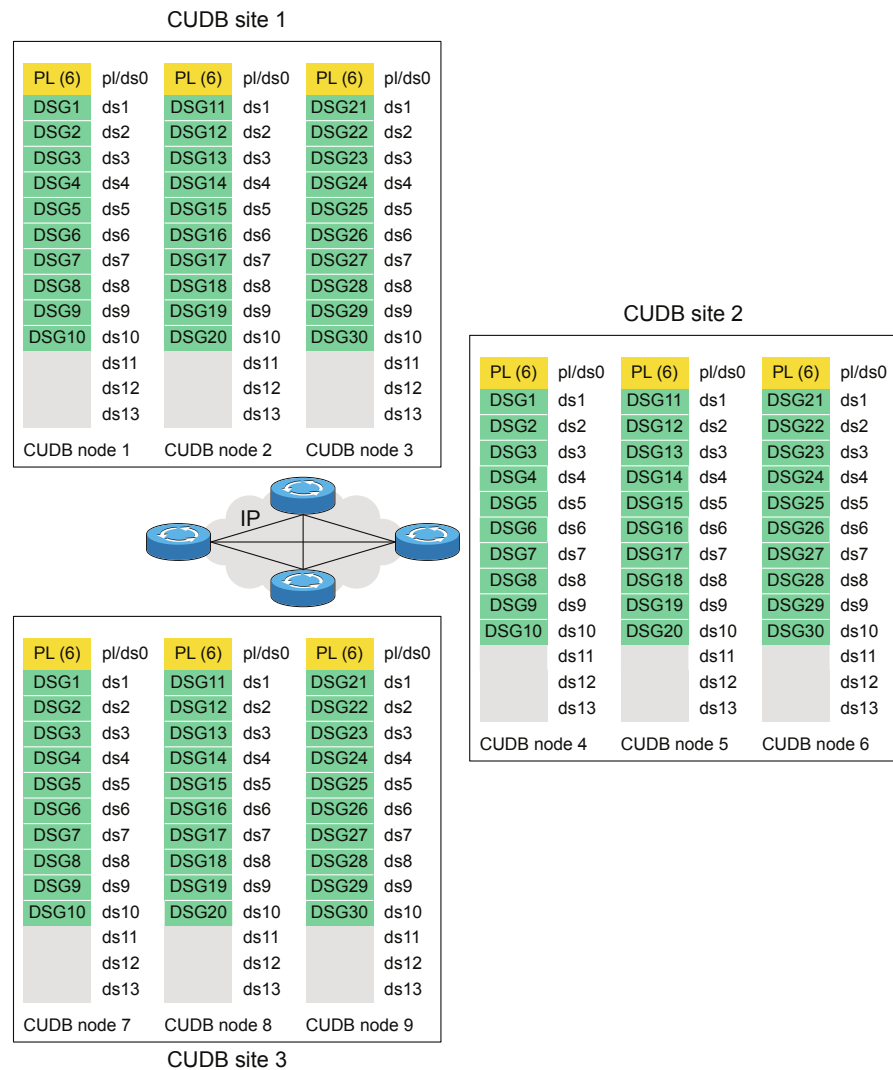


Figure 10 CUDB System Deployment with 30 DSGs, Three Sites and Triple Geographical Redundancy

## 4.4 Example Networks Dimensioned with 44 DSGs

This section describes two example CUDB deployments with 44 DSGs deployed on four and six sites.

### 4.4.1 Example Network with Four Sites and Double Geographical Redundancy

This example describes a reference deployment with double geographical (1+1) redundancy deployed on four sites.

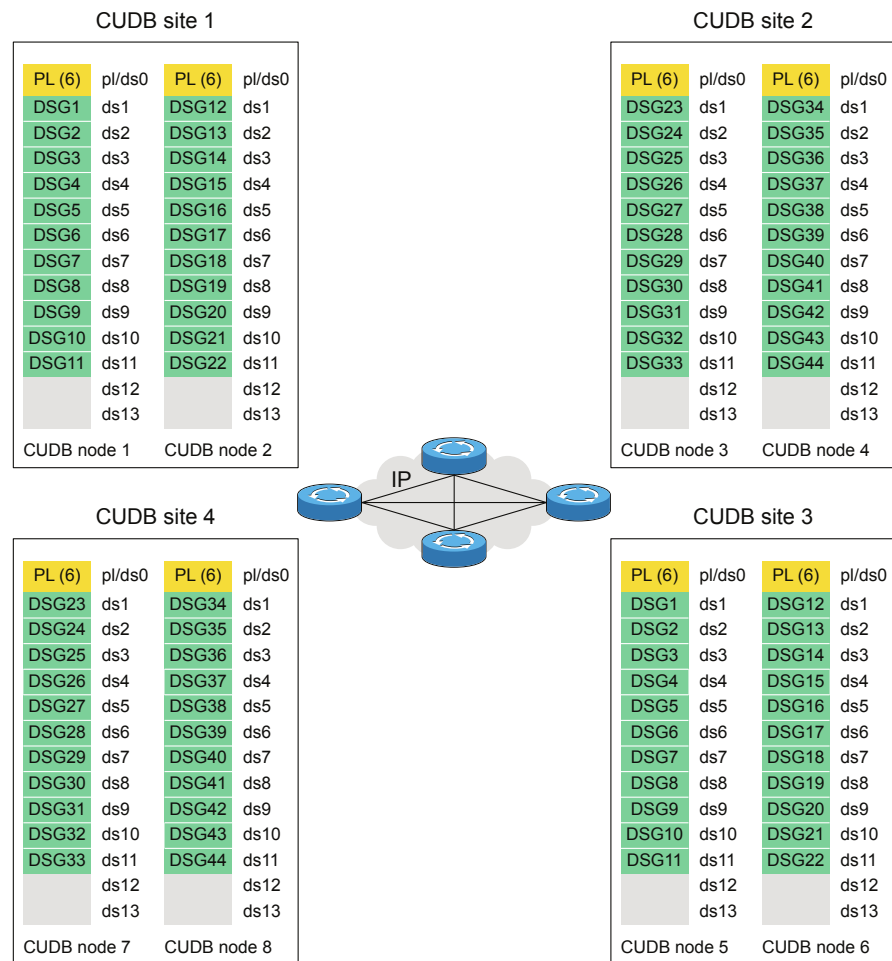


Figure 11 CUDB System Deployment with 44 DSGs, Four Sites and Double Geographical Redundancy

#### 4.4.2

#### Example Network with Six Sites and Triple Geographical Redundancy

This example describes a reference deployment with triple geographical (1+1+1) redundancy deployed on six sites.

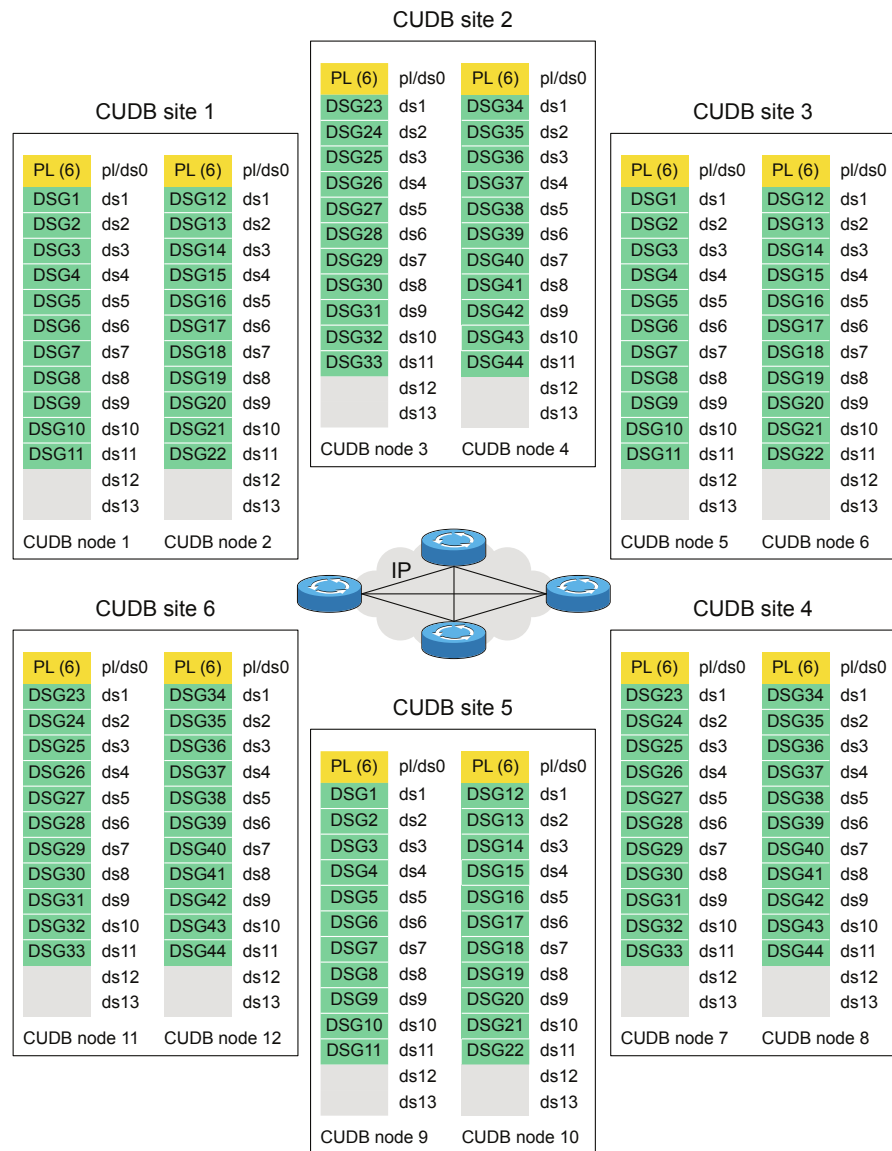


Figure 12 CUDB System Deployment with 44 DSGs, Six Sites and Triple Geographical Redundancy



# Reference List

## CUDB Documents

1. CUDB Technical Product Description
2. CUDB Node Network Description
3. CUDB Security and Privacy Management
4. CUDB Multiple Geographical Areas
5. CUDB High Availability
6. CUDB Glossary of Terms And Acronyms