

WAY4™ Distributed Processing

Contents

TERMINOLOGY	2
INTRODUCTION	4
CHAPTER 1. PURPOSE	5
CHAPTER 2. DISTRIBUTED PROCESSING PRINCIPLES	7
CHAPTER 3. ARCHITECTURE	9
ISO Online, 3-D Secure/iPAS load distribution architecture	10
UXF request load distribution architecture	11
WAY4 Web load distribution architecture	13
CHAPTER 4. FUNCTIONALITY	14
Distributed processing of 3-D Secure/iPAS requests and authorisations (ISO Online)	14
Distributed processing of Back-Office Operations	17
Synchronising data between nodes	19
File import and export	20
UXF Online distributed processing	20
WAY4 Customer Service Workbench (CSW)	20
DB Manager/WAY4 Manager	21
CHAPTER 5. USE CASES	22
Planned migration to DP architecture	22
Creating Secondary	22
Scheduled work	23
Patch	23
Upgrade	23
Loading FX Rates	23
CHAPTER 6. LIMITATIONS	24
CHAPTER 7. INTERACTION WITH EXTERNAL SYSTEMS	27
CHAPTER 8. PARTIAL SECONDARY – TABLES SYNCHRONISED FROM PRIMARY TO SECONDARY	28

Terminology

Operations – access to system services through the provided interface.

Operation source – user applications (DBM, WAY4M, WAY4WEB), Web services, Online and Offline channels, Datamart, etc.

Operation type – group of operations executing the same actions in the database.

Critical operation type – operation type requiring high availability and scalability pursuant to business requirements.

Critical operation – critical type of operation.

Safe operation – an operation that is:

- Reproducible – will be reproduced with consideration of single business rules and with preservation of data integrity in other nodes as a result of synchronisation.
- Self-sufficient – includes all necessary elementary steps and is a logically independent batch of changes from a business viewpoint.
- Non-conflictive – for all data modifications, there are corresponding procedures for conflict resolution during synchronisation.

Operation safety is determined by implementation, not business.

Critical operations are implemented as safe.

If an operation only records to the Process Log, it is already safe.

Unsafe operation – an operation that is not safe. As a result of WAY4 system modifications, unsafe operations may become safe.

Routing – process of defining an operation's routing.

Synchronisation – elimination of differences between copies of WAY4 database data in the source node and target node as a result of the synchronisation process.

Service – group of operation types with the same routing rules.

Routing rule – operation routing algorithm. May depend on the operation type and on database availability.

Node – a WAY4 database (DB) instance.

Node availability – application server's technical ability to use a certain DB to execute operations.

Service main node – the default node in which operations for a certain service are executed.

Service reserve node – node in which operations are executed when a service's main node is unavailable.

Dynamic data – WAY4 data in tables for which the insert row operation is executed frequently; for example, transactions and entries.

Static data – WAY4 data in tables for which the insert row operation is not executed often, but changes in data may occur frequently; for example, clients and contracts.

Configuration data – the set of WAY4 settings. WAY4 configuration data includes: business settings, system settings including financial institution hierarchy, Product settings, card issuing settings, global parameter settings, solution topology settings, etc.

In-Flight operation – an operation that is started in a database but is not completed (is being processed).



Introduction

This document is an introduction to the functionality of the WAY4™ Distributed Processing product.

When working with this document it is recommended to use the following resources from the OpenWay documentation series:

- "WAY4™ Transaction Switch. Functional Specification".
- "WAY4™ WS Runtime Server. Functional Specification".
- "WAY4™ Datamart. Functional Specification".
- "WAY4™ Application Server. Functional Specification".
- "WAY4™ Scheduler R2. Functional Specification".
- "WAY4Replication. Data Synchronisation Solution".
- "Automatic Switching Between Databases"
(HA_Auto_Switchover_Functional_Specification.pdf).

The following conventions are used throughout the document:

- Warnings that an action may have adverse effects are marked with the  sign.
- Messages marked with the  sign contain information about important features, additional facilities, or the optimal use of certain functions of the system.

Chapter 1. Purpose

The "Distributed processing" product is used to ensure the high availability of processing and to decrease the main production database's load by distributing it among additional databases.

WAY4 with the "Distributed processing" product makes it possible to do the following:

- Reduce the risk of authorisation rejection during peak loads.
- Ensure processing's high availability for serving operations and minimise downtime.
- Ensure the stable processing of Back-Office operations in the same time intervals as before the load increased.

Advantages of the "Distributed processing" product:

- The ability to distribute a load in periods when it temporarily increases.
- The same hardware is used for load distribution and for high availability.
- A single point of access for external interfaces.
- Gradual implementation is possible.



The list of operations that can be processed in additional database nodes (list of safe critical operations):

- Incoming authorisations including secondary incoming authorisations (reversals, adjustments, advices, etc.).
- Mini-statement request.



If a mini-statement request is executed in an additional node (when Partial Secondary is used), only transactions for the corresponding additional node will be shown (see limitation 5 in the section "Limitations"). Mini-statement requests in a Secondary node can be prohibited.

- Balance replenishment online.
- Contract Daily Update preliminary process (safe Back-Office operation).
- PIN Set, PIN Change.
- Reset PIN Try Counter.
- SMS notification.

- Card blocking.
- 3D Secure transactions (one-time password generation and use).
- Monitoring usage limiters
 -  Usage limiters for Partial Secondary are only monitored for limiters with a fixed effective period (daily, weekly, monthly, etc.).
 -  The list of operations may be added to.

Chapter 2. Distributed processing principles

WAY4 is scaled by distributing a load to database additional nodes and distributing processing between them (hereinafter, databases are referred to as nodes).

Load distribution is understood to be the ability to execute authorisation operations and Back-Office operations for specific groups of contracts in different nodes.

The main principles of separating contract into groups for distributed processing:

- The atomic unit of distributed processing is the extended contract tree. An extended contract tree is the set of contract trees for all clients related by these trees (see Fig. 1).

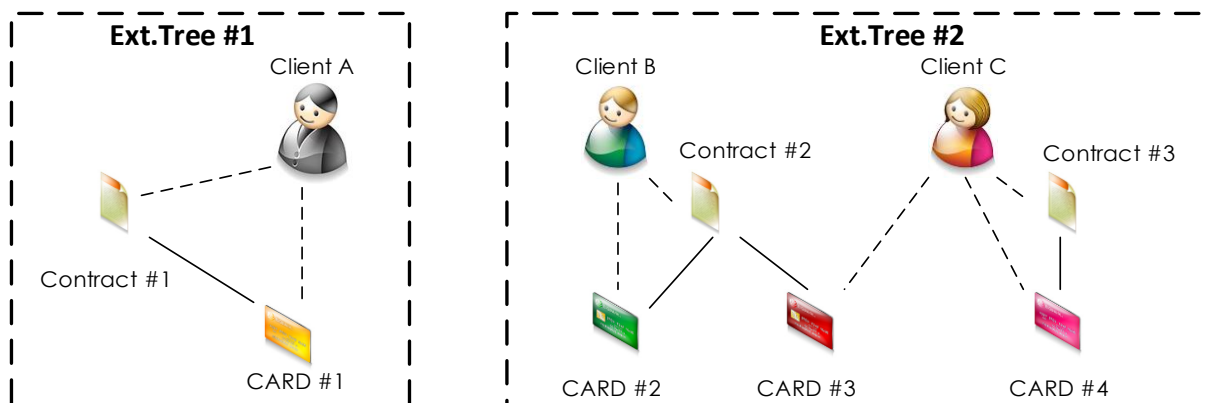


Fig. 1. Illustration of the principle for creating an expanded contract tree

- First, a single routing code is assigned to each extended contract tree. The routing code is used to determine the DB node in which authorisation and BackOffice operations will be executed for each contract in this tree.
- Extended contract trees with the same code are grouped implicitly. Contracts for the same client belong to the same group. Rules for grouping extended contract trees not specified and are determined independently by the client with consideration of the necessary proportions. The integrity of an extended contract tree is monitored by WAY4.
- If necessary, the routing code for extended contract trees can be changed manually.



To change the routing code, service of the corresponding contracts must first be switched to the primary node.

- When creating new contracts, if a contract is created in an existing extended contract tree, this contract is assigned the routing code for this tree. When creating a new contract with extended contract trees, a custom procedure using a standard API can be used to automatically assign these trees a routing code, according to the logic for grouping contracts.

Chapter 3. Architecture

The WAY4 solution with the "Distributed processing" product consists of the following main nodes and data streams shown in Fig. 2.

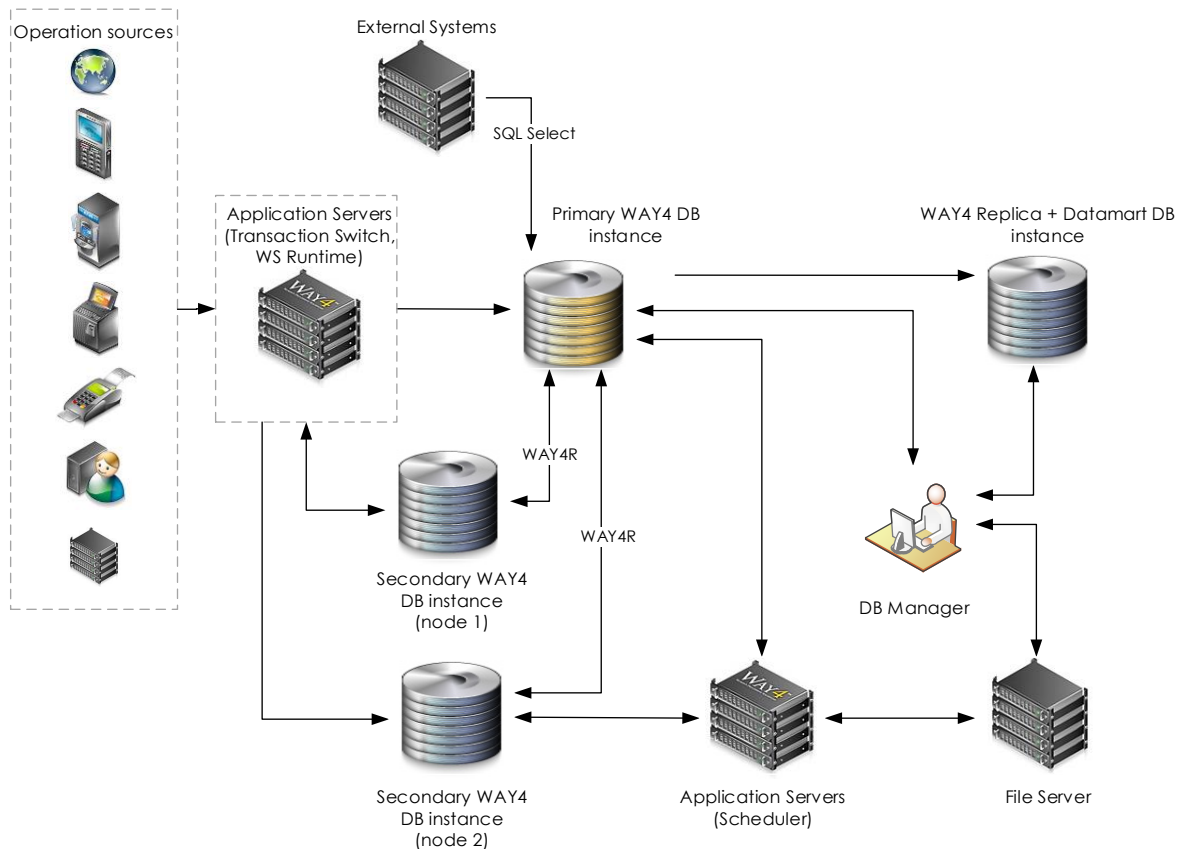



Fig. 2. WAY4 with the "Distributed processing" product and two Secondary DB

Main nodes and data streams:

- **Primary WAY4 DB instance (Primary)** – Primary WAY4 DB instance in which any operations are executed.
- **Secondary WAY4 DB instance (hereinafter Secondary)** – secondary WAY4 DB instance in which only safe operations are executed. The Secondary node may be a full copy of Primary, or a partial copy (Partial Secondary, StandIn – obsolete) with regard to data for replication to this node from Primary.
- **WAY4 DB Replica + Datamart DB instance** – set of DB nodes representing the WAY4 Datamart DB.
- **WAY4R** – WAY4Replication data synchronisation transport.


- File Server – file server. Used to store incoming and outgoing files, provide common access to main and working directories.
 File Server's use and functionality remains the same as in the WAY4 solution with one DB instance.
- WAY4 Scheduler (SH) – scheduler. Used to perform tasks (programs, scripts, etc.) by running DB Manager/WAY4 Manager menu items according to specific rules on workstations with DB access. Used for regular loading of files from external sources, for example banking system files.
- WS Runtime Server (WSR) – application servers providing SOAP Web Service API to WAY4 DB instance nodes (see the section "WAY4 Web load distribution").
- Transaction Switch (TS) – application servers (TS ISO/TS UFX), responsible for routing, processing incoming requests and communicating with WAY4 DB instance nodes (see the section "ISO Online, 3-D Secure/iPAS load distribution architecture" and the section "UFX request load distribution").

ISO Online, 3-D Secure/iPAS load distribution architecture

3-D Secure/iPAS authorisation and request load distribution detailed architecture is shown in the figure below (see Fig. 3). The following are used:

- ISO Front Set – TS ISO front set is responsible for initial routing of authorisations to authorisation TS (Authorization Transaction Switch ISO).

Each front TS is connected to Primary and to only one Secondary.

 If Primary and Secondary to which front TS are connected are unavailable, transaction routing and processing will not be possible even for transactions with contracts served by available Secondary.

A front TS executes all operations either in Primary or in Secondary according to its service's settings and node availability. Balancing to front TS is performed by external systems without limitations.

Only front TS ISO logs to the COMS_LOG table (when Secondary is the main node for services used in front TS, COMS_LOG is written to Secondary and replicated to Primary).

- ISO Authorization Set – TS ISO authorisation set separated into groups whose number is equal to the number of Secondary nodes used.

All authorisation TS in one group are connected to Primary and to only one Secondary (serving this group).

Each authorisation TS can execute some operations in Primary and some in Secondary according to authorisation routing principles and node availability.

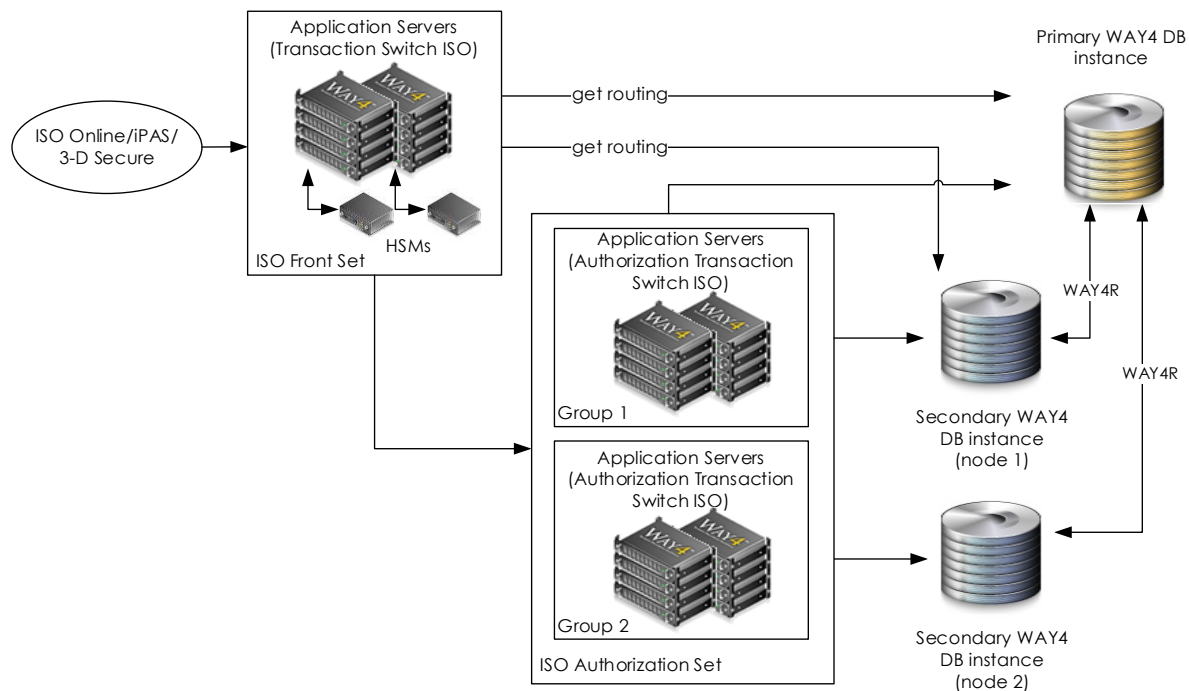


Fig. 3. Authorisation load distribution scheme

To ensure the high availability of authorisation and its uninterrupted service, the following rules are implemented:

- TS ISO front and authorization are reserved – several front and authorisation TS attached to the same Primary and Secondary nodes are used at the same time.

If one of the front or authorisation TS is unavailable, routing is performed in a reserve TS.

- In regular operation, front TS ISO operate in their service's main database node, and if it is not available, in a reserve node.
- In regular operation, an authorisation TS sends an operation with a certain routing code to the main DB node specified for it. If the main node is unavailable, the operation will be executed in a reserve node.

i Front and authorisation TS ISO may be on the same server but this reduces high availability.

UFX request load distribution architecture

UFX request load distribution detailed architecture is shown in the figure below (see Fig. 4). The following are used:

- UFX Front Set – set of front TS UFX. Responsible for initial routing of UFX requests to executive TS (Executive Transaction Switch UFX). Each front TS is connected to the Primary node and to one Secondary node (to the same one). A front TS UFX executes all operations either in Primary or in Secondary according to its service's settings and node availability. Balancing to front TS is performed by external systems without limitations.
- UFX Executive Set – set of executive TS UFX (Executive Transaction Switch UFX).

All Executive TS UFX are separated into groups whose number is equal to the number of Secondary used.

All Executive TS UFX in the same group are connected to the Primary node and to one Secondary node.

Each Executive TS UFX can execute some operations in Primary and some in Secondary according to UFX routing principles and node availability.

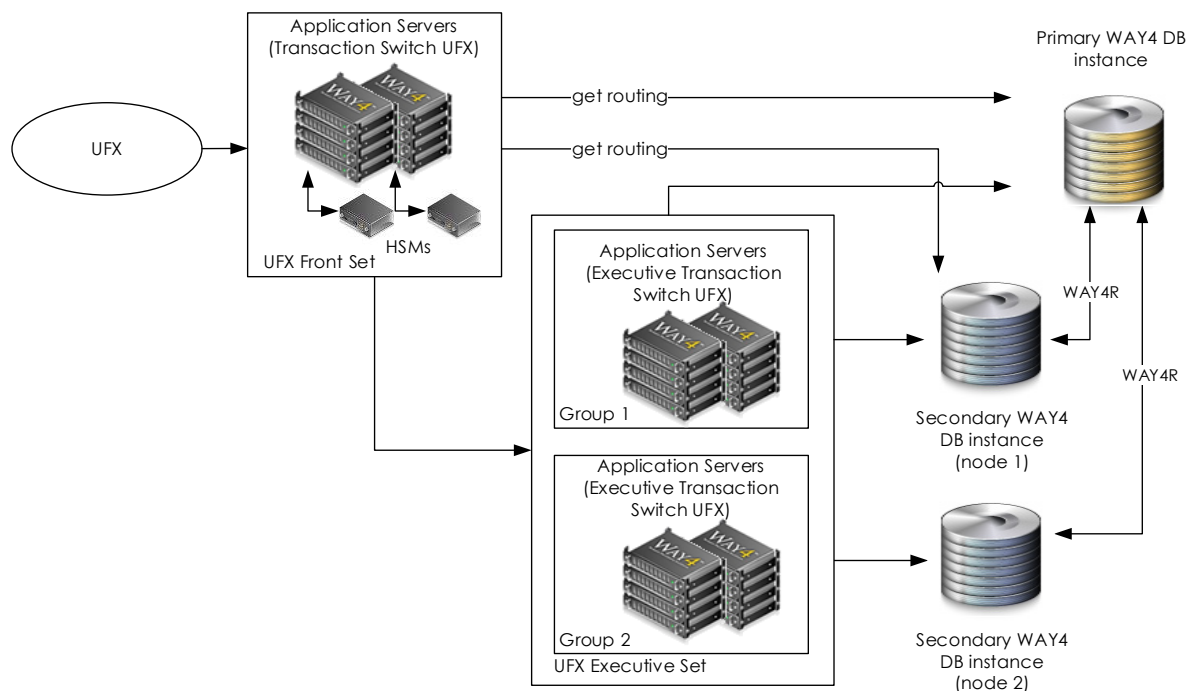


Fig. 4. UFX request authorisation load distribution scheme

To ensure the high availability of authorisation and its uninterrupted service, the following rules are implemented:

- Front and executive TS UFX are reserved – several front and executive TS connected to the same Primary and Secondary nodes are used at the same time.

If one of the front or executive TS is unavailable, routing is performed in a reserve TS.

- In normal operation, frontal TS UFX operate in their service's main DB node, and if they are not available, in a reserve node.
- In normal operation, an executive TS sends an operation with a certain routing code to the main DB node specified for it. If the main node is unavailable, the operation will be executed in a reserve node.

i Front and executive TS UFX may be on the same server but this reduces high availability.

WAY4 Web load distribution architecture

Detailed architecture of the solution for WAY4 Web load distribution is shown in the figure below (see Fig. 5). The following are used:

- WS Set – WS Runtime Server (WSR) are reserved – a load balancer and several WSR are used.
- In all cases with the exception of card blocking and Reset PIN Try Counter, WSR accesses Primary.

Cards are blocked and PIN Try counters are reset through a service in TS, with consideration of the current operation mode.

i WSR functionality is covered in the document "WAY4™ WS Runtime Server. Functional Specification."

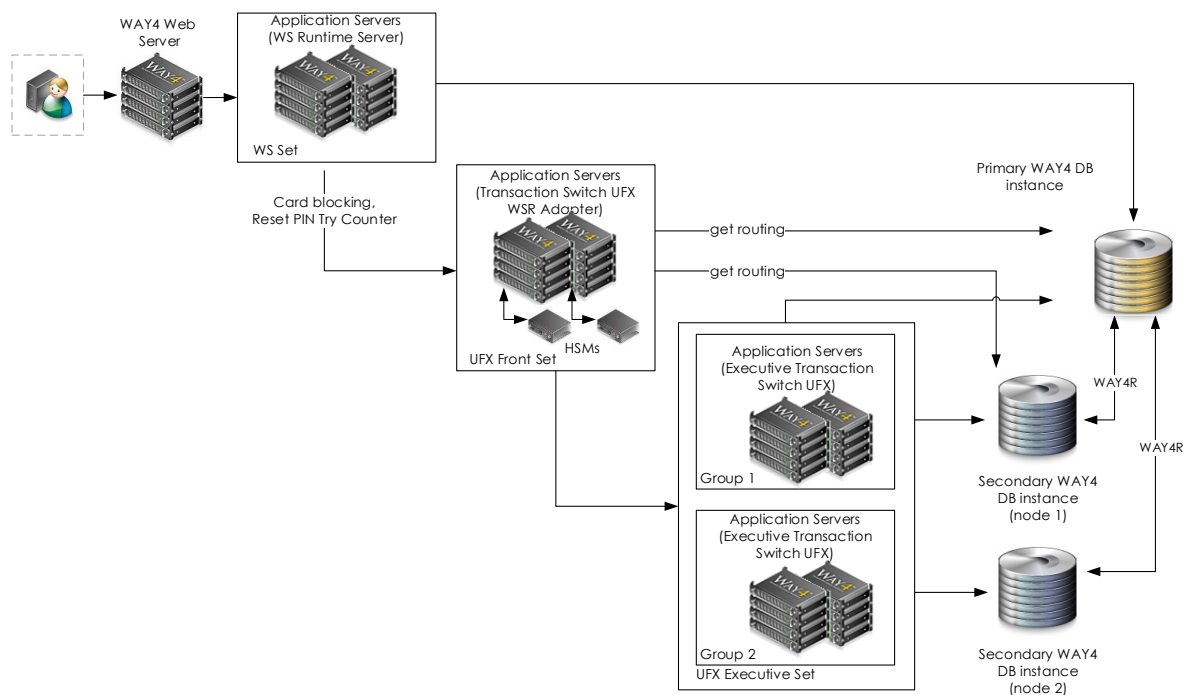



Fig. 5. Web Service API load distribution scheme

Chapter 4. Functionality

WAY4 with the "Distributed processing" product supports the following load distribution modes, as shown in the table (see Table 1).

Table 1. Load distribution modes (P – Primary, S – Secondary)

Mode		P	S1	S2	Comments
Regular	Operation processing	+	-	-	All operations are processed in Primary only (same as the solution with one node). No load distribution. Changes from Primary are replicated to Secondary.
	Replication	-	+	+	
Regular+	Operation processing	+	+	+	The majority of operations are processed in Primary. Operations for a specific operation type (*) are fully or partially forwarded to Secondary for processing. Changes are replicated in both directions: from Primary to Secondary and from Secondary to Primary.
	Replication	+	+	+	
High season (peak loads)	Operation processing	+	+	+	Safe operations are fully or partially processed in Secondary (**). Non-safe operations are processed in Primary. Changes are replicated in both directions: from Primary to Secondary and from Secondary to Primary.
	Replication	+	+	+	

 The aforementioned description of modes is true on the condition that all nodes are available.


All standard functionality of the WAY4 Solution with one node, used by the client at the time of implementing the "Distributed processing" product is supported, as well as:

- Distributed processing of 3-D Secure/iPAS requests and authorisations (ISO Online).
- Distributed processing of Back-Office Operations.
- Synchronising data between nodes.
- File import and export.
- UFX Online distributed processing
- WAY4 Customer Service Workbench (CSW).

Distributed processing of 3-D Secure/iPAS requests and authorisations (ISO Online)

Distributed processing of 3-D Secure/iPAS authorisations requests in more than one node according to configured rules and with consideration of limitations (see "Limitations") is supported.

Main principles of routing setup (see Fig. 6):

- An authorisation's routing is determined by a contract's routing code and, for some operations, by a suffix defining the operation type. In general, the resulting routing code consists of the following parts:
 - The first part of the code defines the group of authorisation TS to which an authorisation will be forwarded from a front TS.
 - The second part of the code together with the first unequivocally determines the DB node to which the authorisation will be forwarded from the authorisation TS.
 - A suffix used when routing by operation type. In this case for several operation types, the routing code is composed of the routing code itself and a suffix depending on the operation type. The suffix is not stored on the contract level; it is passed from the front TS as a parameter during authorisation.
-  The contract's routing code with a suffix must be registered as a Service Code.
- For each group of authorisation TS, rules for routing between Primary and Secondary are determined on the service level. A main node and reserve nodes are set for each service serving a group of contracts with this service code.
- If the main node is available, the authorisation TS always executes an operation with this code in it, and if it is unavailable – in the reserve node.
- If a routing code is not found (for example, new contracts), the default service is used, which must send all transactions to Primary.

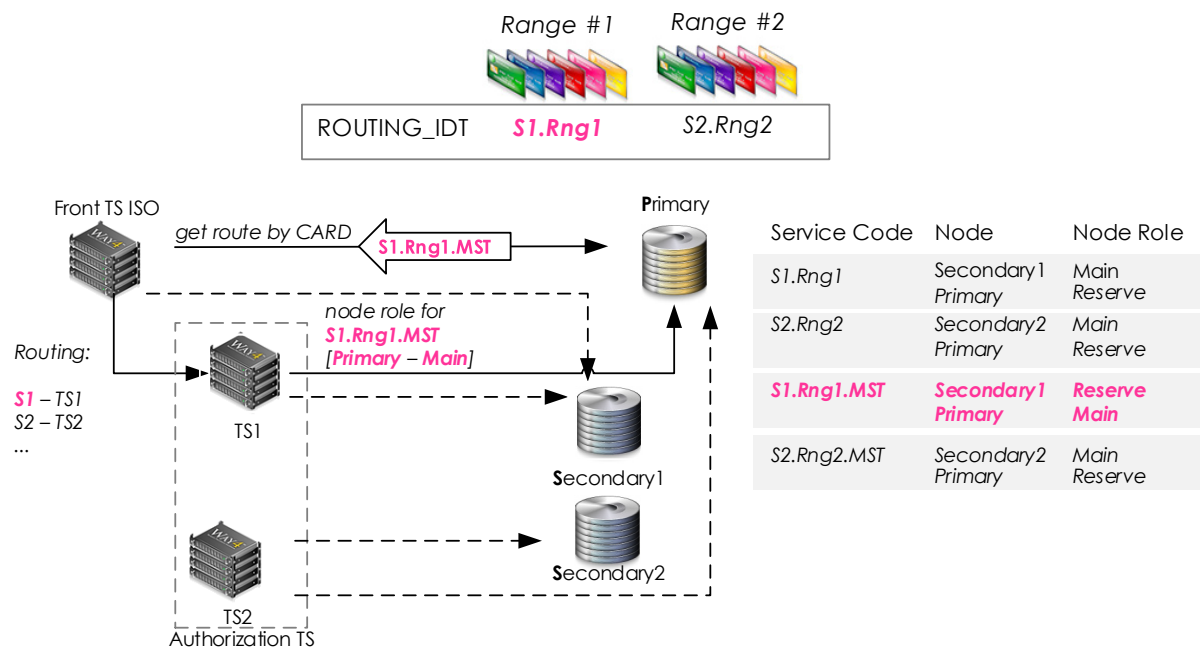


Fig. 6. Main principles of routing

Possible authorisation processing variants depending on load distribution mode are shown in the table (see Table 1).

Table 2. Processing authorisations (P – Primary, S – Secondary)

Mode		P	S1	S2	Comments
Regular	All operations	+	-	-	If routing by operation type is not used, for standard loads, the main node in which authorisation is performed is Primary (Secondary nodes are only used as reserve). If routing by operation type is used, Secondary can be assigned as main nodes, and Primary as the reserve for several operation types (for example, balance inquiry) for certain contract groups.
Regular+	All, except "Balance Inquiry"	+	-	-	
	"Balance Inquiry"	+	+	+	
High season (peak load)	All operations	+	+	+	Authorisation operations for certain routing codes can be switched to Secondary. To implement this routing, for authorisation services used to process the corresponding routing codes, Secondary must be set as main (set as services) using DB Replication Console or DB Manager and Primary will become a reserve. After peak load ends, Primary must be reset as the main node, Secondary will become reserve again for the corresponding services.

When Primary is unavailable, front TS get the routing code in a reserve node. A Secondary acts as the reserve node for getting the contract routing code.

i At this stage, there are several groups of operation for which routing by type is supported: balance inquiry, mini-statement request (see limitation 6 in the section "Limitations"). The list of operation types for which routing by operation type is supported will be added to in client projects.

In "High season" mode, safe operations are processed partially or completely in Secondary (*), unsafe operations are processed in Primary.

Distributed processing of Back-Office Operations

Only safe Back-Office operations can be executed in Secondary. Operations that are not safe can only be executed in Primary.

Safe Back-Office operations and authorisation operations must be defined by a routing code (set during configuration). The code is used to determine the node in which an operation will be executed and the node in which it will be ignored. In Secondary, CDU must be performed for those contracts for which this Secondary may be active.


Executing some operations in Secondary decreases the total time for executing Back-Office operations and ensures their stable processing within an allowed time, including when the load increases.

Safe Back-Office operations can be executed in Primary and in Secondary, regardless of whether an authorisation (Primary or Secondary) is currently being performed. In Secondary, CDU must be executed for those contracts for which this Secondary may be active.

There are two possible modes for coordinated execution (the unsafe part of an operation is executed after the safe part) of Back-Office operations: manually and automatically:

- Coordinated execution of Back-Office operations is manually started by the administrator (using DB Manager/WAY4 Manager connected to Primary through WAY4 Scheduler) based on the job log in the corresponding nodes.
- Coordinated execution of Back-Office operations in different nodes is automatically started with job flags for the corresponding WAY4 Scheduler instances, each of which is attached to its own node (see Fig. 7). System administrators monitor execution of operations using the process log in the corresponding nodes.

Primary setup of WAY4 Scheduler jobs takes place in the Primary node and the status of jobs and flags for execution are synchronised by WAY4Replication transport between Primary and Secondary in both directions.

 In the first stage, functionality of the preliminary process Contract Daily Update (CDU) is implemented as a safe operation. The list of Back-Office operations implemented as safe will increase in client projects.

The following load distribution modes are supported, as shown in the table (see Table 3).

Table 3. Distributed processing modes (P – Primary, S – Secondary)

Mode		P	S1	S2	Comments
Regular	Operation processing	+	-	-	Operations are only processed in Primary (as in the solution with one node). No load distribution. Changes from Primary are replicated to Secondary.
	Replication	-	+	+	
Regular+	Operation processing	+	+	+	The majority of operations are processed in Primary. Operations for a certain operation type (*) are partially or completely switched to Secondary. Changes are replicated in both directions: from Primary to Secondary and from Secondary to Primary.
	Replication	+	+	+	
High season (peak loads)	Operation processing	+	+	+	Safe operations are partially or completely executed in Secondary (**). Unsafe operations are processed in Primary. Changes are replicated in both directions: from the Primary node to Secondary nodes and from Secondary nodes to the Primary node.
	Replication	+	+	+	



The aforementioned description of modes is true on the condition that all nodes are available.

If Primary is unavailable, safe Back-Office operations may be executed in Secondary.

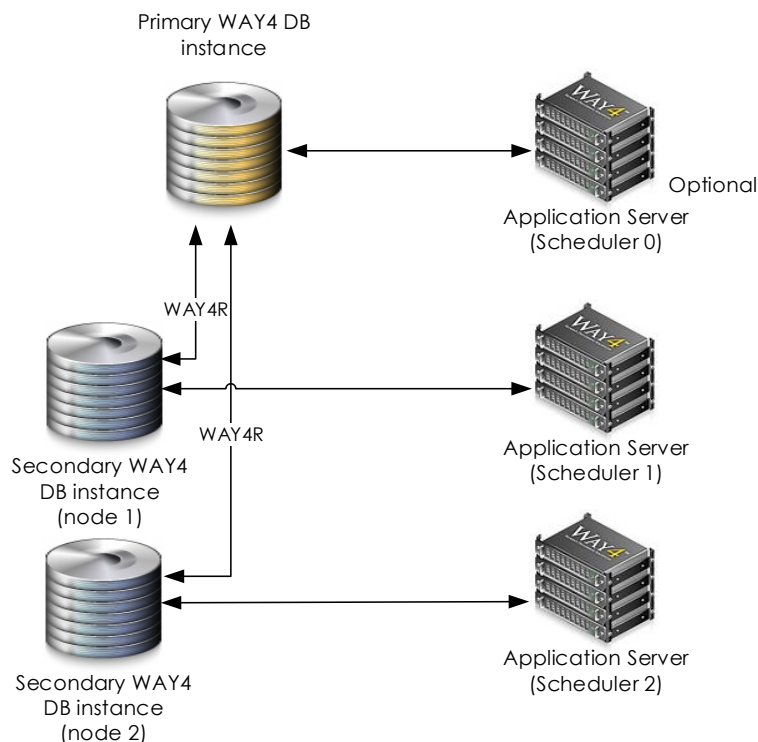



Fig. 7. Scheme for automating coordinated execution of Back-Office operations

 If some Back-Office operations are executed in Secondary, the results of these operations are synchronised to the Primary node by Reproducing synchronisation.

Synchronising data between nodes

WAY4Replication transport is used to synchronise data between nodes (see Fig. 8). Synchronisation takes place between the Primary node and each Secondary node. Synchronisation does not take place between Secondary nodes. The following types of data are synchronised:

- WAY4 configuration settings, including load distribution rules and routing rules are configured in the Primary node and then synchronised to all Secondary nodes.
- Changes in static data ("static data" are defined in the section "Terminology") are only made in the Primary node and all modifications in static data are reproduced in Secondary by Raw synchronisation.
- Dynamic data ("dynamic data" are defined in the section "Terminology") can be changed in Primary and in Secondary:
 - Synchronisation of dynamic data modified in Primary, depends on the selected type of Secondary node. If a full copy of Primary is used, dynamic data are fully synchronised, while if a partial copy (Partial Secondary) is used, they are not synchronised at all.
 - Results of authorisation, including financial documents that were created, in any Secondary are always synchronised to Primary by Reproducing synchronisation. Reproducing synchronisation can be implemented with deferred application of changes.

When Primary is unavailable, after the availability of the Primary node has been restored, data modified in Secondary nodes will be synchronised to Primary.

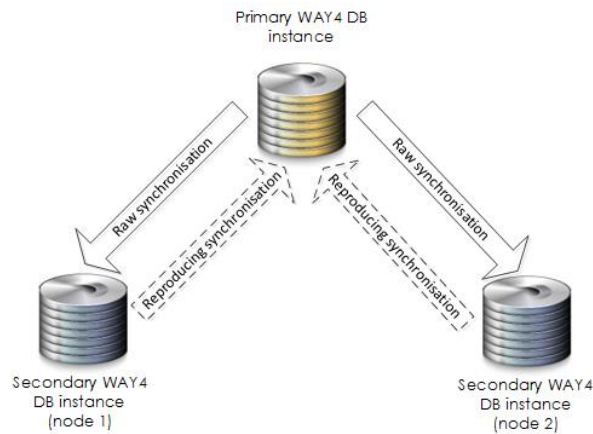


Fig. 8. Scheme for synchronising data between nodes

File import and export

All document file import and export is executed in Primary.

UXF Online distributed processing

The routing principle corresponds to the description in the section "Distributed processing of 3-D Secure/iPAS requests and authorisations (ISO Online)".

WAY4 Customer Service Workbench (CSW)

The routing principle corresponds to the description in the section "UXF Online distributed processing".

Different modes are described in the table (see Table 1), architecture is shown in the section "WAY4 Web load distribution architecture".

Table 4. Specifics of different modes (P – Primary, S – Secondary)

Mode		P	S1	S2	Comments
Regular	Operation processing	+	-	-	All operations are requests are processed in Primary only (the same as the solution with one node).
	Replication	-	+	+	
Regular+	Operation processing	+	+	+	Card status is changed (blocked) and PIN counter is reset in the Secondary where authorisation for this card is currently being performed. Any other operations and requests are executed in Primary only.
	Replication	+	+	+	
High season (peak load)	Operation processing	+	+	+	
	Replication	+	+	+	



WAY4 Customer Service Workbench will not operate if Primary is unavailable.

DB Manager/WAY4 Manager

Operation identical to a single node construction.

If Primary is unavailable, an independent instance of DB Manager/WAY4 Manager is required to work with each remaining available node in the solution.

If an operation is prohibited in Secondary the corresponding message will be shown.

Chapter 5. Use cases

The main use cases of the solution with the "Distributed processing" product are as follows:

- Planned migration to DP architecture.
- Creating Secondary.
- Scheduled work.
- Patch.
- Upgrade.
- Loading FX Rates.

Planned migration to DP architecture

The recommended sequence of measures for moving from a single-node solution to DP architecture:

- Installation and setup of the necessary components.
- Configuration of services and assignment of the corresponding contract routing codes.
- Sequential creation and connection of Secondary nodes (see "Creating Secondary").
- Planned gradual switching of operation processing to Secondary according to contract groups.

Creating Secondary

If a full copy of Primary is used as Secondary, the Secondary DB is created as a full copy of Primary by restoring the DB to a certain SCN, after which processes for synchronising data from Primary are enabled.

If a partial copy of Primary is used as Secondary, the Secondary node's database is created by exporting statistic data from Primary and importing (Export/Import) to Secondary, after which processes for synchronising data from Primary are enabled.



Secondary is created using WAY4 software tools WAY4 (wizard).

Scheduled work

To ensure WAY4 high availability, all scheduled work (with the node detached) at the current time should be performed in one node only, on the condition that the remaining nodes are available.

Patch

A patch is installed in a primary node if the patch does not result in structural data changes. If downtime is necessary, critical operations are executed in Secondary during this node's downtime. To switch critical operations to Secondary, Primary is set to unavailable.

After Primary is started, the patch is installed in each Secondary.

Upgrade

Upgrade is performed in Primary. During the node's downtime for upgrade, critical operations are executed in Secondary. To switch critical operations to Secondary, Primary is set to unavailable.



After Upgrade, sequential re-creation of all Secondary is required.

Loading FX Rates

If Primary is unavailable, to load FX rates an independent instance of DB Manager/WAY4 Manager is required to work with each remaining available node of the solution.

Chapter 6. Limitations

General limitations:


1. Contracts for which a Secondary node is a reserve node cannot be processed in a different Secondary for any operations.
2. It is not possible to change an entire contract group's authorisation reserve node from one Secondary to another, but migration of single extended contract trees from one group to another is possible, including to a group with a different Secondary as reserve (routing code reassignment).
3. Unsafe operations are not allowed in Secondary.
4. Secondary cannot be used as Primary even with full replication.
5. Additional limit when Partial Secondary is used. If a mini-statement request is performed in Secondary, information is only shown for transactions processed in this Secondary.
6. It is only possible to route a request for an operation type to a node differing from the contract's current authorisation node if the operation does not change contract data (limiters and fees are not set up).
7. Chip scripts are only sent to cards from Primary.
8. The solution does not support blocking cards in Secondary:
 - Through Events.
 - Through applications if the Advanced Applications R1 module is used, but the operation is supported if the Advanced Applications R2 module is used (for example, supported WAY4 Web).
9. One or two Secondary is used for load distribution.
10. When switching authorisation for a contract group to Secondary, all unsafe Back-Office operations are blocked in Primary for this contract group. Blocking (operations are blocked using triggers) is in effect until authorisation for these contracts is switched back to Primary.
11. If Secondary was created as a partial copy of Primary, authorisation functionality in Secondary may differ from that in Primary, if authorisation logic depends on data in dynamic tables. Specific differences require examination.
12. If Primary is unavailable, external systems that are directly attached to primary will not function.

13. If Primary and Secondary to which front TS are connected are unavailable, transaction routing and processing will not be possible even for transactions with contracts processed by available Secondary
14. When Primary and one or more Secondary are simultaneously unavailable, the solution cannot guarantee the high availability of processing for service of critical operations.
15. Possible situations leading to simultaneous unavailability of Primary and Secondary:
 - Simultaneous power outage.
 - Simultaneous coming into effect of IPS releases after which transactions in unprepared nodes will be declined.
 - Need to stop processing due to an application error or system software error in both nodes, etc.
16. If Primary is unavailable, WAY4 Customer Service Workbench (CSW) cannot operate. For Customer Support, several copies of DB Manager/WAY4 Manager must be set up and launched for the corresponding Secondary.
17. Every instance of the DB Manager and WAY4 Manager user applications can only work with a single node. For Customer Support to operate correctly, several instances of DBM/WAY4M must be set up and launched, or a Web client should be used.
18. After system upgrade, all Secondary must be sequentially recreated.
19. In the case of scheduled switching of a contract group's service to another node, the downtime for processing critical operations for this contract group consists of the time required to complete In-Flight operations (~10 seconds), the time required for synchronising changes between nodes (~10 seconds), and the time for switching (~3 seconds).
20. In the case of unscheduled switching of a contract group's service to another node, the period necessary to detect the unavailability and make the decision to switch (~10 seconds) is added to the downtime for processing critical operations for this group (see the document "Automatic Switching between Databases").
21. In-Flight operations are executed in the same database where they began. In scheduled switching of the transaction steam to another node, processing of In-Flight operations is always completed in the same node where their processing began. In case of unscheduled unavailability of the node where processing of In-Flight operations began, all these operations will be technically rejected.

22. In the case of a node's unscheduled unavailability, changes in other nodes that are not synchronised with this node are possible.
23. Deferred application of changes in Primary is completed for a finite time interval sufficient to unload the queue of changes.
24. To ensure high availability if one of the sites is wholly unavailable, the second site must have applications servers as well as a secondary node. External applications must automatically select available application servers for connection.
25. The solution requires additional protection of Primary. Options for additional protection:
 - StandBy.
 - GeoMirroring.
26. To change a routing code, service of the corresponding contracts must first be switched to the primary node.
27. For Partial Secondary, only usage limiters with a fixed effective period are monitored (daily, weekly, monthly, etc.).

Chapter 7. Interaction with external systems

Application Servers or Primary are the single point of access to data for external systems.

 Additional analysis of functionality, requirements for WAY4 and SLA for the requested interface are required for each external system.

Chapter 8. Partial Secondary – tables synchronised from Primary to Secondary

CODE	CODE
1 ACCOUNT	27 ADD_PACK_INC
2 ACCOUNT_TYPE	28 ADD_SERVICE_TPLT
3 ACC_SCHEME	29 ADD_SERV_CONTR
4 ACC_SCHEME_EVNT	30 ADD_SERV_TYPE
5 ACC_SCHEME_INCL	31 AFFILIATED_CLIENT
6 ACC_TEMPL	32 AFFILIATION_TYPE
7 ACNT_BALANCE	33 ANALYTIC_ACCOUNT
8 ACNT_CDU	34 APPL_COND_TYPE
9 ACNT_CONTRACT	35 APPL_HANDBOOK
10 ACNT_RELATION	36 APPL_HANDBOOK_ITEM
11 ACQ_DEVICE_STATE	37 APPL_INFO
12 ACQ_DEV_MONGRP_ENTRY	38 APPL_INFO_TYPE
13 ACQ_DEV_MON_GROUP	39 APPL_PRODUCT
14 ACQ_DFLT_HDW	40 APPL_PR_GROUP
15 ACQ_TAG_MAPPING	41 APPL_SCR_MDL
16 ADDRESS_TYPE	42 APPL_SCR_RULE
17 ADDR_LEVEL	43 APPL_SECTION
18 ADDR_LEVEL_LINK	44 APPL_SECTION_TYPE
19 ADDR_OBJECT_LINK	45 APPL_TYPE
20 ADDR_OBJECT_TRL	46 APPL_WF_RULE
21 ADDR_SCHEME	47 AREA
22 ADDR_STORING_RULE	48 AREA_TREE
23 ADD_DATA_COL	49 BALANCE_TYPE
24 ADD_DATA_TAB	50 BANK_UNIT
25 ADD_GLOBAL_PARMS	51 BEHAVIOR_TYPE
26 ADD_PACK	52 BEH_GROUP

CODE	CODE
53 BIN_GROUP	83 CM_EVENT_TYPE
54 BIN_ID	84 CM_EXT_STATUS
55 BIN_TABLE	85 CM_GROUP
56 BPD_MODULE	86 CM_MAP
57 BP_DOMAIN	87 CM_MAP_PARM
58 BP_FLAG	88 CM_MAP_ROLE
59 BP_LOG_PAR	89 CM_MAP_SCH
60 BRANCH	90 CM_MAP_STR
61 CALENDAR	91 CM_NOTIF
62 CARD_INFO	92 CM_OBJ_ROLE
63 CARD_STOP_LIST	93 CM_PARM
64 CHANNEL_CURRENCY	94 CM_PARM_VAL
65 CHANNEL_USAGE	95 CM_REASON
66 CH_FLOOR_LIMIT	96 CM_RESULT
67 CLIENT	97 CM_ROLE
68 CLIENT_ADDRESS	98 CM_ROLE_ACTIV
69 CLIENT_ADDRESS_LINK	99 CM_RULE
70 CLIENT_CONTEXT	100 CM_RULE_TRIG
71 CLIENT_TITLE	101 CM_STEP_ACTIV
72 CLIENT_TYPE	102 CM_STR
73 CLL_FUNC_AREA	103 CM_STR_SCH
74 CL_CHCK_RULE	104 CM_STR_STEP
75 CL_STOP_LIST	105 CM_SYS_ACTION
76 CM_ACTIV	106 CM_USER
77 CM_ACTIV_RES	107 CM_USER_ROLE
78 CM_ACTIV_TXT	108 CM_USER_VAC
79 CM_ADD_PARM	109 CONTRACT_IDT_SCHEME
80 CM_AMOUNT_TYPE	110 CONTR_PARM
81 CM_DOMAIN	111 CONTR_PARM_LINK
82 CM_DOMAIN_FI	112 CONTR_STATUS

CODE	CODE
113 CONTR_SUBTYPE	143 CWF_PARM_GRP
114 CONTR_TYPE	144 CWF_PARM_TYPE
115 COUNTRY	145 CWF_RATE
116 COUNTRY_OBJECT	146 CWF_ROLE
117 CS_ACTION	147 CWF_RULE
118 CS_ACTION_RULE	148 CWF_RULE_APPR
119 CS_DECISION	149 CWF_RULE_EXPR
120 CS_DEC_RESULT	150 CWF_RULE_GRP
121 CS_DEC_RULE	151 CWF_RULE_REL
122 CS_RULE_COND	152 CWF_RULE_SORT
123 CS_STATUS_LOG	153 CWF_RULE_TEST
124 CS_STATUS_TYPE	154 CWF_SCHEMA
125 CS_STATUS_VALUE	155 CWF_STATE
126 CURRENCY	156 CWF_STATE_INC
127 CWF_ACTION	157 CWF_STATE_T
128 CWF_ACTION_T	158 CWF_USER
129 CWF_ACTIVITY	159 CWF_USER_COND
130 CWF_ACTIVITY_T	160 CWF_USER_GRANT
131 CWF_CONST	161 CWF_USER_ROLE
132 CWF_DATA_FORM	162 CWF_USER_RULE
133 CWF_DIC	163 DATE_SCHEME
134 CWF_DISP_ITEM	164 DATE_TEMPL
135 CWF_DISP_SCH	165 DATE_TEMPL_APPROVED
136 CWF_DUTY_ITEM	166 DATE_TYPE
137 CWF_DUTY_SCH	167 DC_COND
138 CWF_GRP	168 DEFAULT_OPER
139 CWF_LINK_RATE	169 DELIVERY_TYPE
140 CWF_MAP	170 DENOMINATIONS
141 CWF_MAP_GRP	171 DENOM_DICT
142 CWF_OFFICER	172 DEVICE_ENH_PRM

CODE	CODE
173 DEVICE_PARMS	203 GRANT_TAB_COL
174 DEVICE_REC	204 HARDWARE
175 DEVICE_TYPE	205 HSK_ARCVIEW_TEMPL_CUST
176 DEV_CONFIG	206 HSK_DB_PARMS_CUST
177 DICT	207 HSK_GLOBAL
178 DISPUTE_RULE	208 HSK_LINE
179 DISPUTE_TYPE	209 HSK_PARMS_CUST
180 DSP_REASON	210 HSK_RESTRICTION_CUST
181 DSP_REQ	211 HSK_RULE_CUST
182 EMBOSSING_CODES	212 HSK_RULE_PRM_NODE
183 EN_OPER	213 HSK_SAVING_CUST
184 EVENT_TYPE	214 HSK_STEP
185 EVENT_TYPE_CHAIN	215 HSK_TABLESPACE_GROUP
186 EVNT_MSG_TEMPL	216 HSK_TABLE_CUST
187 FEE_PROGRAM	217 HSK_T_PARMS_CUST
188 FX_RATE	218 INST_AMOUNT_TYPE
189 FX_SCHEME	219 INST_EVENT_FEE
190 FX_SEQV	220 INST_EVENT_FEE_INCL
191 FX_TYPE	221 INST_ROUTING
192 F_I	222 INST_SCHEME
193 GLOBAL_CONSTANTS	223 INST_TERMS_SET
194 GL_ACCOUNT	224 INTERCH_ROUTING
195 GL_TYPE	225 INVOICE_EVENT
196 GOODS_CODING_SET	226 IRD_FEE_DESC
197 GOODS_GROUP	227 ISS_PROD_SCH
198 GOODS_ITEM	228 ITEM_DUE
199 GOODS_LOCAL_ITEM	229 LANG
200 GOODS_NOMENCLATURE	230 LTR_CHANNEL
201 GOODS_UNIT_TYPE	231 LTR_PART_TMPL
202 GRANT_TAB	232 LTR_TEMPLATE

CODE	CODE
233 LTR_TYPE	263 MP_ACCOUNT_GROUP
234 LTR_TYPE_RULE	264 MP_ACCOUNT_GROUP_RULE
235 MARITAL_STATUS	265 MP_APPLY_HISTORY
236 MENU_ITEM	266 MP_CONSIST_TYPE
237 MENU_TREE	267 MP_ETL_PARM
238 MESSAGE_TYPE	268 MP_OPERATION_TYPE
239 MESS_CHANNEL	269 MP_OPERATION_TYPE_RULE
240 MESS_DICT	270 MP_PS_MEMBER
241 META_GEN_COLUMN	271 MP_PS_MEMBER_SUBS
242 META_GEN_LINK	272 MP_QUALITY_GRADE
243 META_GEN_TABLE	273 MP_QUALITY_GRADE_RULE
244 MPE_IP0016T1	274 MP_SCOPE
245 MPE_IP0018T1	275 MP_TRANSACTION_TYPE
246 MPE_IP0019T1	276 MP_TRANSACTION_TYPE_RULE
247 MPE_IP0030T1	277 NUM_REGISTERED
248 MPE_IP0036T1	278 NUM_SEQ_RANGE
249 MPE_IP0040T1	279 NW_AREA
250 MPE_IP0041T1	280 NW_GROUP
251 MPE_IP0052T1	281 NW_GROUP_PARM
252 MPE_IP0053T1	282 NW_MBR_GROUP
253 MPE_IP0057T1	283 NW_PARM
254 MPE_IP0059T1	284 OBJECT_CHOICE
255 MPE_IP0060T1	285 OFFICER
256 MPE_IP0072T1	286 OFFICER_GRANT
257 MPE_IP0075T1	287 OFFICER_GROUP
258 MPE_IP0087T1	288 OFFICER_ROLE
259 MPE_IP0090T1	289 OFFICER_USED_ROLE
260 MPE_IP0091T1	290 OL_LOGICAL_CHANNEL
261 MPE_IP0095T1	291 OL_MSG_SETTINGS
262 MPE_IP0096T1	292 OL_PHYSICAL_CHANNEL

CODE	CODE
293 OL_SERVER	323 PM_KEYS_OPT
294 ONLINE_PARDS	324 PM_KEY_CERT
295 OW_STATION	325 PM_KEY_DEFAULT
296 PARM_GROUP	326 PM_KEY_OWNER
297 PARM_GROUP_ATTR	327 PM_PARDS
298 PARM_HANDBOOK	328 PM_PARDS_OPT
299 PARM_HANDBOOK_VALUE	329 PM_PROFILE
300 PARM_NODE	330 PREFERRED
301 PARM_SCOPE	331 PREF_TYPE
302 PARM_SET	332 PRODUCT_INIT_EVNT
303 PAYMENT_PRODUCT	333 PRODUCT_OPTION
304 PAYMENT_TYPE	334 PROD_EVENT
305 PAYM_REC	335 RC_USAGE
306 PAYM_REC_PARTY	336 REASON_ACTION
307 PM_BANK	337 REASON_CODE
308 PM_CMND_TASK	338 REASON_COND
309 PM_DEVICE	339 REPORT_ITEM
310 PM_DEVICE_OPT	340 REPORT_TEMPL
311 PM_GP_ACTOR	341 REPORT_TYPE
312 PM_GP_APPL_DATA	342 REP_PARM
313 PM_GP_APPL_INSTANCE	343 REP_TYPE
314 PM_GP_APPL_PROFILE	344 REQUIREMENT
315 PM_GP_CARD_PROFILE	345 RESOURCE_LOCK
316 PM_GP_CARD_PROFILE_DATA	346 RES_RISK_PARDS
317 PM_GP_LF_CONTENT	347 RES_RISK_RATES
318 PM_GP_LF_INSTANCE	348 RES_RISK_SCH
319 PM_GP_LF_MODULE	349 RISK_PARDS
320 PM_GP_LF_PROFILE	350 RISK_PARM_CMND
321 PM_GP_TOKEN	351 RISK_PARM_TYPE
322 PM_KEYS	352 RISK_PRN_V

CODE	CODE
353 RISK_SCHEME	383 SIC_GROUP
354 RISK_TEMPL_CUST	384 SIC_GROUP_TREE
355 SALUTATION	385 SRC_FEE_CODE
356 SCH_CONDITION	386 STANDING_ORDER
357 SCH_ERR_HANDLER	387 STATUS_MESS_TYPE
358 SCH_INSTANCE	388 STAT_ATTR
359 SCH_JOB	389 STAT_DIAGR
360 SCH_JOB_GROUP	390 STAT_IND
361 SCH_TIMETABLE	391 SUBBALANCE_TYPE
362 SCH_TIME_PERIOD	392 SUBITEM
363 SCR_ACTION	393 SW_DB_MON_JOB
364 SCR_ACTION_T	394 SW_NODE
365 SCR_CALC	395 SW_NODE_STATE
366 SCR_MODEL_SEL	396 SW_ROLE
367 SCR_OBJ_ACT	397 SW_SERVICE
368 SCR_POINT_T	398 SW_SERVICE_ACTIVITY
369 SCR_RULE_REL	399 SYC_CLNDR_TYPE
370 SCR_SCHEMA	400 SYL_FMT_PATT
371 SC_SCHEDULER	401 SYNCH_PLAYING_ROLE
372 SC_TASK	402 SYNCH_PROCESS_ROLE
373 SC_TASK_PARAM	403 SYNCH_PROCESS_TABLE
374 SEC_GRANT	404 SYNCH_PROCESS_TYPE
375 SERVICE	405 SYNCH_PROC_INSTANCE
376 SERVICE_APPROVED	406 SYNCH_SOLUTION
377 SERVICE_CONV	407 SYNCH_SYSTEM_ROLE
378 SERVICE_GROUP	408 SYNCH_SYS_CONNECT
379 SERV_PACK	409 SYNCH_SYS_INSTANCE
380 SERV_PACK_EVNT	410 SYNCH_TABLE_INSTANCE
381 SERV_PACK_TYPE	411 SYNCH_TBL_PRC_INST
382 SIC	412 SYS_QUERY

CODE	CODE
413 SYS_SUBITEM_DATA	443 TD_DATA_SCHEDULE
414 SYS_VIEWS	444 TD_DOMAIN
415 SY_APPL_VERSION	445 TD_MENU
416 SY_CONF_GROUP	446 TD_MENU_ITEM
417 SY_CONF_GROUP_GROUP	447 TD_MSG_ATTR
418 SY_CONF_GROUP_REC	448 TD_MSG_ATTR_DEP
419 SY_CONF_GROUP_VAL	449 TD_MSG_COND
420 SY_GROUP_GRANT	450 TD_MSG_COND_ITEM
421 SY_HANDBOOK	451 TD_MSG_TYPE
422 SY_OFFICER_PRIV	452 TD_PARM_RULE
423 SY_PRIVILEGE	453 TD_RT_RULE
424 SY_PROC_PRM_TMPLT	454 TEMPL_APPROVED
425 TARIFF	455 TRANS_COND
426 TARIFF_ACTION	456 TRANS_COND_DTLS
427 TARIFF_DATA	457 TRANS_SUBTYPE
428 TARIFF_DOMAIN	458 TRANS_TYPE
429 TARIFF_GROUP	459 TREE_TYPE
430 TD_ATTR_FILTER	460 TVF_MAPPING_RULE
431 TD_AUTH_PARM	461 TVF_OBJECT
432 TD_AUTH_SCH	462 TVF_TAG
433 TD_AUTH_TYPE	463 UNRES_BIN
434 TD_AUTH_TYPE_USED	464 UNRES_MERCHANT
435 TD_AUTH_VAL	465 USAGE_LIMITER
436 TD_CONS	
437 TD_CONS_COND	
438 TD_CONS_DATA	
439 TD_CONS_DISPATCH	
440 TD_CONS_MSG_TYPE	
441 TD_CONS_TYPE	
442 TD_CONS_TYPE_LTR	