FIG. 1

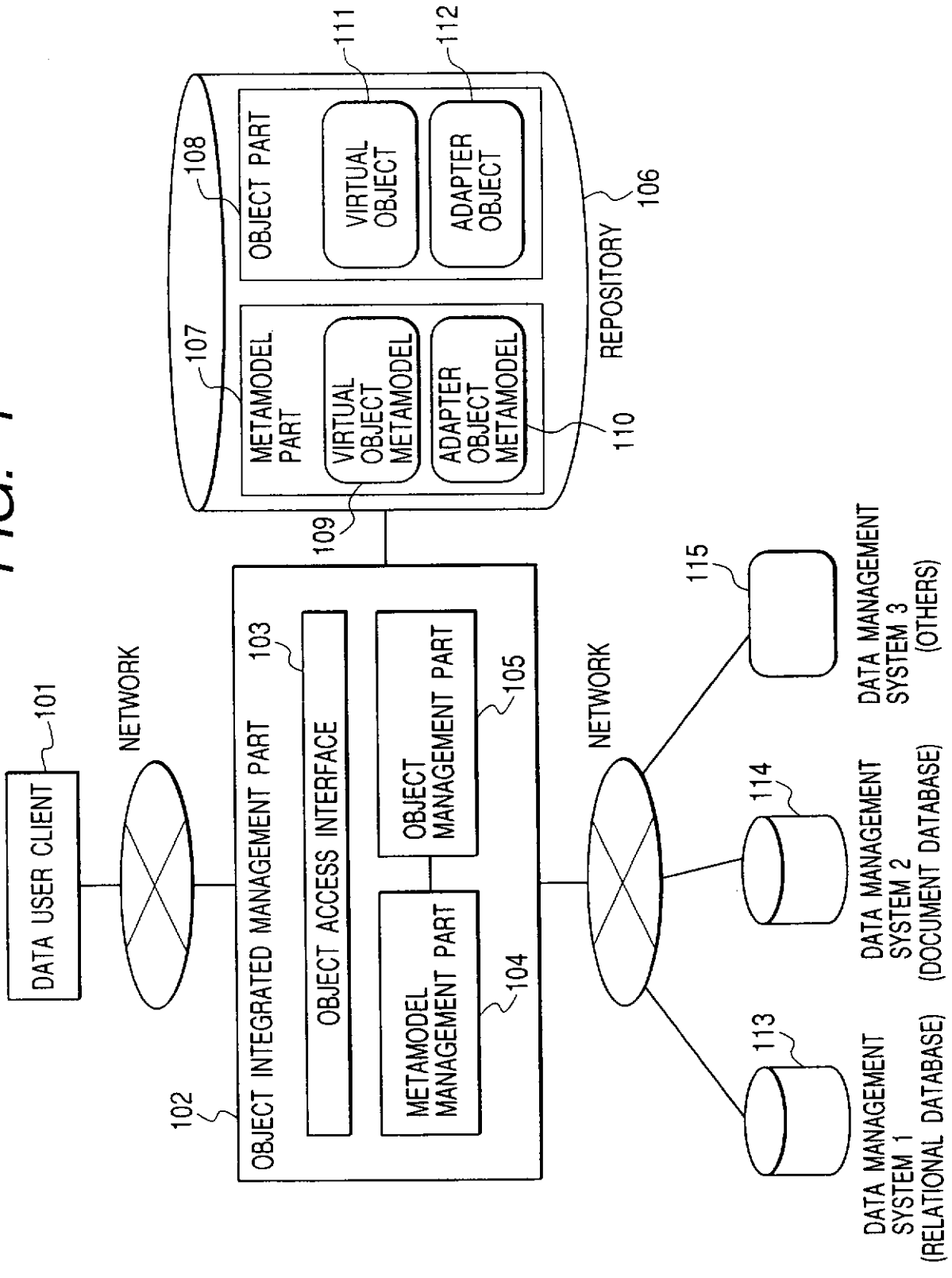

DATA USER CLIENT
101
NETWORK
OBJECT INTEGRATED MANAGEMENT PART
102
OBJECT ACCESS INTERFACE
103
METAMODEL MANAGEMENT PART
104
OBJECT MANAGEMENT PART
105
109
REPOSITORY
106
METAMODEL PART
107
VIRTUAL OBJECT METAMODEL
ADAPTER OBJECT METAMODEL
110
OBJECT PART
108
VIRTUAL OBJECT
111
ADAPTER OBJECT
112
NETWORK
113
DATA MANAGEMENT SYSTEM 1 (RELATIONAL DATABASE)
114
DATA MANAGEMENT SYSTEM 2 (DOCUMENT DATABASE)
115
DATA MANAGEMENT SYSTEM 3 (OTHERS)

FIG. 2

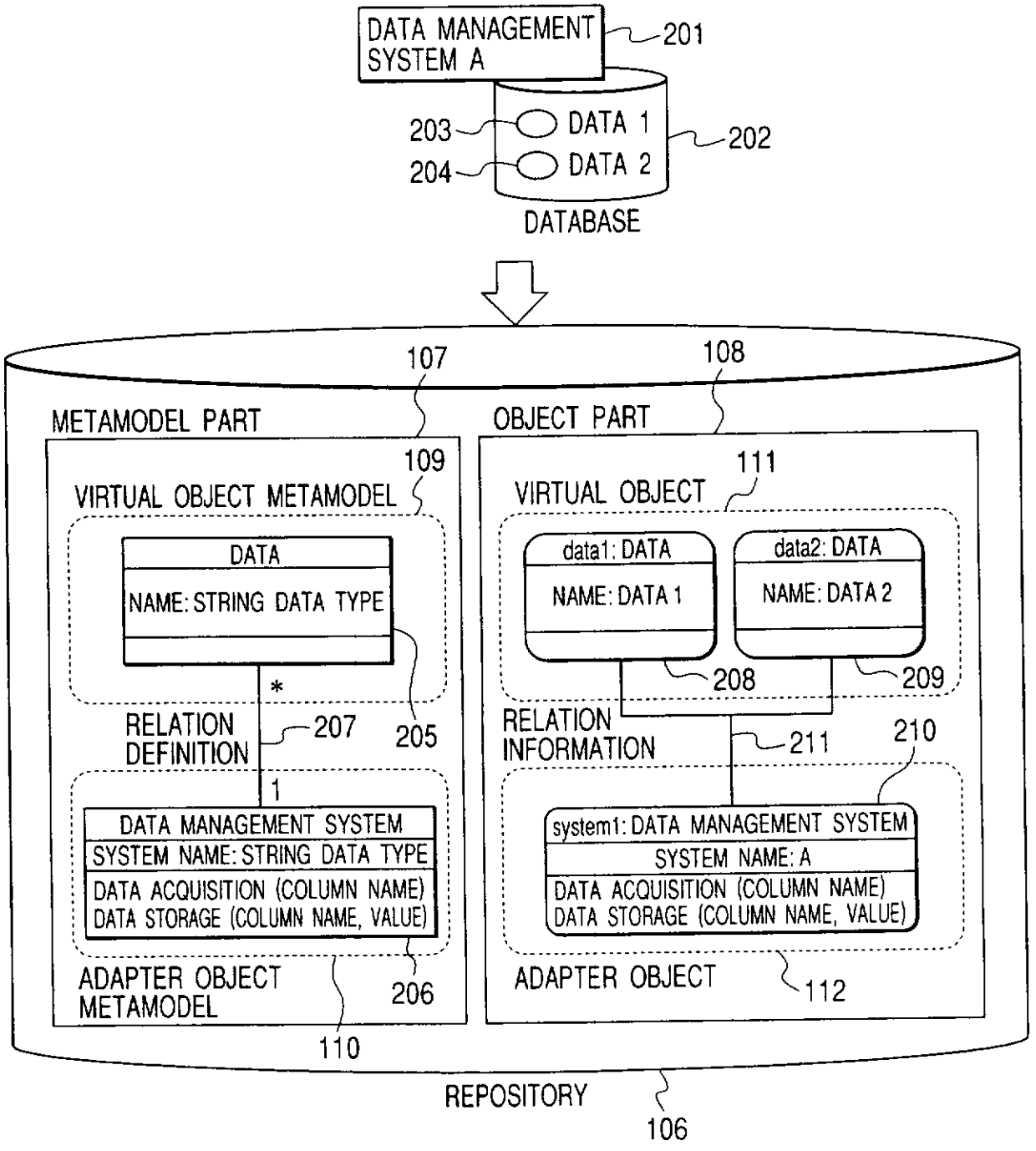

DATA MANAGEMENT SYSTEM A
201
203
DATA 1
202
204
DATA 2
DATABASE
107
108
METAMODEL PART
OBJECT PART
109
VIRTUAL OBJECT METAMODEL
111
VIRTUAL OBJECT
DATA
NAME: STRING DATA TYPE
data1: DATA
NAME: DATA 1
data2: DATA
NAME: DATA 2
*
208
209
RELATION DEFINITION
207
205
RELATION INFORMATION
211
210
1
DATA MANAGEMENT SYSTEM
SYSTEM NAME: STRING DATA TYPE
DATA ACQUISITION (COLUMN NAME)
DATA STORAGE (COLUMN NAME, VALUE)
system1: DATA MANAGEMENT SYSTEM
SYSTEM NAME: A
DATA ACQUISITION (COLUMN NAME)
DATA STORAGE (COLUMN NAME, VALUE)
ADAPTER OBJECT METAMODEL
206
ADAPTER OBJECT
112
110
REPOSITORY
106

FIG. 3

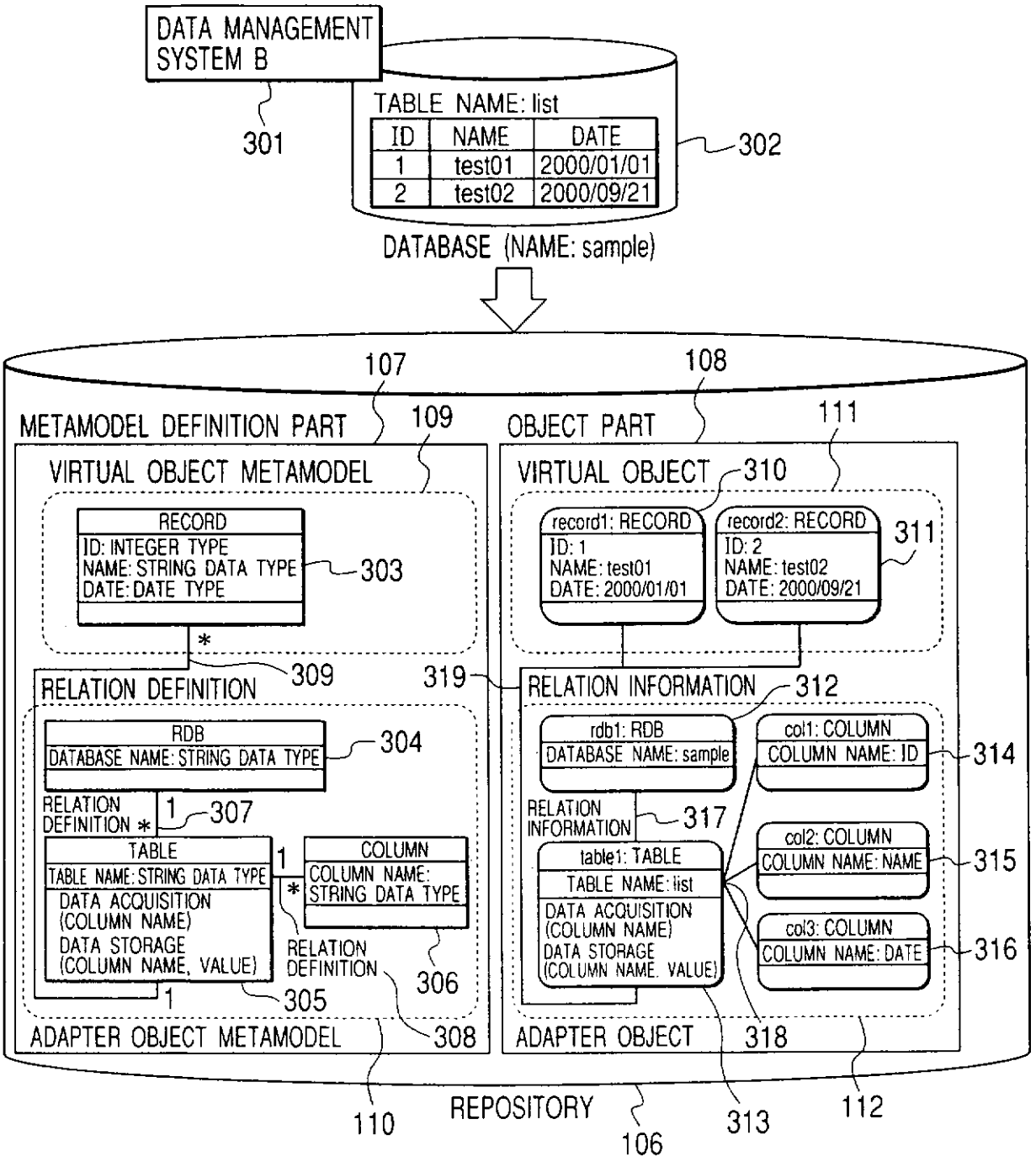

DATA MANAGEMENT SYSTEM B
301
TABLE NAME: list
ID | NAME | DATE
1 | test01 | 2000/01/01
2 | test02 | 2000/09/21
302
DATABASE (NAME: sample)
107
108
METAMODEL DEFINITION PART
109
OBJECT PART
111
VIRTUAL OBJECT METAMODEL
VIRTUAL OBJECT
310
RECORD
ID: INTEGER TYPE
NAME: STRING DATA TYPE
DATE: DATE TYPE
303
record1: RECORD
ID: 1
NAME: test01
DATE: 2000/01/01
record2: RECORD
ID: 2
NAME: test02
DATE: 2000/09/21
311
*
309
319
RELATION DEFINITION
RELATION INFORMATION
312
RDB
DATABASE NAME: STRING DATA TYPE
304
rdb1: RDB
DATABASE NAME: sample
col1: COLUMN
COLUMN NAME: ID
314
RELATION DEFINITION *
1
307
RELATION INFORMATION
317
TABLE
TABLE NAME: STRING DATA TYPE
DATA ACQUISITION (COLUMN NAME)
DATA STORAGE (COLUMN NAME, VALUE)
1
*
COLUMN
COLUMN NAME: STRING DATA TYPE
table1: TABLE
TABLE NAME: list
DATA ACQUISITION (COLUMN NAME)
DATA STORAGE (COLUMN NAME, VALUE)
col2: COLUMN
COLUMN NAME: NAME
315
col3: COLUMN
COLUMN NAME: DATE
316
RELATION DEFINITION
306
1
305
ADAPTER OBJECT METAMODEL
308
ADAPTER OBJECT
318
110
REPOSITORY
106
313
112

FIG. 4

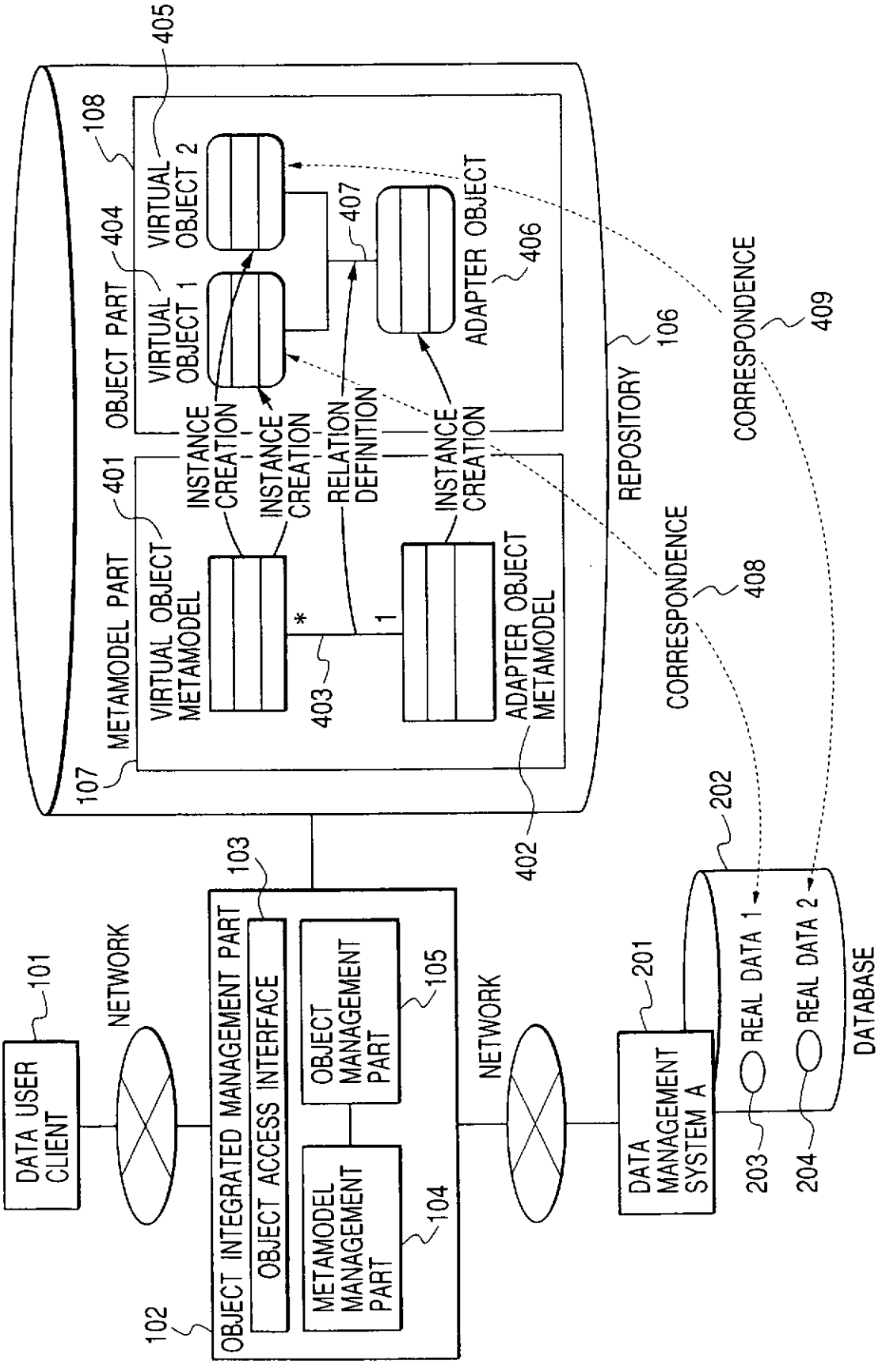

405
108
404
VIRTUAL OBJECT 2
OBJECT PART
VIRTUAL OBJECT 1
407
ADAPTER OBJECT
406
401
METAMODEL PART
VIRTUAL OBJECT METAMODEL
INSTANCE CREATION
INSTANCE CREATION
RELATION DEFINITION
INSTANCE CREATION
REPOSITORY
106
CORRESPONDENCE
409
CORRESPONDENCE
408
403
*
1
ADAPTER OBJECT METAMODEL
107
402
103
OBJECT INTEGRATED MANAGEMENT PART
OBJECT ACCESS INTERFACE
OBJECT MANAGEMENT PART
105
METAMODEL MANAGEMENT PART
104
102
101
DATA USER CLIENT
NETWORK
NETWORK
201
DATA MANAGEMENT SYSTEM A
202
REAL DATA 1
REAL DATA 2
DATABASE
203
204

FIG. 5

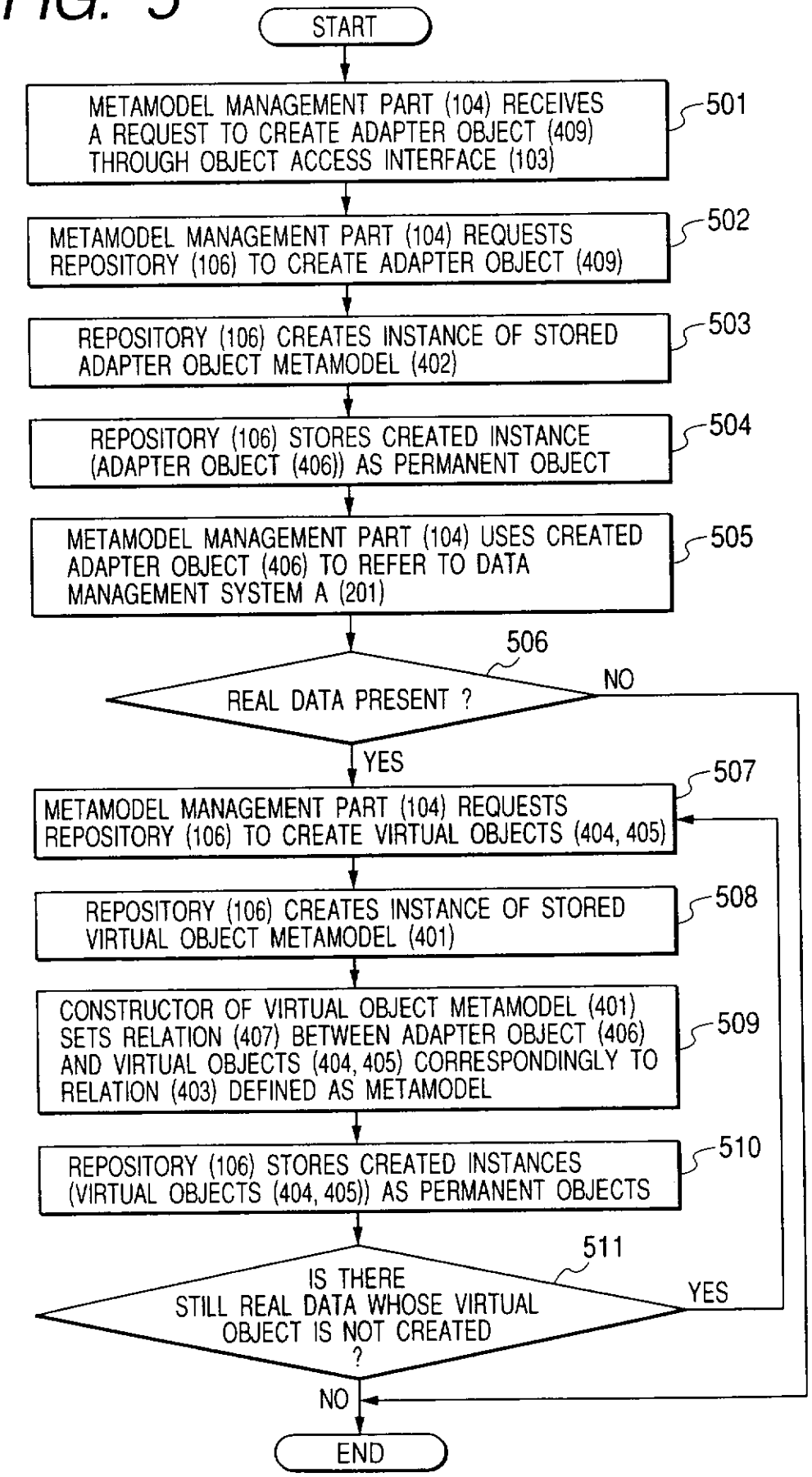

START
METAMODEL MANAGEMENT PART (104) RECEIVES A REQUEST TO CREATE ADAPTER OBJECT (409) THROUGH OBJECT ACCESS INTERFACE (103)
501
METAMODEL MANAGEMENT PART (104) REQUESTS REPOSITORY (106) TO CREATE ADAPTER OBJECT (409)
502
REPOSITORY (106) CREATES INSTANCE OF STORED ADAPTER OBJECT METAMODEL (402)
503
REPOSITORY (106) STORES CREATED INSTANCE (ADAPTER OBJECT (406)) AS PERMANENT OBJECT
504
METAMODEL MANAGEMENT PART (104) USES CREATED ADAPTER OBJECT (406) TO REFER TO DATA MANAGEMENT SYSTEM A (201)
505
506
REAL DATA PRESENT ?
NO
YES
507
METAMODEL MANAGEMENT PART (104) REQUESTS REPOSITORY (106) TO CREATE VIRTUAL OBJECTS (404, 405)
508
REPOSITORY (106) CREATES INSTANCE OF STORED VIRTUAL OBJECT METAMODEL (401)
509
CONSTRUCTOR OF VIRTUAL OBJECT METAMODEL (401) SETS RELATION (407) BETWEEN ADAPTER OBJECT (406) AND VIRTUAL OBJECTS (404, 405) CORRESPONDINGLY TO RELATION (403) DEFINED AS METAMODEL
510
REPOSITORY (106) STORES CREATED INSTANCES (VIRTUAL OBJECTS (404, 405)) AS PERMANENT OBJECTS
511
IS THERE STILL REAL DATA WHOSE VIRTUAL OBJECT IS NOT CREATED ?
YES
NO
END

FIG. 6

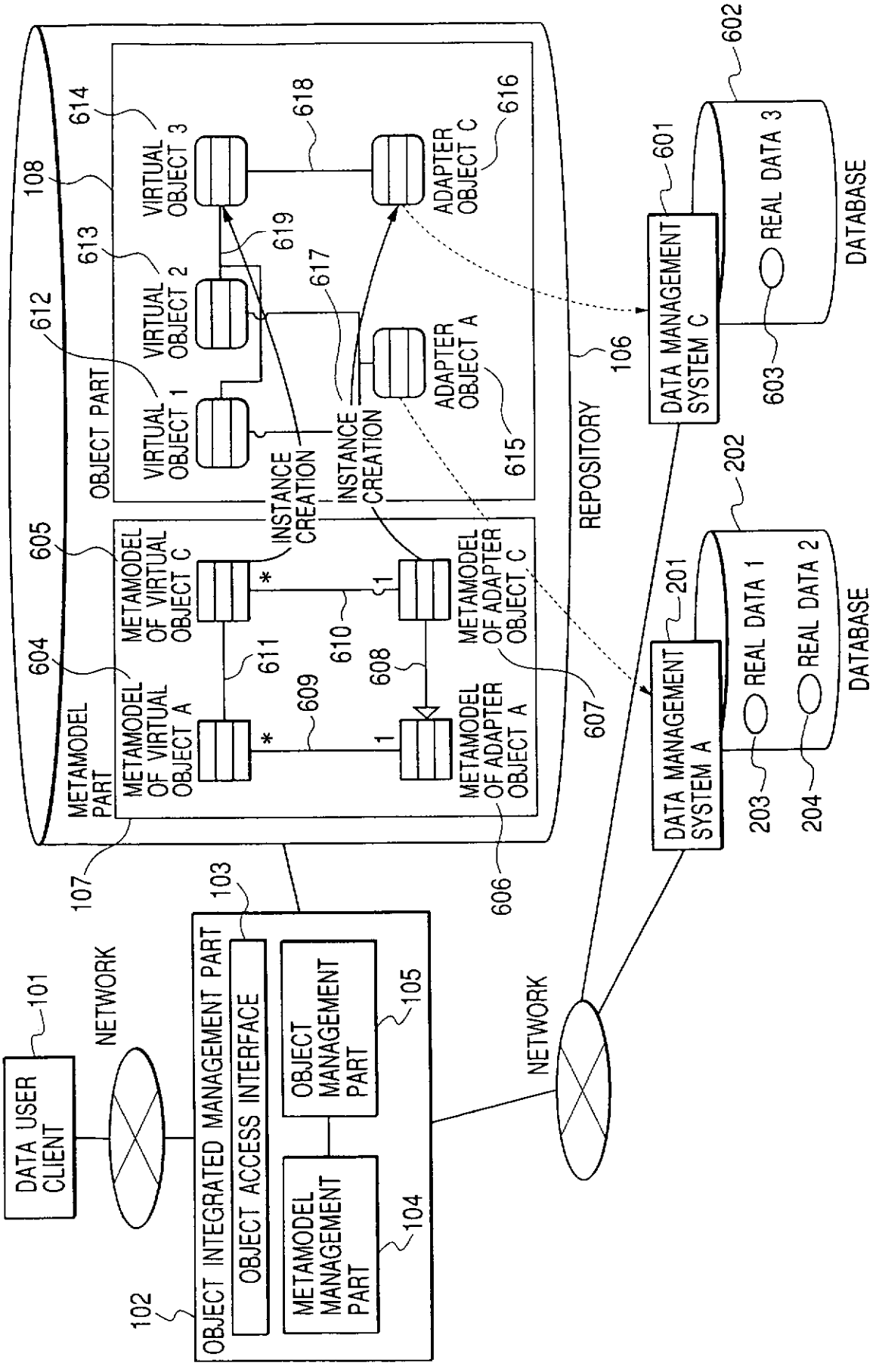

DATA USER CLIENT
101
NETWORK
OBJECT INTEGRATED MANAGEMENT PART
OBJECT ACCESS INTERFACE
OBJECT MANAGEMENT PART
METAMODEL MANAGEMENT PART
102
103
104
105
NETWORK
REPOSITORY
106
METAMODEL PART
107
108
OBJECT PART
VIRTUAL OBJECT 1
VIRTUAL OBJECT 2
VIRTUAL OBJECT 3
ADAPTER OBJECT A
ADAPTER OBJECT C
INSTANCE CREATION
INSTANCE CREATION
METAMODEL OF VIRTUAL OBJECT A
METAMODEL OF VIRTUAL OBJECT C
METAMODEL OF ADAPTER OBJECT A
METAMODEL OF ADAPTER OBJECT C
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
DATA MANAGEMENT SYSTEM A
DATA MANAGEMENT SYSTEM C
REAL DATA 1
REAL DATA 2
REAL DATA 3
DATABASE
DATABASE
201
202
203
204
601
602
603

FIG. 7

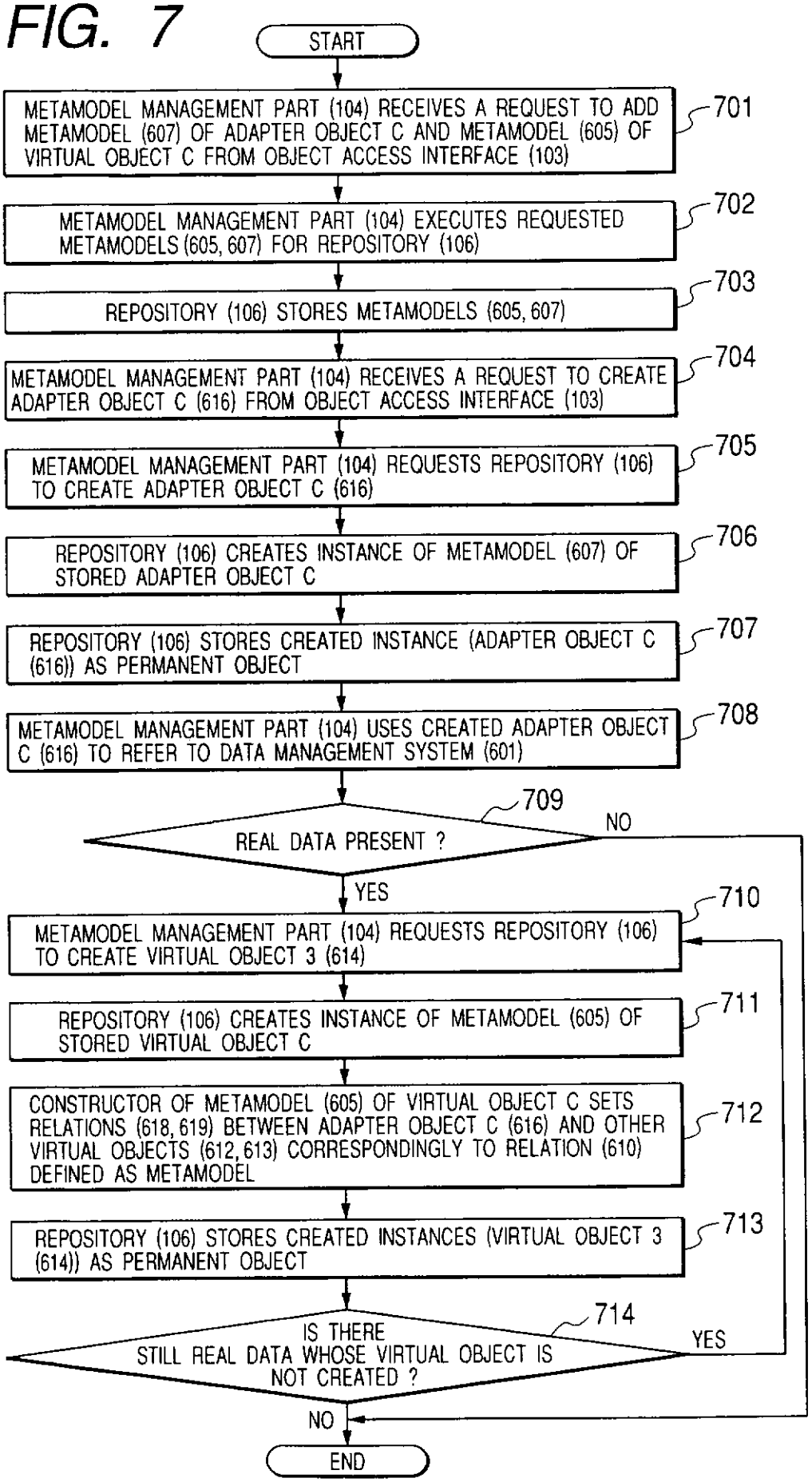
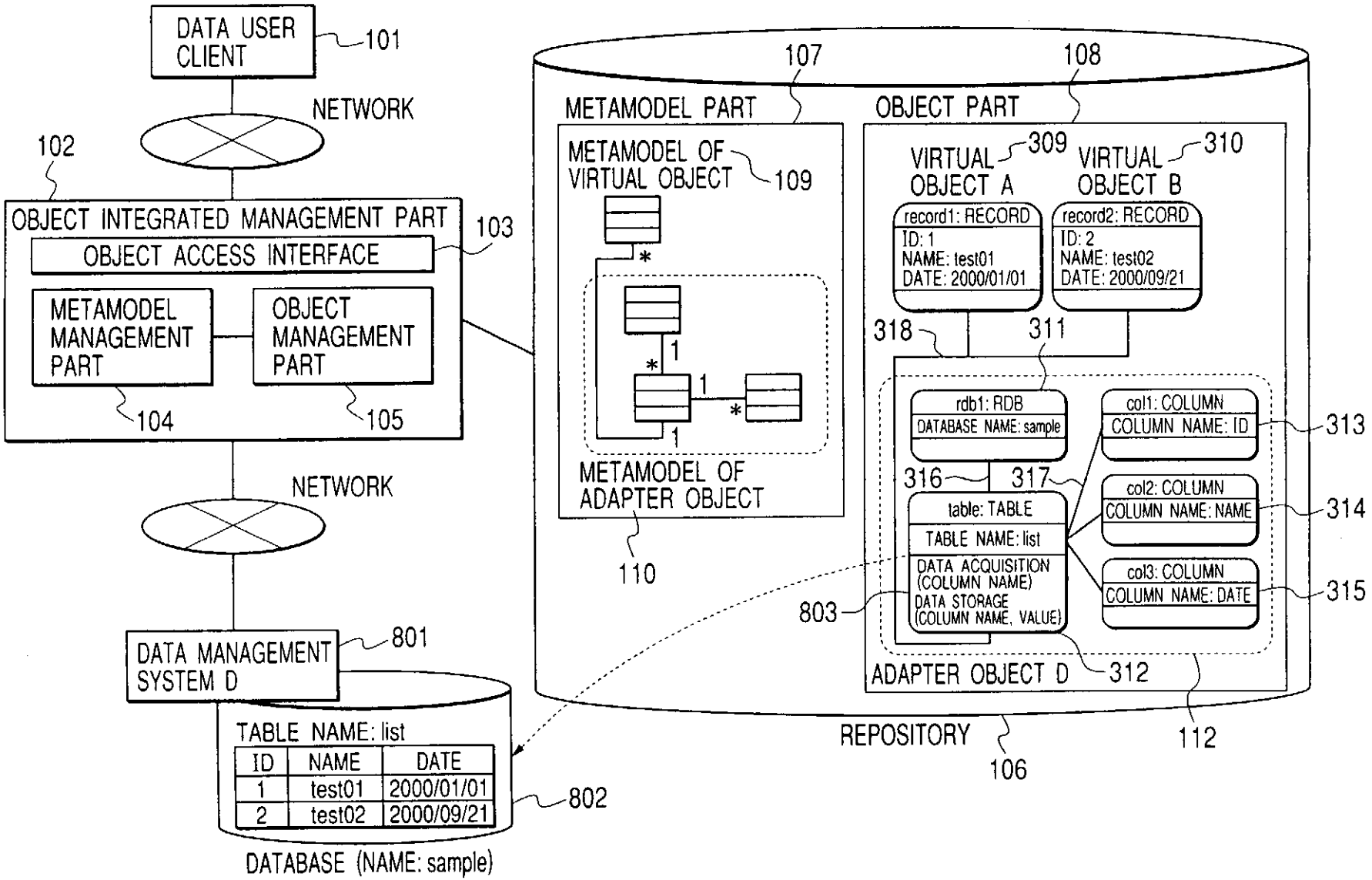

START
METAMODEL MANAGEMENT PART (104) RECEIVES A REQUEST TO ADD METAMODEL (607) OF ADAPTER OBJECT C AND METAMODEL (605) OF VIRTUAL OBJECT C FROM OBJECT ACCESS INTERFACE (103)
701
METAMODEL MANAGEMENT PART (104) EXECUTES REQUESTED METAMODELS (605, 607) FOR REPOSITORY (106)
702
REPOSITORY (106) STORES METAMODELS (605, 607)
703
METAMODEL MANAGEMENT PART (104) RECEIVES A REQUEST TO CREATE ADAPTER OBJECT C (616) FROM OBJECT ACCESS INTERFACE (103)
704
METAMODEL MANAGEMENT PART (104) REQUESTS REPOSITORY (106) TO CREATE ADAPTER OBJECT C (616)
705
REPOSITORY (106) CREATES INSTANCE OF METAMODEL (607) OF STORED ADAPTER OBJECT C
706
REPOSITORY (106) STORES CREATED INSTANCE (ADAPTER OBJECT C (616)) AS PERMANENT OBJECT
707
METAMODEL MANAGEMENT PART (104) USES CREATED ADAPTER OBJECT C (616) TO REFER TO DATA MANAGEMENT SYSTEM (601)
708
REAL DATA PRESENT ?
709
NO
YES
METAMODEL MANAGEMENT PART (104) REQUESTS REPOSITORY (106) TO CREATE VIRTUAL OBJECT 3 (614)
710
REPOSITORY (106) CREATES INSTANCE OF METAMODEL (605) OF STORED VIRTUAL OBJECT C
711
CONSTRUCTOR OF METAMODEL (605) OF VIRTUAL OBJECT C SETS RELATIONS (618, 619) BETWEEN ADAPTER OBJECT C (616) AND OTHER VIRTUAL OBJECTS (612, 613) CORRESPONDINGLY TO RELATION (610) DEFINED AS METAMODEL
712
REPOSITORY (106) STORES CREATED INSTANCES (VIRTUAL OBJECT 3 (614)) AS PERMANENT OBJECT
713
IS THERE STILL REAL DATA WHOSE VIRTUAL OBJECT IS NOT CREATED ?
714
YES
NO
END

FIG. 8



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FIG. 9

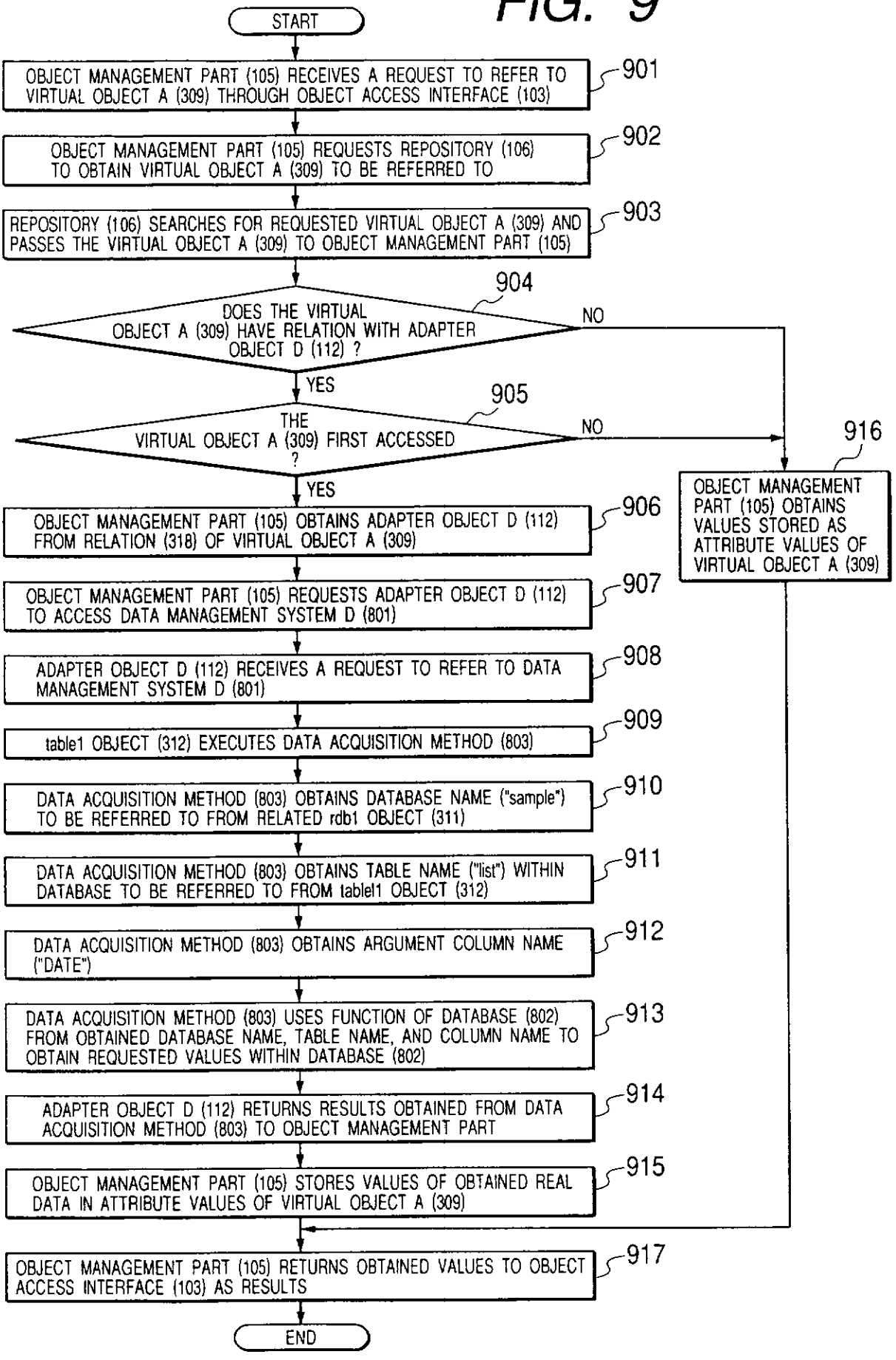

START
OBJECT MANAGEMENT PART (105) RECEIVES A REQUEST TO REFER TO VIRTUAL OBJECT A (309) THROUGH OBJECT ACCESS INTERFACE (103)
901
OBJECT MANAGEMENT PART (105) REQUESTS REPOSITORY (106) TO OBTAIN VIRTUAL OBJECT A (309) TO BE REFERRED TO
902
REPOSITORY (106) SEARCHES FOR REQUESTED VIRTUAL OBJECT A (309) AND PASSES THE VIRTUAL OBJECT A (309) TO OBJECT MANAGEMENT PART (105)
903
DOES THE VIRTUAL OBJECT A (309) HAVE RELATION WITH ADAPTER OBJECT D (112) ?
904
NO
YES
THE VIRTUAL OBJECT A (309) FIRST ACCESSED ?
905
NO
YES
916
OBJECT MANAGEMENT PART (105) OBTAINS VALUES STORED AS ATTRIBUTE VALUES OF VIRTUAL OBJECT A (309)
OBJECT MANAGEMENT PART (105) OBTAINS ADAPTER OBJECT D (112) FROM RELATION (318) OF VIRTUAL OBJECT A (309)
906
OBJECT MANAGEMENT PART (105) REQUESTS ADAPTER OBJECT D (112) TO ACCESS DATA MANAGEMENT SYSTEM D (801)
907
ADAPTER OBJECT D (112) RECEIVES A REQUEST TO REFER TO DATA MANAGEMENT SYSTEM D (801)
908
table1 OBJECT (312) EXECUTES DATA ACQUISITION METHOD (803)
909
DATA ACQUISITION METHOD (803) OBTAINS DATABASE NAME ("sample") TO BE REFERRED TO FROM RELATED rdb1 OBJECT (311)
910
DATA ACQUISITION METHOD (803) OBTAINS TABLE NAME ("list") WITHIN DATABASE TO BE REFERRED TO FROM table1 OBJECT (312)
911
DATA ACQUISITION METHOD (803) OBTAINS ARGUMENT COLUMN NAME ("DATE")
912
DATA ACQUISITION METHOD (803) USES FUNCTION OF DATABASE (802) FROM OBTAINED DATABASE NAME, TABLE NAME, AND COLUMN NAME TO OBTAIN REQUESTED VALUES WITHIN DATABASE (802)
913
ADAPTER OBJECT D (112) RETURNS RESULTS OBTAINED FROM DATA ACQUISITION METHOD (803) TO OBJECT MANAGEMENT PART
914
OBJECT MANAGEMENT PART (105) STORES VALUES OF OBTAINED REAL DATA IN ATTRIBUTE VALUES OF VIRTUAL OBJECT A (309)
915
OBJECT MANAGEMENT PART (105) RETURNS OBTAINED VALUES TO OBJECT ACCESS INTERFACE (103) AS RESULTS
917
END

FIG. 10

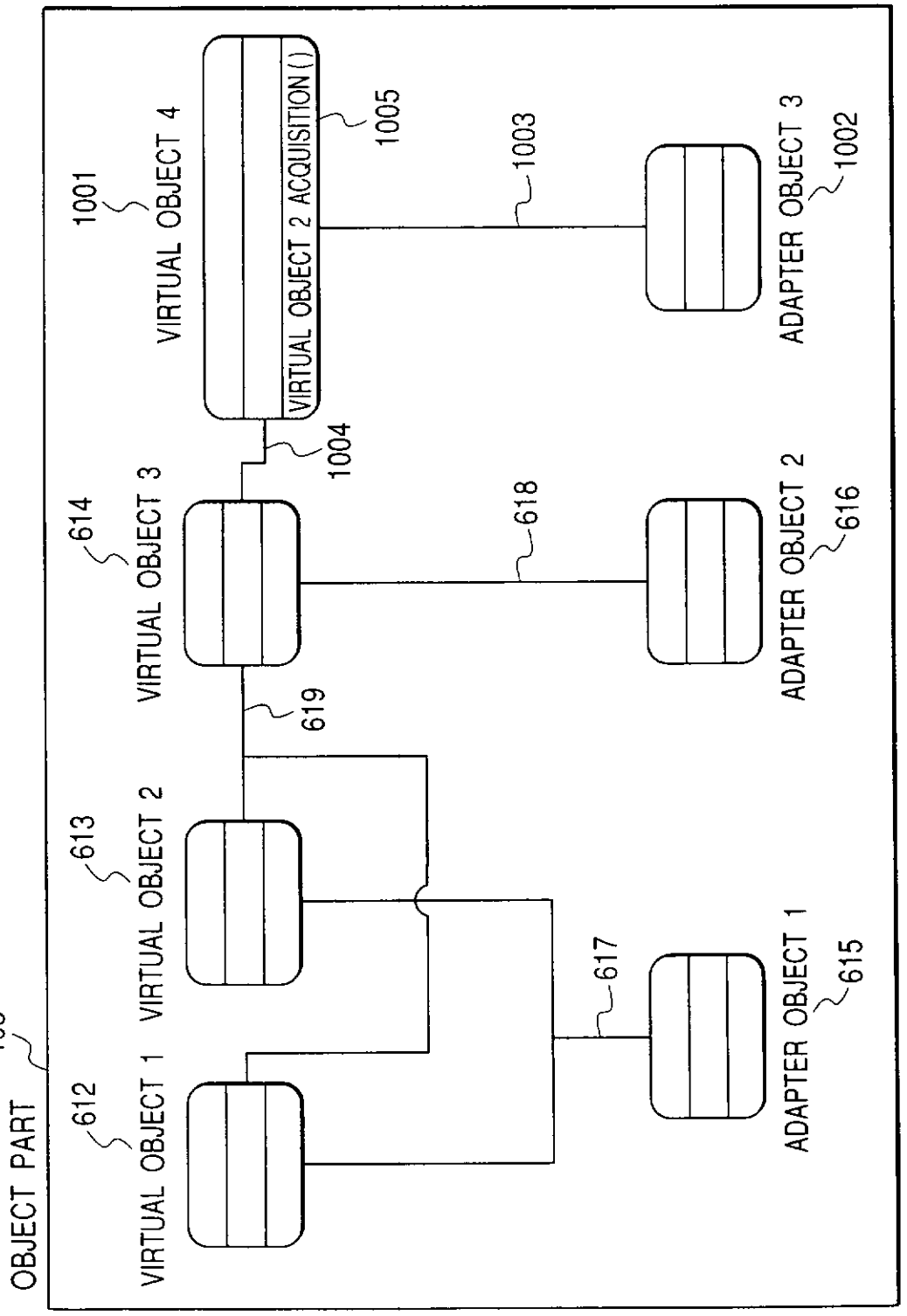

OBJECT PART
108
VIRTUAL OBJECT 1
612
VIRTUAL OBJECT 2
613
VIRTUAL OBJECT 3
614
VIRTUAL OBJECT 4
1001
VIRTUAL OBJECT 2 ACQUISITION ( )
1005
1004
619
617
618
1003
ADAPTER OBJECT 1
615
ADAPTER OBJECT 2
616
ADAPTER OBJECT 3
1002

FIG. 11

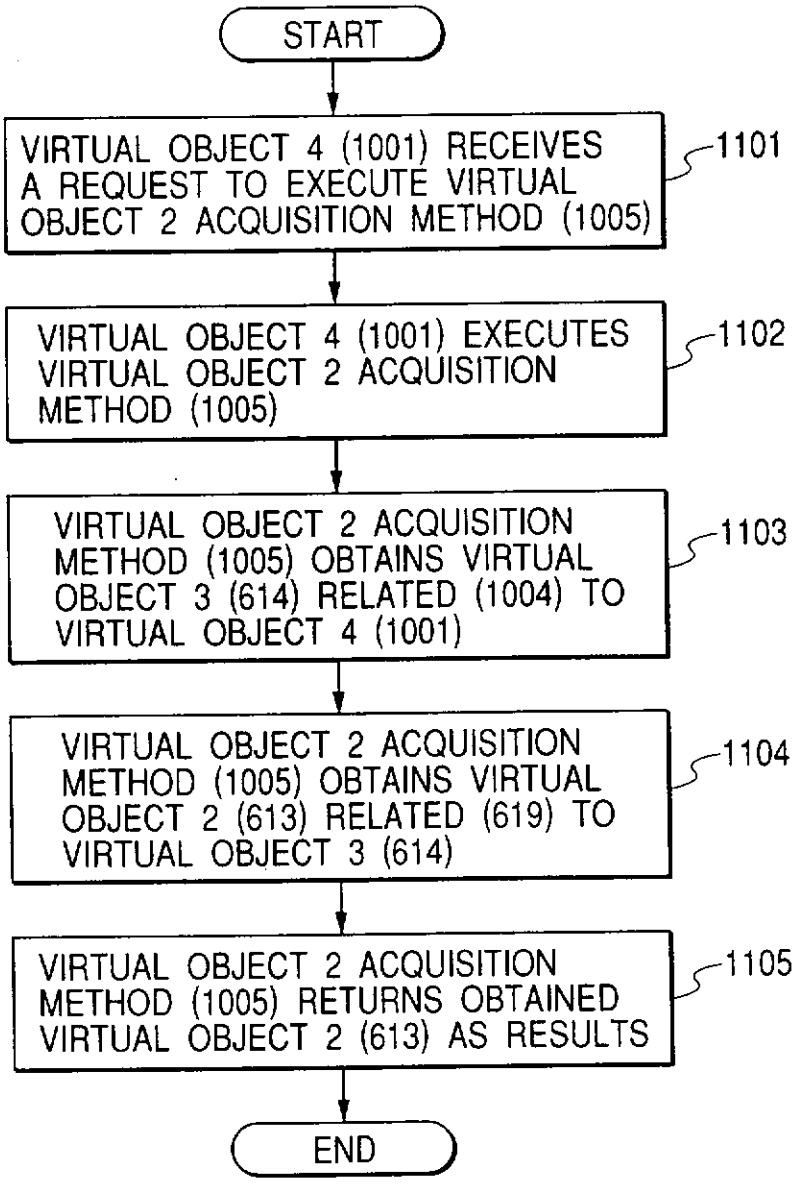
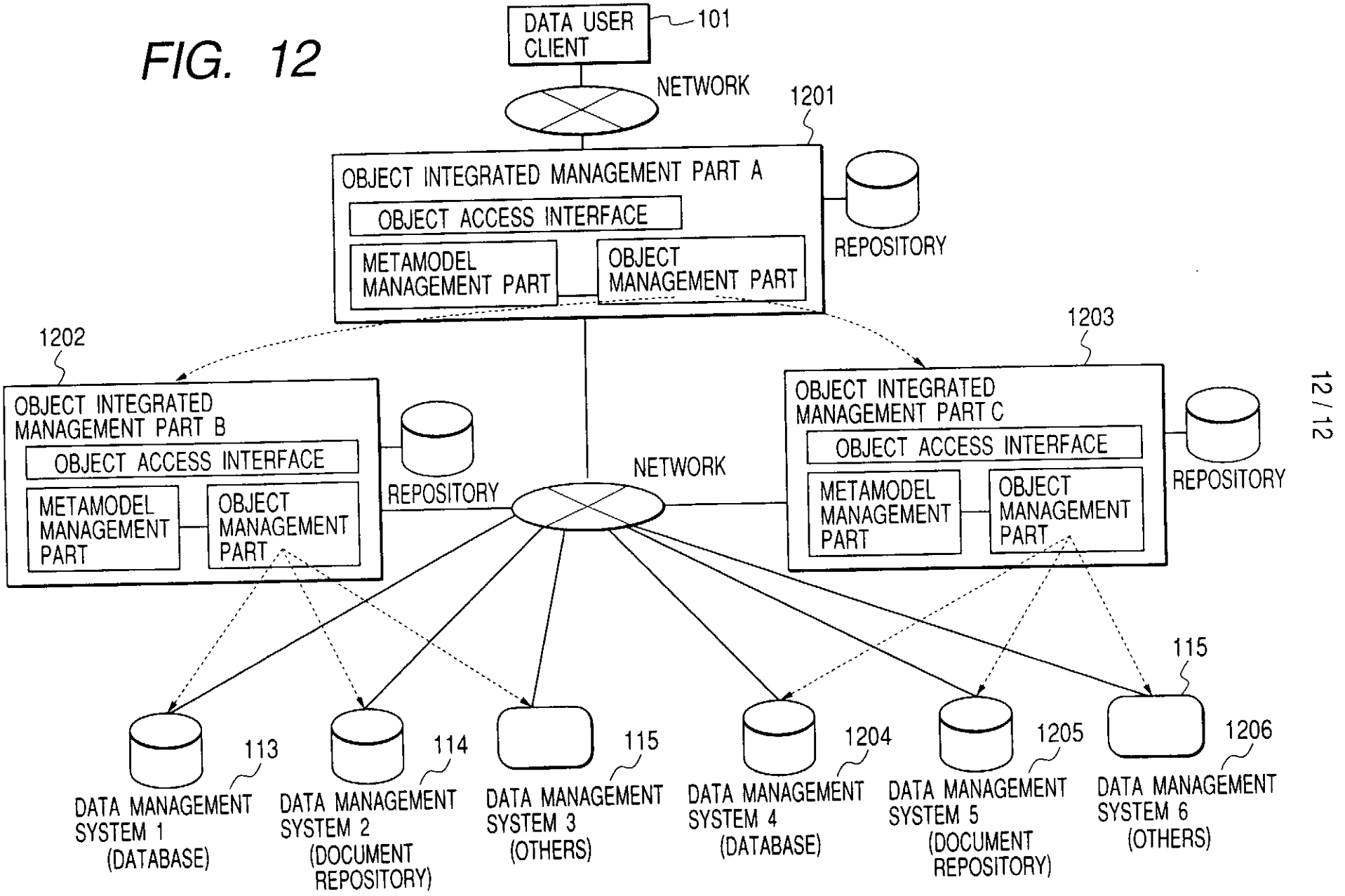

START
VIRTUAL OBJECT 4 (1001) RECEIVES A REQUEST TO EXECUTE VIRTUAL OBJECT 2 ACQUISITION METHOD (1005)
1101
VIRTUAL OBJECT 4 (1001) EXECUTES VIRTUAL OBJECT 2 ACQUISITION METHOD (1005)
1102
VIRTUAL OBJECT 2 ACQUISITION METHOD (1005) OBTAINS VIRTUAL OBJECT 3 (614) RELATED (1004) TO VIRTUAL OBJECT 4 (1001)
1103
VIRTUAL OBJECT 2 ACQUISITION METHOD (1005) OBTAINS VIRTUAL OBJECT 2 (613) RELATED (619) TO VIRTUAL OBJECT 3 (614)
1104
VIRTUAL OBJECT 2 ACQUISITION METHOD (1005) RETURNS OBTAINED VIRTUAL OBJECT 2 (613) AS RESULTS
1105
END

FIG. 12



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