RFID

Trends of Middlewares for Processing the RFID-Based Sensor Data on the Ubiquitous Computing Environment

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(M.J. Kim)   ,

RFID

, RFID

.   RFID

EPCglobal   EPC Network Architecture

,

.

I.

5C(Computing, Communication, Connectivity, Contents, Calm)   5Any(Any- time, Any- where, Any- network, Any- device, Any- service)

,

.

(silent commerce)
RFID
, RFID

.

.

RFID   ,   EPCglobal
EPC Network Architecture   ,
RFID   RFID

.

RFID

.

II. EPC Network Architecture

21   MIT,
UCC, P&G   46   1999
auto- ID
RFID   RF(Radio Frequency)

(1) EPC Network Architecture

,

.

EPCglobal

EPC Network Architecture   (1)

Electronic Product Code(EPC),

(Radio Frequency Identification: RFID)

RFID   , SAVANT, EPC   (Information

Server), ONS(Object Name Server)   .

1. EPC

EPC

(2)   EPC

, ,   EPC

(header), EPC   ,

EPC manager   ,

SKU   object

class,

(serial number)   [1].

[1]

64bit 96bit   EPC
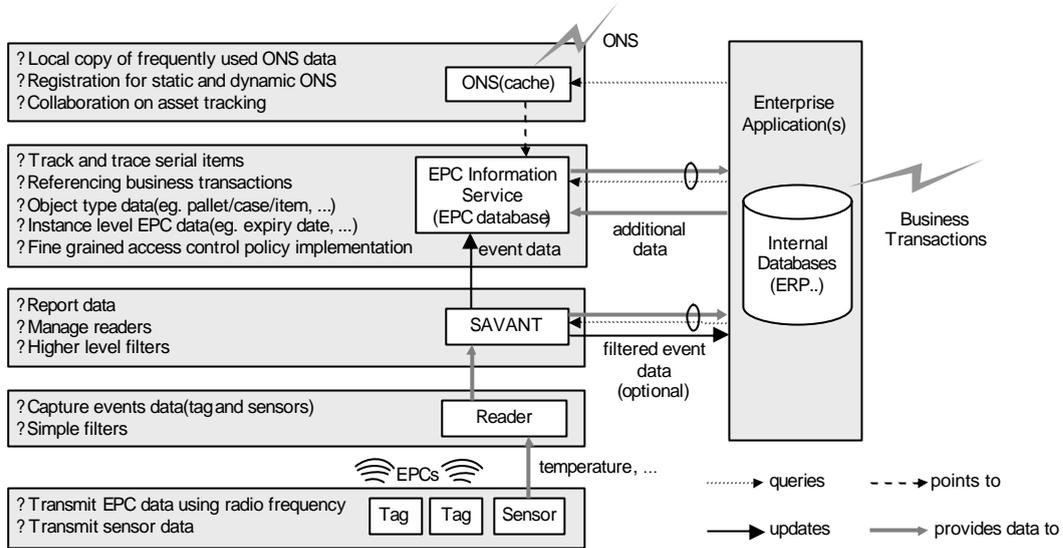
Header	EPC Manager Number	Object Class	Serial Number

(2) EPC

, (256bit   EPC

) GID(General

IDentifier), SGTIN(Serialized Global Trade Identifi-

cation Number), SSCC(Serial Shipping Container

Code), SGLN(Serialized Global Location Number),

GRAI(Global Returnable Asset Identifier), GIAI

(Global Individual Asset Identifier)

EPC

.

2. RFID & RFID

(smart tag)

(RFID)

RFID

RFID   .

RFID   (power)

, RFID   RFID

.

RFID (passive) ,
(semi- passive) ,
(active) .
(,
) ,
,
.

RF ,
124~134kHz LF(Low Freqeuncy)
, IC , 13.56MHz
HF(High Frequency) ,
400~915MHz UHF(Ultra
HF) ,
2.45GHz
(, 5.8
GHz).
RFID
(identity tag) (functional tag)
.
EPC
CRC(Cyclic
Redundancy Checking) ,
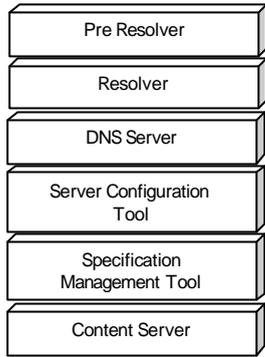
.
EPCglobal [2]- [4].

• Generation 1 Class 0(C0g1 C0v1):
Read- Only(R/O)
• Generation 1 Class 1(C1g1): Write Once,
Read Many(WORM)
• Generation 1 Class 2(C2g1): Write Many,
Read Many(WMRM)
RFID
RFID ( )
,
(air protocol)
.
EPCglobal
RFID Generation 2

, 2003 10 23 860MHz~
960MHz UHF
Class 1(C1g2)
"Last Call Working Draft" ,
2004 9 ISO .

3 EPC

EPC Network (manu-
facturer) EPC (EPC
Information Server: EIS)
. EPC
EPC , ,
,
.
XML(eXtensible Markup Language)
PML 1.0 2003 9 15
[5]. PML
PML ,
PML W3C XSD(XML Schema
Definition)
(element) .

4 ONS
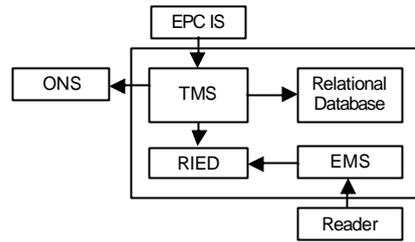
DNS
(Domain Name Service) ONS RFID
EPC
[6].
ONS DNS , EPC
EPC Pre Re-
solver, EPC EPC PML
Resolver, PML IP
EPC
DNS , ONS (specification file)
DNS
Server Configuration Tool, ONS
ONS Specification
Management Tool,
ONS

Pre Resolver
Resolver
DNS Server
Server Configuration Tool
Specification Management Tool
Content Server

(3) ONS

TYPLCAL ONS QUERY

ETAG → TAG Encoded EPC 1 → TAG READER → TAG Encoded EPC 2 → LOCAL SERVER

EPC(URI Form) 3
URL of PML Server 6   7
LOCAL ONS RESOLVER
EPC Domain- name 4   NAPTR Records 5
Contacting PML Server
ONS SERVER INFRASTRUCTURE
PML SERVER

(4) ONS

Content Server   (3)
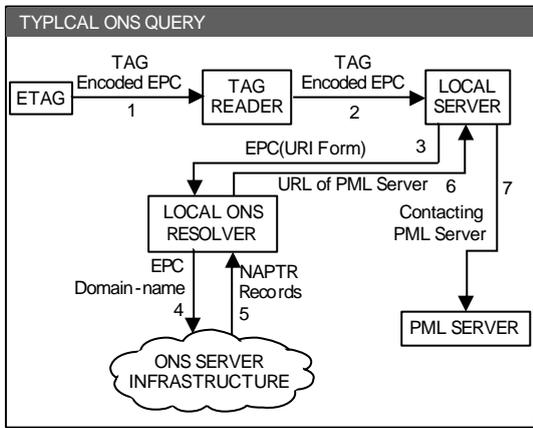.

ONS   (
4)   (1) RFID
EPC   , (2)
. (3)   URI(Uni-
form Resource Identifier)   ONS
Resolver   (4) Resolver   URI
DNS   . (5) DNS
EPC IS   URL   ,
(6) Resolver   URL   (7)
URL   EPC IS   EPC
EPC IS   [7].

5. SAVANT

RFID   EPC

EPC IS
ONS → TMS → Relational Database
RIED ← EMS
Reader

(5) SAVANT

EPC
, EPC   ,
,
(transmission)
.

SAVANT   (5)

(Event Management System: EMS),

(real- time in- memory data structure: RIED),

(Task Management System:
TMS)   ,
,
, ONS   EPC IS
[7].(SAVANT

.)

III. RFID

RFID

RFID   , RFID
RFID   ,
ERP(Enterprise Resource Planning),
SCM(Supply Chain Management)
.

RFID
RFID

RFID   .

RFID   ,   RFID

RFID

        .   . TagsWare   RFID

EPC

                                                                            link

                        .   .

        ,

3 RFTagAware

                                            Solaris, Linux, Windows

        RFID   ConnecTerra   RFTagAware[10]

                EPC   , RFID

                        ,   ,   ,

                .   . RFTagAware

1. SUN Savant[8]

                                            RFID

        EPCglobal   EPC Network Architecture   .

                SAVANT

                        Java   RFID   ## 4 iMotion

                (event manager)

                        RFID   .NET

                                    reader adapter, filter,   GlobeRanger   iMotion[11]

logger, enterprise gateway   . RFID   RFID

                RFID   EPC   ,

                                                                        (alerts)

                                        RFID   .

EPC   visual workflow editor   RFID

        .   ,   ,

                                            .   visual reader emulator   .

2. TagsWare   ## 5 URIS

                                                            EPC   Network   Archi-

                                                    tecture   SAVANT

                            CapTech   TagsWare[9]   RFID   URIS[12]   , URIS

RFID

RFID   , RFID

EPC

Network Architecture

Savant,   ERP, CRM(Customer Rela-
tionship Management), WMS(Warehouse Man-
agement System)

RFID   RFID

enterprise middleware   .

6

GenuOne   Acsis

RFID   [13],
MIT auto- ID   OATSys-
tem

Senseware

[14],[15].

SAP   Java   SAP
event management   SAP event portal

SAP auto- ID infrastructure

, RFID

(tracing)   [16].

IV.

RFID

.

[17].

• (order)   (time)

.

•   .
•

(blocking)

.

•

(backtracking)

.

•

.

•

.

(Database Man-
agement System: DBMS)

,

(trigger)   (materialized
view)   ,

.

•   .
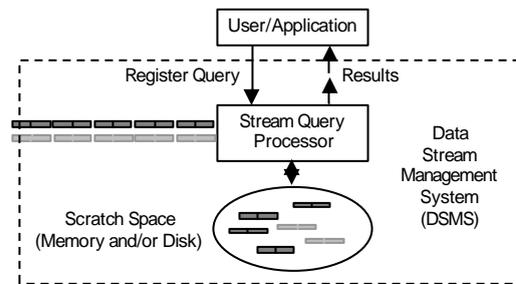•   ,

.

•   .
•   .
•   .

(6)

(Data Stream Management System: DSMS)

.

(6)

,

(6)   (DSMS)

.

(stream query processor)

1. AURORA

.

(continuous query)

,

(scratch space)   .   AURORA   [18]   Brown   ,
DSMS   Brandeis   , MIT
(7)   [17].   (DSMS)
(7)   (input monitor)   .
.
(working   ,
storage),   (summary storage)
(static storage)   .   ,   ,
,
.
,
.
.
(source)   ,
.   (query   (introspection)
repository)   DSMS   .
,   (query processor)   AURORA

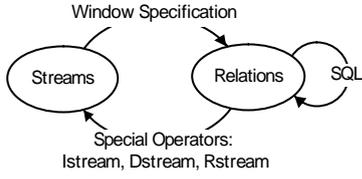(output buffer)   .   Filter, Map, Union, BSort, Aggregate, Join,
Resample
,   , QoS

QoS

.
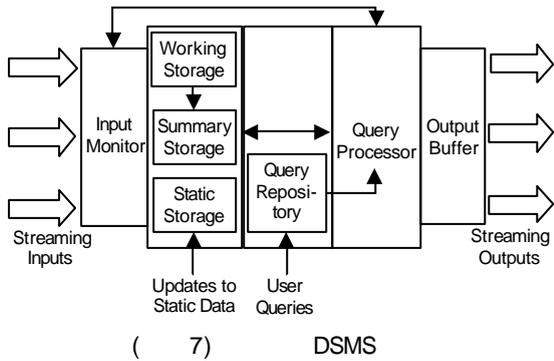
2 STREAM

STREAM(STanford stREam datA Manager)
[19]

,

(7)   DSMS

Window Specification

Streams   Relations   SQL

Special Operators:
Istream, Dstream, Rstream

(8) CQL

(Continuous Query: CQ)

STREAM

SQL

, QoS

-

,

,   (load shedding)

STREAM   SQL
CQL(Continuous Query Lan-
guage)   , CQL

(8)

Istream, Dstream,
Rstream   .

3 NiagaraCQ

NiagaraCQ   [20]

1999   2002

NiagaraCQ   XML
Niagara
,   XML
XML   XML- QL
,

CPU

.

4 TelegraphCQ

Adaptive
Dataflow
Telegraph
Post-
greSQL   .

,
.

Tele-
graphCQ[21]   StreaQuel

.

WindowIS   .

5 OpenCQ

Geor-
gia Tech   1996

,

.

OpenCQ[22]

,

,

,

.

OpenCQ   ,   ,

,

.

.   RFID

6. COUGAR.

EPCglobal

EPC Network Architecture

COUGAR[23]

,

,

(flexibility)   (scalability)   ,

(fault tolerant)

.

,

, RFID

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COUGAR

(Abstract Data Type: ADT)

,   ADT

.

$every()   SQL

.

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DSWare, UCLA   SensorWare,
Impala, UC   Mate

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V.

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RFID

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[13] http://www.acsisinc.com

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