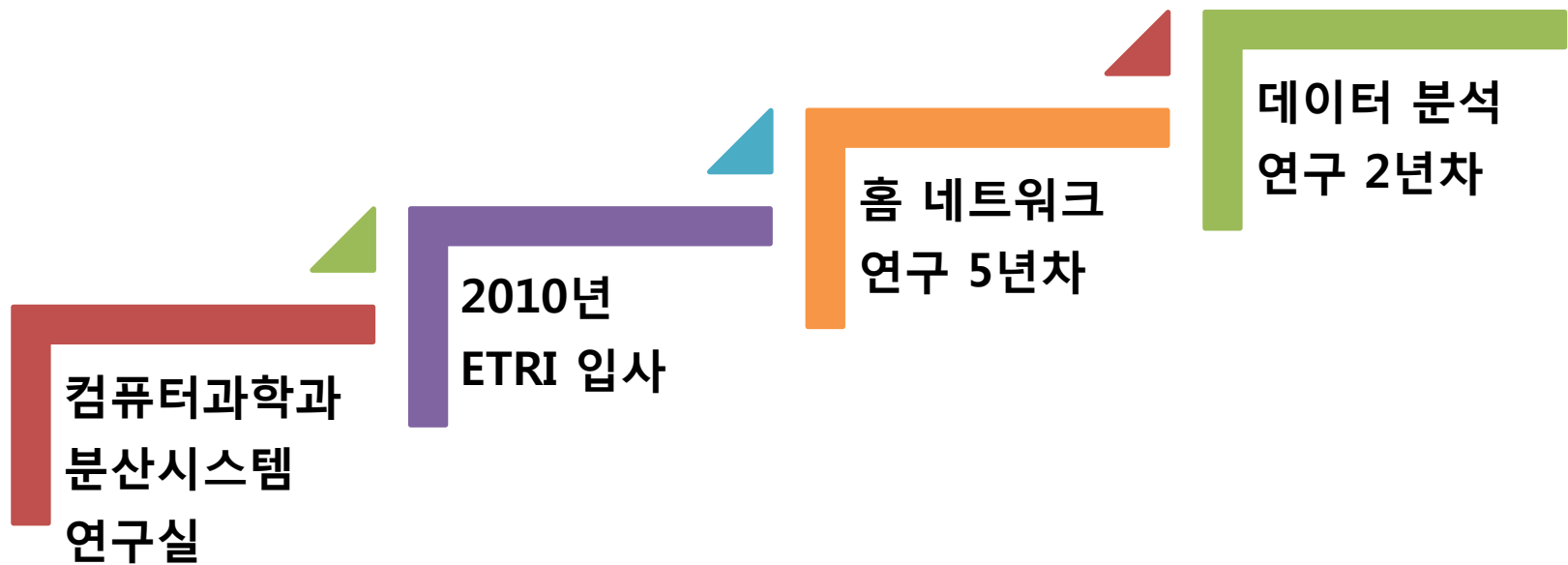


R을 활용한 홈 데이터 분석 플랫폼

2015-06-26 김 지 영
jeuyk@etri.re.kr

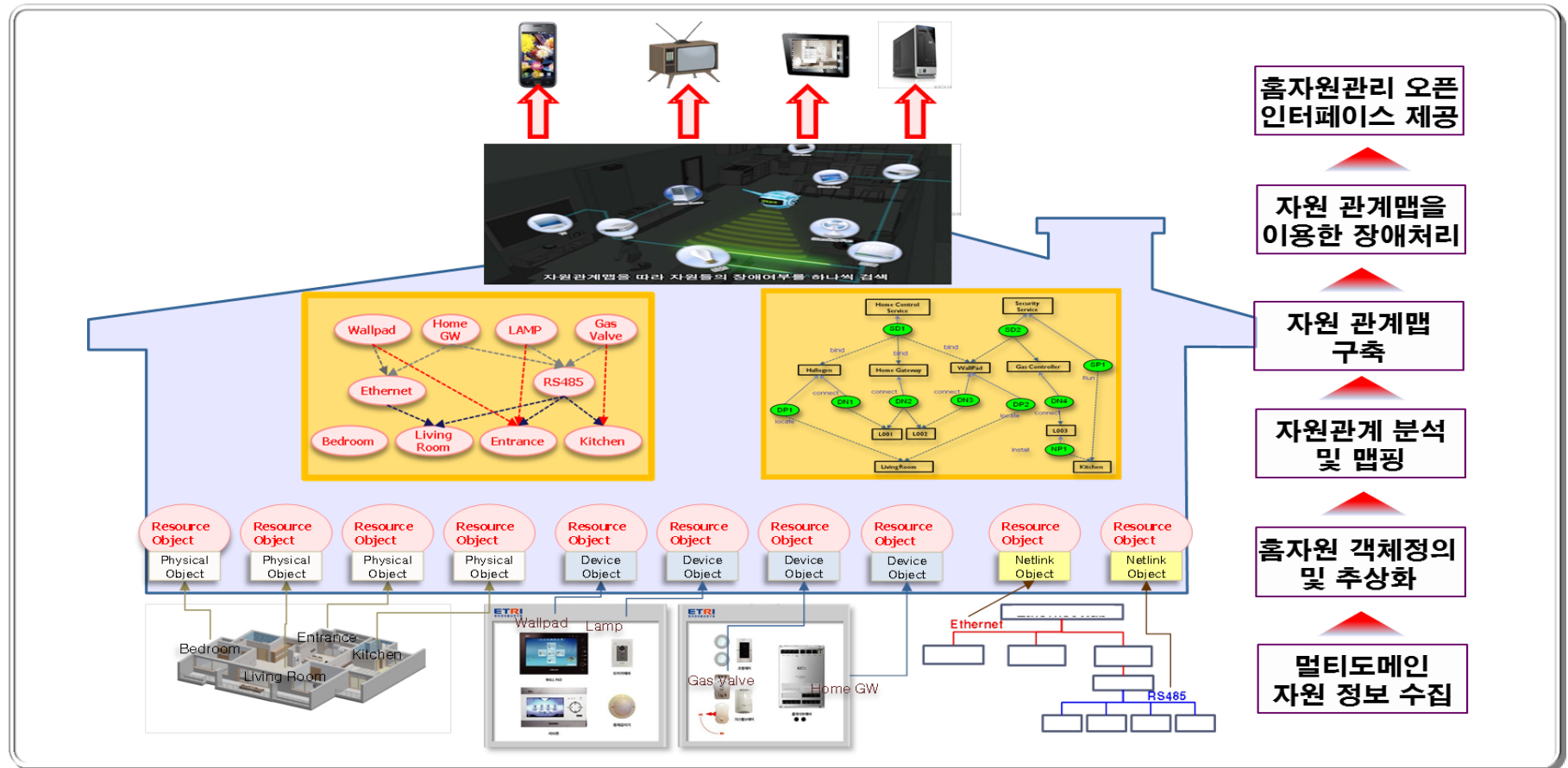
INDEX

1. 소개
2. 기존 홈 네트워크 연구
3. 분석 플랫폼
4. 향후 계획



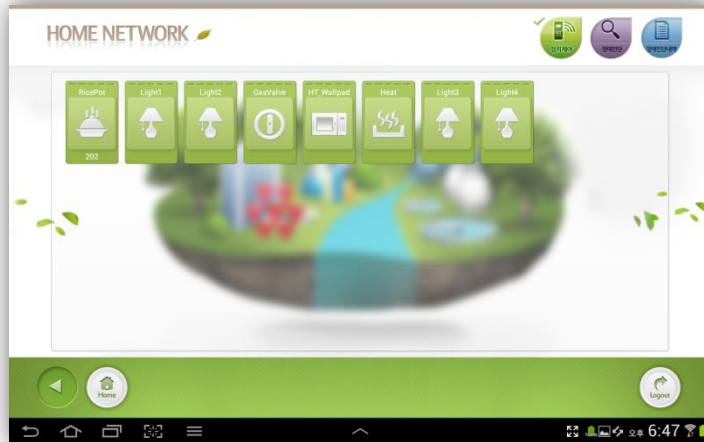
기존 홈 네트워크 연구

➤ 홈 자원 관리 기술



자원 관리 기술을 활용한 예

홈 기기관리 서비스



장애진단 서비스



단지 관리 서비스



전력 사용량 확인 서비스



엔터테인먼트



Smart Plug

IoT + Home



Smart 가전

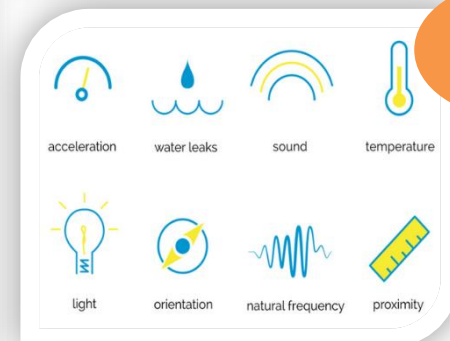
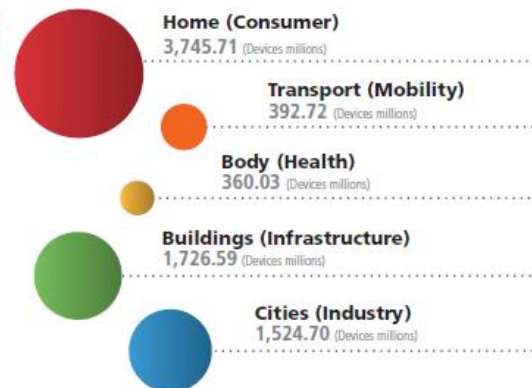
Connected Devices



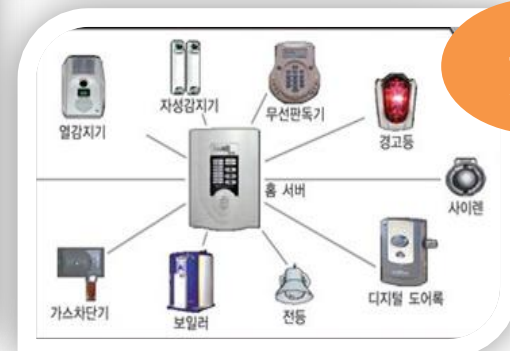
In 2014 nearly **2 billion** connected devices will be shipped

This number will grow to nearly **8 billion** devices for the year 2020

*Not including mobile phones



환경 센서



보안 기기

분석 대상



Smart Plug



Papers



Articles

가전 인식

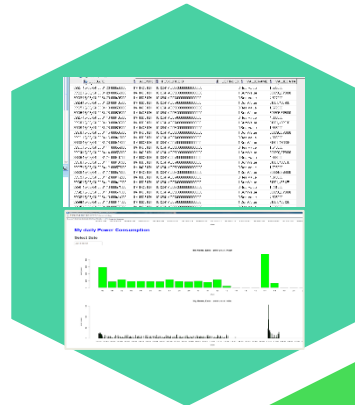
사용 패턴

식습관 예측

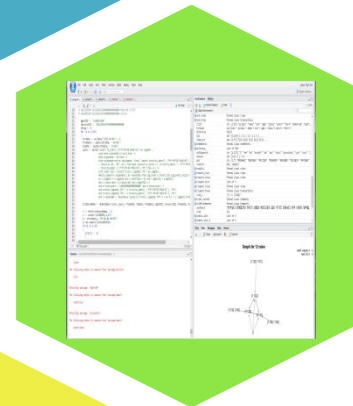
상태 식별

전력 사용량
예측

데이터
검토



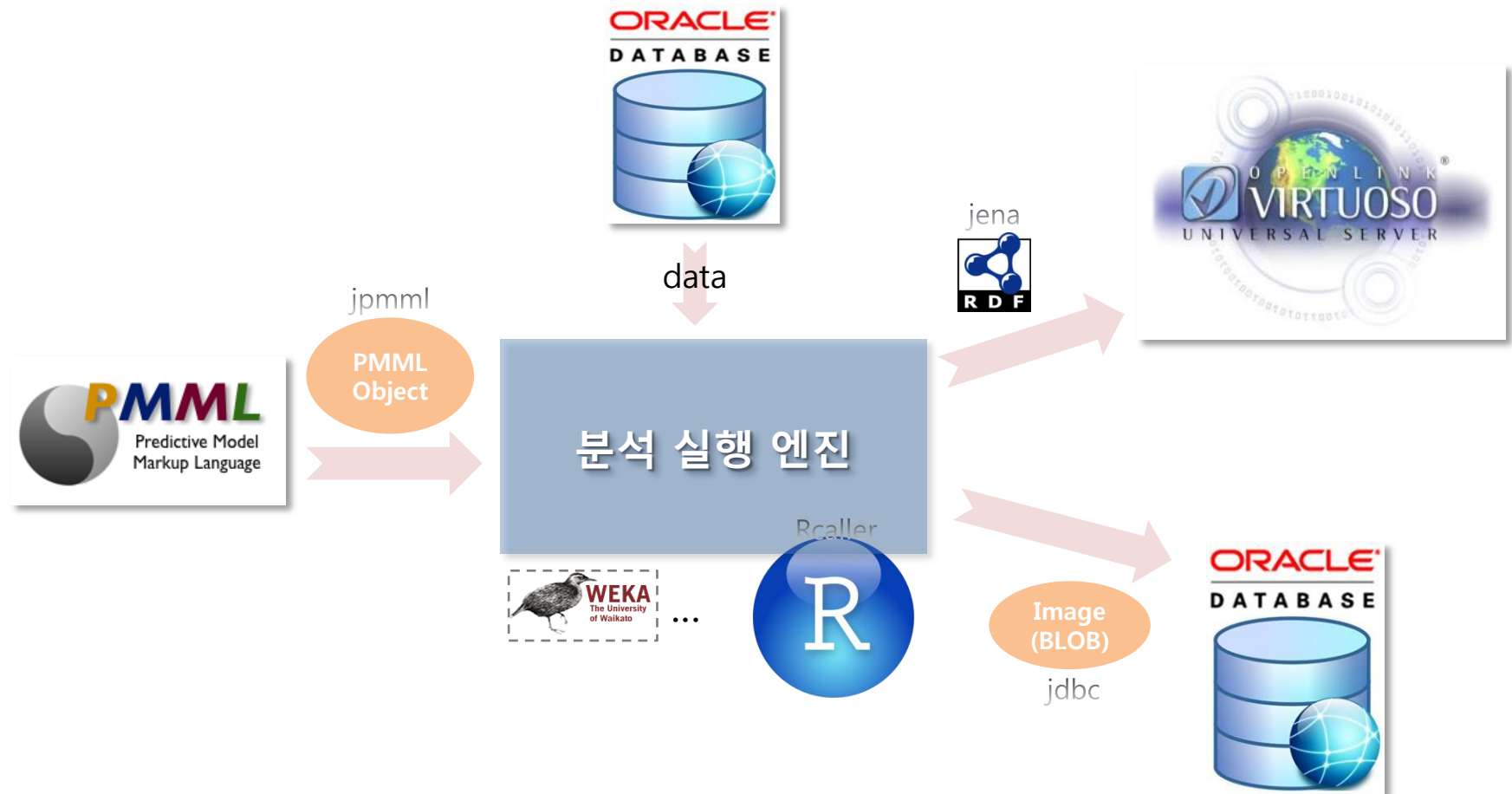
분석테스트
및
분석엔진
개발



결과이미지
활용



분석 실행 구조



- XML 기반 Predictive Model Markup Language(PMML)
- The Data Mining Group (DMG) 에서 정의
- DataFields와 OutputFields를 활용해 input/output 정의
- 각 element별 자유로운 Extension 가능

```

<xs:element name="PMML">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="Header"/>
      <xs:element ref="MiningBuildTask" minOccurs="0"/>
      <xs:element ref="DataDictionary"/>
      <xs:element ref="TransformationDictionary" minOccurs="0"/>
      <xs:sequence minOccurs="0" maxOccurs="unbounded">
        <xs:group ref="MODEL-ELEMENT"/>
      </xs:sequence>
      <xs:element ref="Extension" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="version" type="xs:string" use="required"/>
  </xs:complexType>
</xs:element>

<xs:group name="MODEL-ELEMENT">
  <xs:choice>
    <xs:element ref="AssociationModel"/>
    <xs:element ref="BaselineModel"/>
    <xs:element ref="ClusteringModel"/>
    <xs:element ref="GeneralRegressionModel"/>
    <xs:element ref="MiningModel"/>
    <xs:element ref="NaiveBayesModel"/>
    <xs:element ref="NearestNeighborModel"/>
    <xs:element ref="NeuralNetwork"/>
    <xs:element ref="RegressionModel"/>
    <xs:element ref="RuleSetModel"/>
    <xs:element ref="SequenceModel"/>
    <xs:element ref="Scorecard"/>
    <xs:element ref="SupportVectorMachineModel"/>
    <xs:element ref="TextModel"/>
    <xs:element ref="TimeSeriesModel"/>
    <xs:element ref="TreeModel"/>
  </xs:choice>
</xs:group>

```

➤ Appliance Usage Pattern Model

- › 가전 사용 패턴 분석 모델
- › 두 가지 분석을 통해 패턴 발견
 - Number of Analysis Model => 2
 - Mining Update Interval => periodic, 1 week
 - Clustering Model => Appliance Status Model
 - Mining Field => PowerMeter
 - Target Resource => HERA_DEVICE_TYPE_RICEPOT
 - Output Field
 - » External Output => ApplianceStatus
 - » Output Decision => 1, Cook
 - » Output Decision => 2, Warm

➤ Appliance Usage Pattern Model

- Association Model => Appliance Usage Pattern Model
 - Transaction type => 1 week
 - Item => week;hour;previousModel
 - Mining Field => PowerMeter
 - Target Resource => HERA_DEVICE_TYPE_RICEPOT
 - Output Field
 - » External Output => UsagePattern
 - » Output Pattern

실제 데이터 수집 환경

- 스마트(WiFi) 미터기 10가구에 배포
- 스마트 미터기를 자원화 하고 전력 사용량 DB에 기록
 - › 매 2초마다 수집
 - › 평균 6가구 (총 10가구)
 - › 평균 31GB/9일 생성

Hera Hera-1 LOG_EVENT_VALLIST

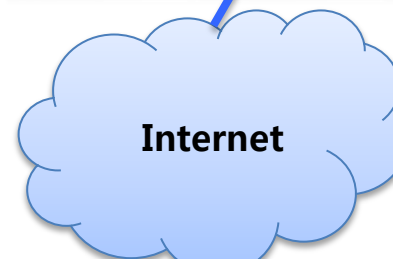
데이터 계약 조건 권한 부여 통계 트러거 플러시백 종속성 세부 정보 인덱스 SQL

정렬... 필터:

LOGDATE	AGENTID	RESOURCEID	LISTINDEX	VALUENAME	VALUEDATA
11/11/05 11:27:07.000156000	1A104D310H	1012341AC05C000000000000000000000	0	RealValue	4.860000
12/11/05 11:27:07.000156000	1A104D310H	1012341AC05C000000000000000000000	1	SumValue	486578.125000
3/11/05 11:27:06.000730000	1A105D310H	1012341B01E4000000000000000000000	0	RealValue	0.000000
4/11/05 11:27:06.000730000	1A105D310H	1012341B01E4000000000000000000000	1	SumValue	9221.233398
5/11/05 11:27:02.000220000	1A111D310H	1012341AC14000000000000000000000	0	RealValue	1.221000
6/11/05 11:27:02.000220000	1A111D310H	1012341AC14000000000000000000000	1	SumValue	719536.500000
7/11/05 11:24:46.000777000	1A105D310H	1012341B01E4000000000000000000000	1	SumValue	9221.233398
8/11/05 11:24:46.000777000	1A105D310H	1012341B01E4000000000000000000000	0	RealValue	0.000000
9/11/05 11:24:46.000233000	1A104D310H	1012341AC05C000000000000000000000	1	SumValue	486575.937500
10/11/05 11:24:46.000233000	1A104D310H	1012341AC05C000000000000000000000	0	RealValue	4.860000
11/11/05 11:24:41.000292000	1A111D310H	1012341AC14000000000000000000000	0	RealValue	1.196000
12/11/05 11:24:41.000292000	1A111D310H	1012341AC14000000000000000000000	1	SumValue	719536.437500
13/11/05 11:22:26.000316000	1A104D310H	1012341AC05C000000000000000000000	0	RealValue	83.443001
14/11/05 11:22:26.000316000	1A104D310H	1012341AC05C000000000000000000000	1	SumValue	486574.937500
15/11/05 11:22:25.000854000	1A105D310H	1012341B01E4000000000000000000000	1	SumValue	9221.233398
16/11/05 11:22:25.000854000	1A105D310H	1012341B01E4000000000000000000000	0	RealValue	0.000000
17/11/05 11:22:20.000340000	1A111D310H	1012341AC14000000000000000000000	0	RealValue	1.157000
18/11/05 11:22:20.000340000	1A111D310H	1012341AC14000000000000000000000	1	SumValue	719536.437500



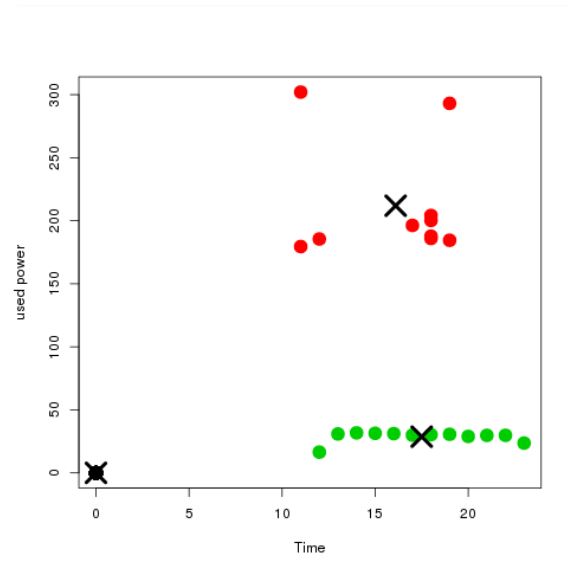
ETRI
12동
실험실



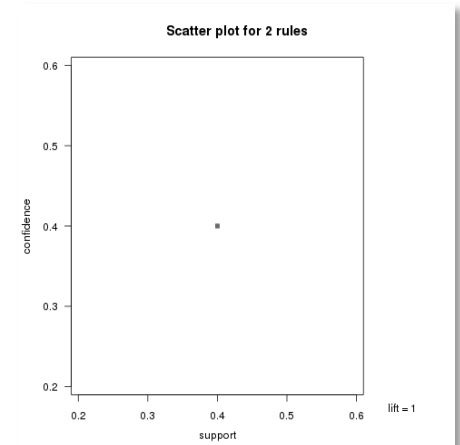
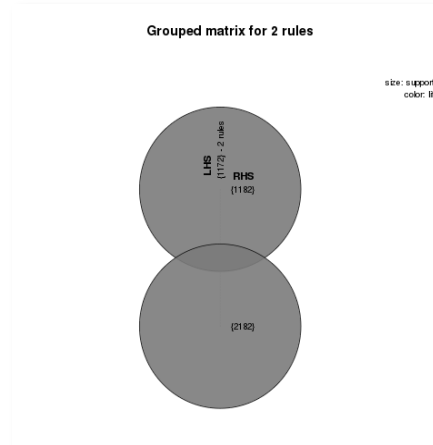
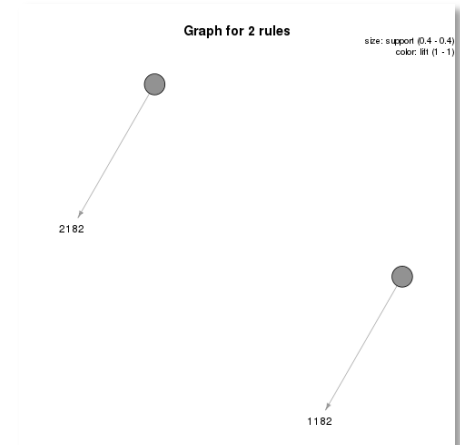
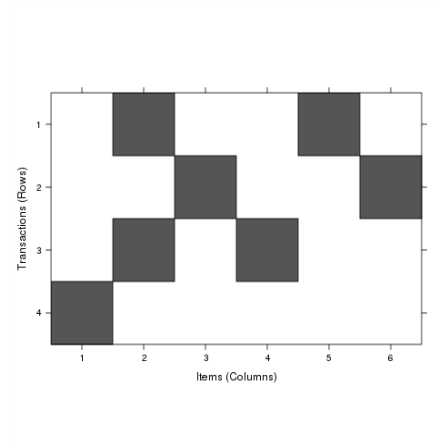
실제 가정



분석 결과

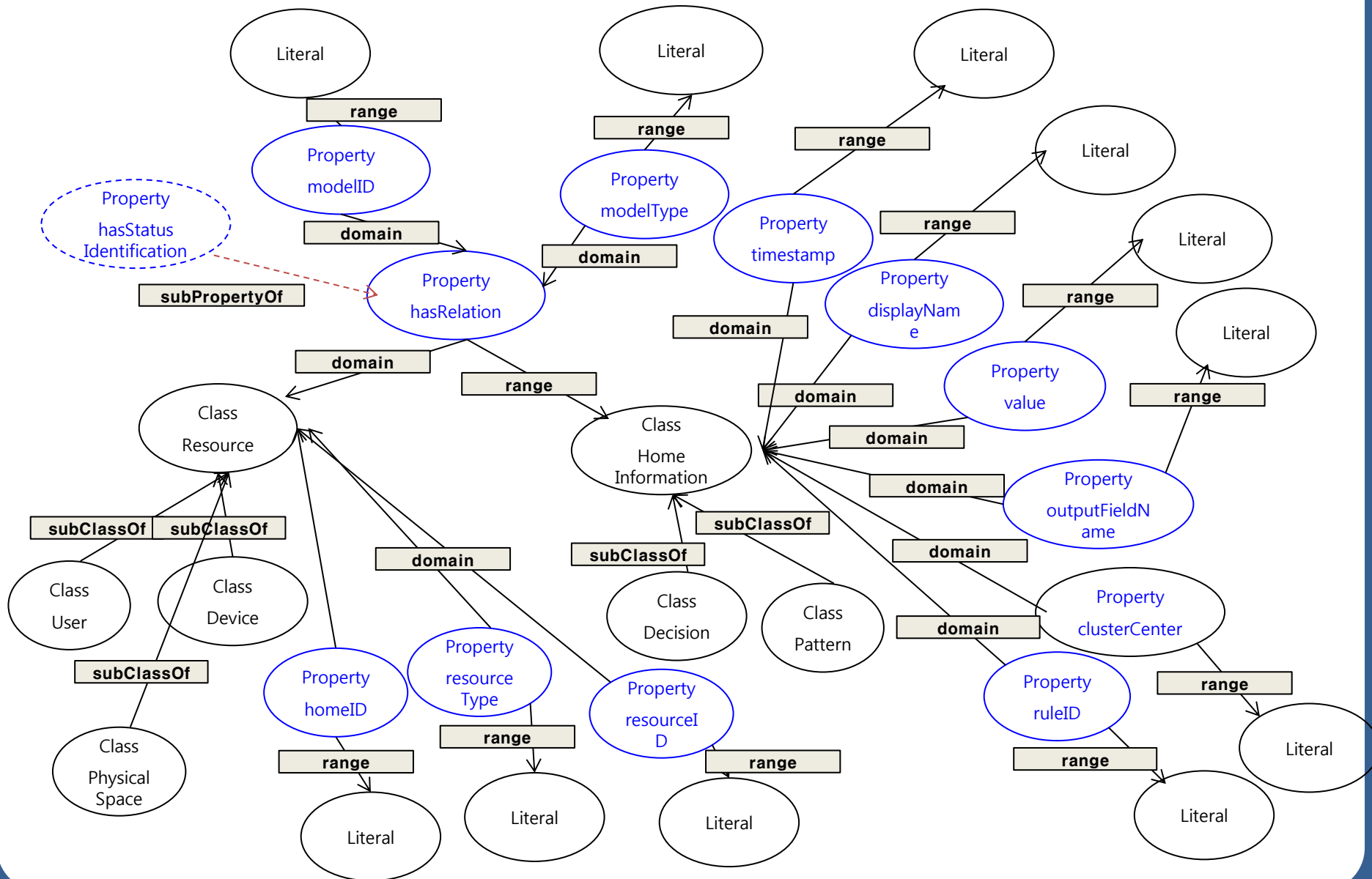


Clustering Result



Association Rule Results

홈 지식 RDFS



분석 결과 RDF화

129.254.89.157:8890/conductor/sparql_input.vsp?sid=7bc58cdf0a29a22a2e86f6ef55a0192e&realm=virtuoso_admin		
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:48:54_7	http://129.254.89.156/swoa/0.1/OutputFieldName	"RulesOutput"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:48:54_8	http://129.254.89.156/swoa/0.1/OutputFieldName	"RulesOutput"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:48:54_9	http://129.254.89.156/swoa/0.1/OutputFieldName	"RulesOutput"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:48:54_10	http://129.254.89.156/swoa/0.1/OutputFieldName	"RulesOutput"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:48:54_11	http://129.254.89.156/swoa/0.1/OutputFieldName	"RulesOutput"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-17 16:20:02_0	http://129.254.89.156/swoa/0.1/OutputFieldName	"ClusteringOutput"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-17 16:20:02_1	http://129.254.89.156/swoa/0.1/OutputFieldName	"ClusteringOutput"
http://SWOA/KM/#1A105D310H_HomeInformation_05.26.2015T13:58:36_0	http://129.254.89.156/swoa/0.1/OutputFieldName	"ClusteringOutput"
http://SWOA/KM/#1A105D310H_HomeInformation_05.26.2015T13:58:36_1	http://129.254.89.156/swoa/0.1/OutputFieldName	"ClusteringOutput"
http://SWOA/KM/#1A105D310H_HomeInformation_05.26.2015T17:07:30_0	http://129.254.89.156/swoa/0.1/OutputFieldName	"ClusteringOutput"
http://SWOA/KM/#1A105D310H_HomeInformation_05.26.2015T17:07:30_1	http://129.254.89.156/swoa/0.1/OutputFieldName	"ClusteringOutput"
http://SWOA/KM/#1A105D310H_HomeInformation_05.26.2015T14:01:17_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"11.0.302.03033"
http://SWOA/KM/#1A105D310H_HomeInformation_05.26.2015T14:01:17_1	http://129.254.89.156/swoa/0.1/ClusterCenter	"18.0.195.94273"
http://SWOA/KM/#1A105D310H_HomeInformation_05.26.2015T17:30:22_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"11.0.302.03033"
http://SWOA/KM/#1A105D310H_HomeInformation_05.26.2015T17:30:22_1	http://129.254.89.156/swoa/0.1/ClusterCenter	"18.0.195.94273"
http://SWOA/KM/#1A105D310H_HomeInformation_05.27.2015T09:41:35_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"11.0.302.03033"
http://SWOA/KM/#1A105D310H_HomeInformation_05.27.2015T09:41:35_1	http://129.254.89.156/swoa/0.1/ClusterCenter	"18.0.195.94273"
http://SWOA/KM/#1A105D310H_HomeInformation_05.27.2015T10:40:59_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"11.0.302.03033"
http://SWOA/KM/#1A105D310H_HomeInformation_05.27.2015T10:40:59_1	http://129.254.89.156/swoa/0.1/ClusterCenter	"18.0.195.94273"
http://SWOA/KM/#1A105D310H_HomeInformation_05.27.2015T15:46:21_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"11.0.302.03033"
http://SWOA/KM/#1A105D310H_HomeInformation_05.27.2015T15:46:21_1	http://129.254.89.156/swoa/0.1/ClusterCenter	"18.0.195.94273"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-01 11:53:21_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"11.0.302.03033"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-01 11:53:21_1	http://129.254.89.156/swoa/0.1/ClusterCenter	"18.0.195.94273"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-10 15:02:59_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"16.1.211.892424"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-10 15:02:59_1	http://129.254.89.156/swoa/0.1/ClusterCenter	"0.221052631578947.0.36256761368421"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:31_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"8.0.87.8677"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:31_1	http://129.254.89.156/swoa/0.1/ClusterCenter	"18.8.34.532161"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-17 09:41:10_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"16.1.211.892424"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-17 09:41:10_1	http://129.254.89.156/swoa/0.1/ClusterCenter	"17.5.28.7032694166667"
http://SWOA/KM/#1A105D310H_HomeInformation_05.26.2015T15:22:19_0	http://129.254.89.156/swoa/0.1/ClusterCenter	"11.0.302.03033"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_1	http://129.254.89.156/swoa/0.1/Pattern	"0 => {182}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_2	http://129.254.89.156/swoa/0.1/Pattern	"0 => {5232}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_3	http://129.254.89.156/swoa/0.1/Pattern	"{4142} => {4172}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_4	http://129.254.89.156/swoa/0.1/Pattern	"{4172} => {4142}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_5	http://129.254.89.156/swoa/0.1/Pattern	"{4142} => {5232}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_6	http://129.254.89.156/swoa/0.1/Pattern	"{5232} => {4142}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_7	http://129.254.89.156/swoa/0.1/Pattern	"{4172} => {5232}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_8	http://129.254.89.156/swoa/0.1/Pattern	"{5232} => {4172}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_9	http://129.254.89.156/swoa/0.1/Pattern	"{4142.4172} => {5232}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_10	http://129.254.89.156/swoa/0.1/Pattern	"{4142.5232} => {4172}"
http://SWOA/KM/#1A108D310H_HomeInformation_2015-06-12 10:38:41_11	http://129.254.89.156/swoa/0.1/Pattern	"{4172.5232} => {4142}"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-10 14:47:07_0	http://129.254.89.156/swoa/0.1/Pattern	"0 => {182}"
http://SWOA/KM/#1A105D310H_HomeInformation_2015-06-10 14:47:07_1	http://129.254.89.156/swoa/0.1/Pattern	"0 => {2182}"

RDF API 검색

13676 x SPARQL Execution x

restserver/#!/SWOA_MAPInterface/getHomeInformationbyHomeInfoid_get_6

검색 유성도서관 ETRI 전자도서관 Facebook Google 네이버 사전 우리은행 The 60 second gui...

GET /SWOA_MAPInterface/getHomeInformationbyHomeInfoid Returns AnalysisResultInfo

Implementation Notes
Returns AnalysisResultInfo By AnalysisID.

Response Class
Model | Model Schema

JSONObject {
 nullObject (boolean, optional),
 empty (boolean, optional),
 array (boolean, optional)
}

Response Content Type
application/json

Parameters

Parameter	Value	Description	Data Type
AnalysisID	http://SWOA/KM/#1A105D310H_HomeInfomati	The Id of the Analysis to be viewed ex)http://SWOA/KM/#1A105D310H_HomeInformation_05.15.2015T14:19:11_1	String

Try it out! Hide Response

Request URL

http://129.254.89.156:18888/restserver/SWOA_MAPInterface/getHomeInformationbyHomeInfoid?AnalysisID=http%3A%2F%2Fswoa%2FKM%2F%2

Response Body

```
{  
  "predicate": {  
    "type": "uri",  
    "value": "http://129.254.89.156/swoa/0.1/outputFieldName"  
  },  
  "object": {  
    "type": "literal",  
    "value": "ClusteringOutput"  
  },  
},  
{  
  "predicate": {  
    "type": "uri",  
    "value": "http://129.254.89.156/swoa/0.1/clusterCenter"  
  },  
  "object": {  
    "type": "literal",  
    "value": "18.0;195.04273"  
  },  
}  
}
```

Response Code

200

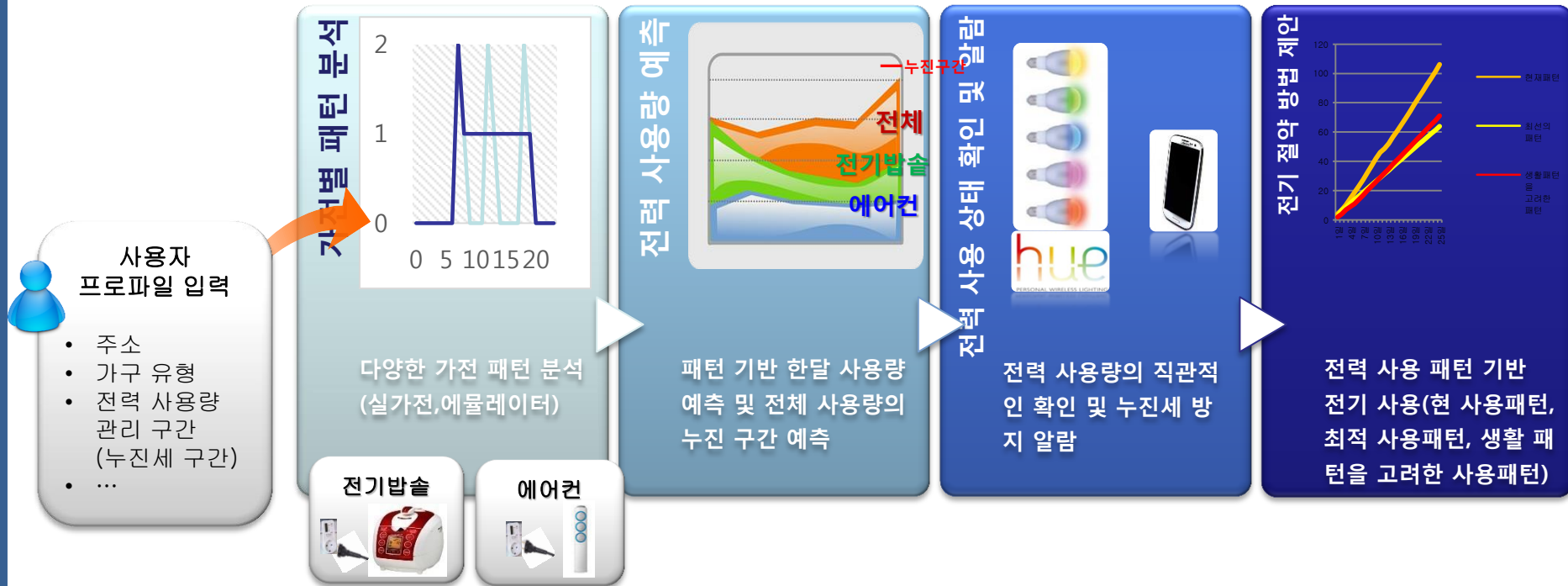
Response Headers

Date: Tue, 23 Jun 2015 04:43:21 GMT

분석 플랫폼 OpenAPI

Show/Hide | List Operations | Expand Operations | Raw

➤ 누진세 방지 Energy-Saving Service



➤ 분석 다양화

- › 분석 대상 데이터 다양화
- › 분석 알고리즘 고도화 및 확장
- › 오프라인 데이터 분석 방안

➤ 홈 지식 활용

- › RDF 추론 적용
- › 주방 가전 패턴을 통한 식생활 습관 분석



RUCK 2015

