

# PORT-MIS 선박 입출항 빅데이터를 이용한 항로 통항 특성 분석

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**요약** : 일반적으로 항만 내 선박 교통류 평가는 AIS 데이터를 이용하여 수행이 되어져 왔다. AIS 데이터는 선박의 위치 확인에 용이하여 항로상 선박 교통분포 분석에 용이하였다. 하지만, AIS 데이터는 VTS에 저장되어 있는 기간이 짧고, 처리할 데이터의 양이 많은 단점이 있다. 한편, PORT-MIS 선박 입출항 데이터는 10년 이상 저장이 되어 있으며, 통항로상 통계적 선박교통밀도 분석에 활용이 용이하다. 본 연구에서는 PORT-MIS 빅데이터 분석 방법과 선박 입출항 데이터를 항로상의 통항데이터로 변환하는 방법을 개발하여 제시하고자 한다.

**핵심용어** : PORT-MIS, 선박입출항 데이터, VTS, 맵리듀스, 빅데이터

### 1. Research Background & Objectives

- ◆ Route traffic in port water area is important for :
  - Shore : port safety, ship traffic prediction and analysis
  - Ship : consideration of navigation safety
- ◆ Usually, route traffic analysis in port area has used the AIS or RADAR trajectory data.
- ◆ However, AIS data is difficult to access long-term analysis because of **large capacity of trajectory data and lack of trajectory analysis technology**.



### 1. Research Background & Objectives

- ◆ PORT-MIS data are stored for **20 years** (1998~)
- ◆ PORT-MIS data is the record of entry, departure, movement between port facilities only.



- ◆ In order to analyze ship route traffic characteristic, it required to **develop an algorithm for extracting ship route traffic data**.

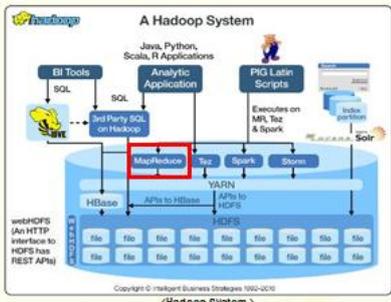
### 1. Research Background & Objectives

- ◆ Port Information Management System(PORT-MIS) is information system that **integrates data on ships and cargoes moving in and out of the Korean ports**.
- ◆ It provides users with **real-time information about port-operation, port facility usage, cargo entry/departure and collecting tax and so on**.



### 2. PORT-MIS BIG DATA Analysis

- **Big Data Analysis Framework**
  - **Hadoop system**



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## 2. PORT-MIS BIG DATA Analysis

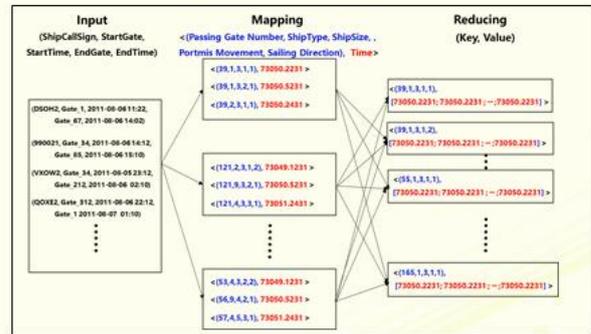
### Preparation of GATE Lines

- the position of the port facility (A~E) is shifted to the adjacent gateline



## 2. PORT-MIS BIG DATA Analysis

### MapReduce Analysis of Ship Trajectory in Port Area.



## 2. PORT-MIS BIG DATA Analysis

### MapReduce Process of PORT-MIS Big Data

#### port facility usage event data

ShipName	CallSign	Voy.No	Movement	Event Position	Time
130	000	0000	0000	0000	0000-00-00
130	000	0000	0000	0000	0000-00-00
130	000	0000	0000	0000	0000-00-00

#### Mapper Function

ShipType	Length	Breadth	GateNum	Time	Status	In_Out_Direction
1	180	30	39	730499.9	1	1
1	180	30	38	730499.9	1	1
1	180	30	37	730499.9	1	1
1	180	30	36	730499.9	1	1
1	180	30	35	730499.9	1	1
1	180	30	34	730499.9	1	1
1	180	30	33	730499.9	1	1
1	180	30	32	730499.9	1	1
1	180	30	31	730499.9	1	1
1	180	30	30	730499.9	1	1
1	180	30	29	730499.9	1	1
1	180	30	28	730499.9	1	1

#### Sequence gate Transaction Data

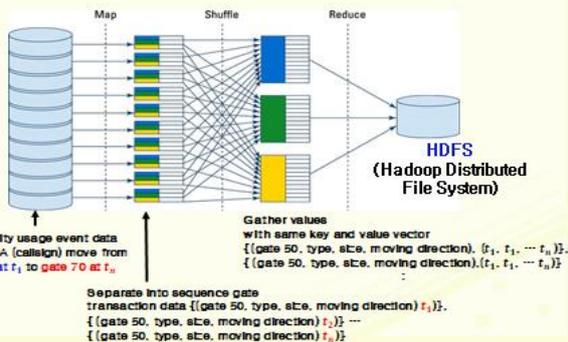
## 2. PORT-MIS BIG DATA Analysis

### Results of Key-Value Data

The screenshot shows a table with three columns: Key, Value, and Value(15, 1). The Key column contains tuples like  $\langle (09, 1, 1, 1), 1 \rangle$ . The Value column contains ship trajectory data like  $\langle (09, 1, 1, 1), 73050, 2231 \rangle$ . The Value(15, 1) column contains a list of values like  $\langle (09, 1, 1, 1), (73050, 2231; 73050, 2231; \dots; 73050, 2231) \rangle$ .

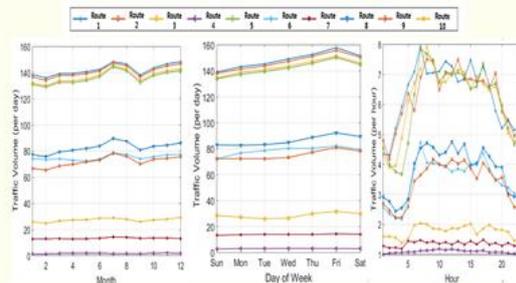
## 2. PORT-MIS BIG DATA Analysis

### MapReduce Process of PORT-MIS Big Data



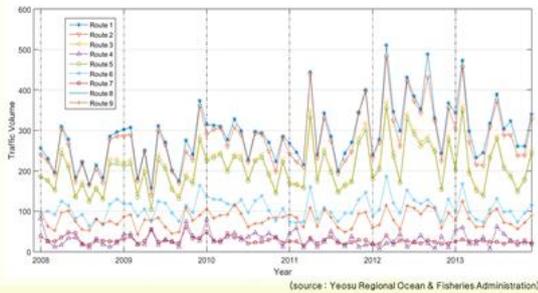
## 3. Application of PORT-MIS Big Data

### Route Statistical Analysis in Monthly (left), Day of weekly (middle), Hourly (right)



### 3. Application of PORT-MIS Big Data

#### Time Series Analysis of Ship Traffic Volume Grouped by Route



## 사 사

“이 논문은 2016년도 정부(교육부)의 재원으로 한국연구재단의 지원을 받아 수행된 해상교통관제(VTS)에서 선박 교통 빅데이터 기반의 선박충돌 위험도 평가기술 개발 연구사업임 (NRF-2016R1A6A3A11935806).“

“이 논문은 2017년도 정부(과학기술정보통신부)의 재원으로 한국연구재단의 지원을 받아 수행된 사용자 개입 최소화를 위한 고성능 자율 기계학습 플랫폼 기초 원천기술 개발사업임 (NRF-2017M3C4A7069432).“

### 3. Application of PORT-MIS Big Data

#### Ship Traffic Estimating Simulation



### 4. Conclusion

- ◆ Until now, the PORT-MIS data is not suitable for traffic analysis because it only has berth or anchorage movements records.
- ◆ In this paper, we propose the method to convert PORT-MIS data to route traffic data and apply big data analysis using MapReduce process.
- ◆ Using this PORT-MIS big data, we apply to Route Statistical Analysis, Time Series Analysis, Ship Traffic Estimating Simulation
- ◆ This approach is considered to be suitable for the long-term statistical analysis like BIG DATA and time series analysis.