Implementation case of K8s(PaaS-Ta) in Water supply special accounting ERP system of local government

Lee Kyungjong *[1]

1. Business overview

○ (Business name) Construction of the next generation water supply management information system.

○ (Business period) 18 months from the date of signing the contract / Long-term continuous business.

2. Business Promotion Background

○ (Business Purpose) Realization of user-centered intelligent management information service that supports efficient business management

○ (Domestic Environment) There is a need for efficient management of waterworks in order to revive the local economy, which has been contracted due to COVID-19, and to solve problems that have arisen in the preparation of basic data calculation plans for water bills.

○ (Government policy) Reflects the system on the demand for strengthening autonomy and accountability of budget management and mid- to long-term budget compilation through the implementation of the budget system for each project.

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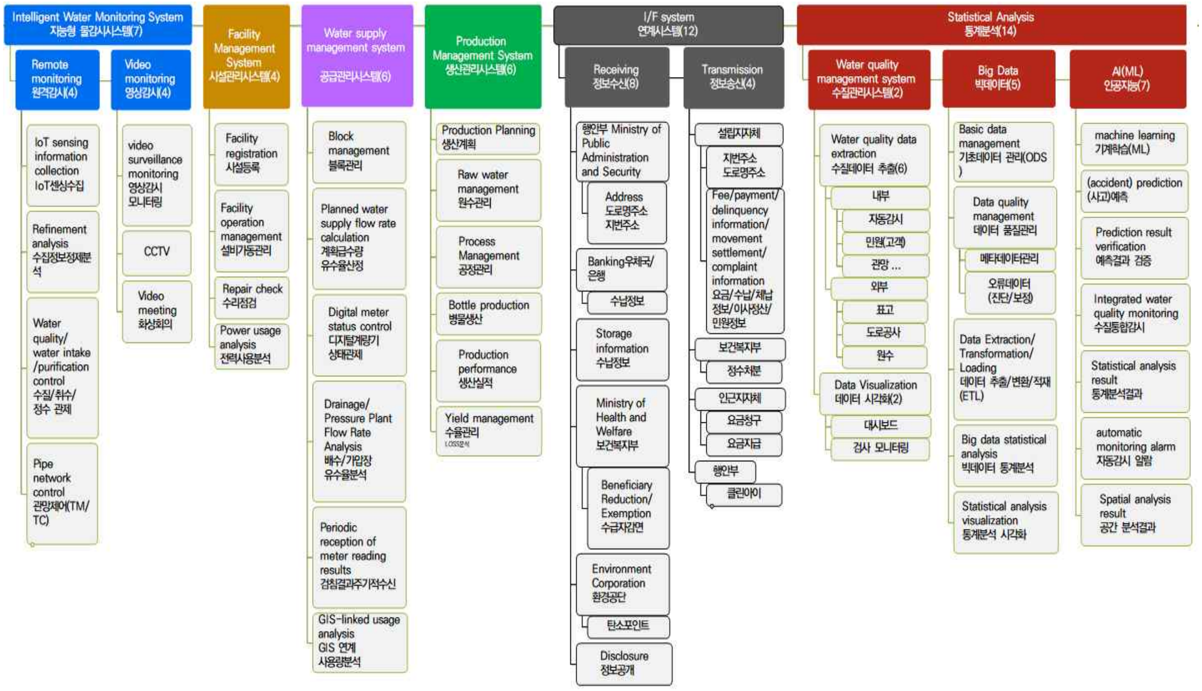
[1] * Head of Hypertech Headquarters, ph.D. It is revealed that this study was modified and developed as a case of building a next-generation management system for waterworks in 00 City of Korea.

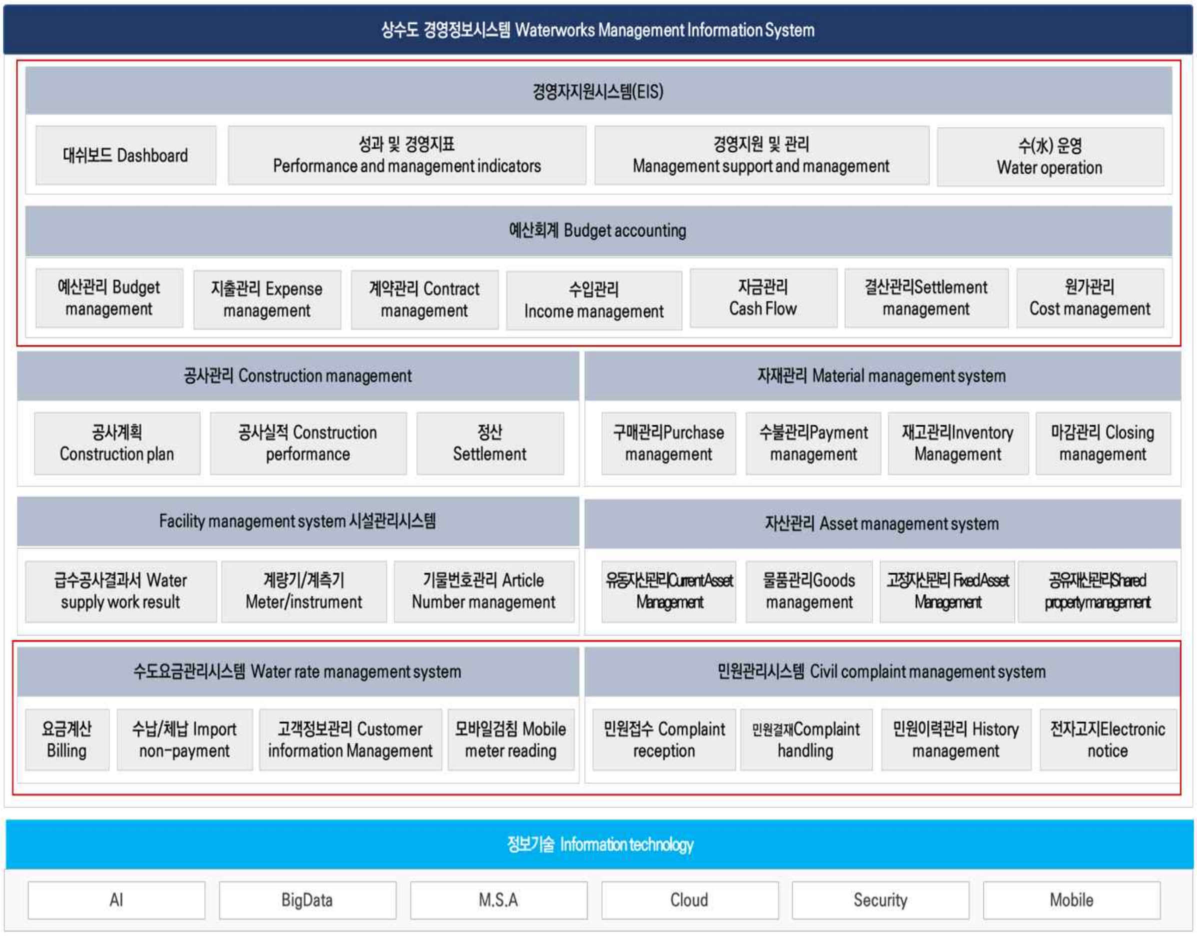
3. Business scope

3.1 Conceptual diagram of target system

- ○ Conceptual diagram of water supply system based on iot


Intelligent Water Monitoring System
지능형 물감시시스템(7)
Remote monitoring
원격감시(4)
IoT sensing information collection
IoT센싱수집
Refinement analysis
수집정보정제분석
Water quality/ water intake /purification control
수질/취수/ 정수 관제
Pipe network control
관망제어(TM/ TC)
Video monitoring
영상감시(4)
video surveillance monitoring
영상감시 모니터링
CCTV
Video meeting
화상회의
Facility Management System
시설관리시스템(4)
Facility registration
시설등록
Facility operation management
설비가동관리
Repair check
수리점검
Power usage analysis
전력사용분석
Water supply management system
공급관리시스템(6)
Block management
블록관리
Planned water supply flow rate calculation
계획급수량 유수율산정
Digital meter status control
디지털계량기 상태관제
Drainage/ Pressure Plant Flow Rate Analysis
배수/가압장 유수율분석
Periodic reception of meter reading results
검침결과주기적수신
GIS-linked usage analysis
GIS 연계 사용량분석
Production Management System
생산관리시스템(6)
Production Planning
생산계획
Raw water management
원수관리
Process Management
공정관리
Bottle production
병물생산
Production performance
생산실적
Yield management
수율관리
LOSS분석
I/F system
연계시스템(12)
Receiving
정보수신(8)
행안부 Ministry of Public Administration and Security
Address
도로명주소
지번주소
Banking우체국/은행
수납정보
Storage information
수납정보
Ministry of Health and Welfare
보건복지부
Beneficiary Reduction/ Exemption
수급자감면
Environment Corporation
환경공단
탄소포인트
Disclosure
정보공개
Transmission
정보송신(4)
설립지자체
지번주소
도로명주소
Fee/payment/ delinquency information/ movement settlement/ complaint information
요금/수납/체납 정보/이사정산/ 민원정보
보건복지부
정수처분
인근지자체
요금청구
요금지급
행안부
클린아이
Statistical Analysis
통계분석(14)
Water quality management system
수질관리시스템(2)
Water quality data extraction
수질데이터 추출(6)
내부
자동감시
민원(고객)
관망 ...
외부
표고
도로공사
원수
Data Visualization
데이터 시각화(2)
대시보드
검사 모니터링
Big Data
빅데이터(5)
Basic data management
기초데이터 관리(ODS)
Data quality management
데이터 품질관리
메타데이터관리
오류데이터 (진단/보정)
Data Extraction/ Transformation/ Loading
데이터 추출/변환/적재 (ETL)
Big data statistical analysis
빅데이터 통계분석
Statistical analysis visualization
통계분석 시각화
AI(ML)
인공지능(7)
machine learning
기계학습(ML)
(accident) prediction
(사고)예측
Prediction result verification
예측결과 검증
Integrated water quality monitoring
수질통합감시
Statistical analysis result
통계분석결과
automatic monitoring alarm
자동감시 알람
Spatial analysis result
공간 분석결과

- ○ Business function of target system(Red Line)


상수도 경영정보시스템 Waterworks Management Information System

경영자지원시스템(EIS)
대쉬보드 Dashboard
성과 및 경영지표 Performance and management indicators
경영지원 및 관리 Management support and management
수(水) 운영 Water operation

예산회계 Budget accounting
예산관리 Budget management
지출관리 Expense management
계약관리 Contract management
수입관리 Income management
자금관리 Cash Flow
결산관리Settlement management
원가관리 Cost management

공사관리 Construction management
공사계획 Construction plan
공사실적 Construction performance
정산 Settlement

자재관리 Material management system
구매관리Purchase management
수불관리Payment management
재고관리Inventory Management
마감관리 Closing management

Facility management system 시설관리시스템
급수공사결과서 Water supply work result
계량기/계측기 Meter/instrument
기물번호관리 Article Number management

자산관리 Asset management system
유동자산관리Current Asset Management
물품관리Goods management
고정자산관리 Fixed Asset Management
공유재산관리Shared property management

수도요금관리시스템 Water rate management system
요금계산 Billing
수납/체납 Import non-payment
고객정보관리 Customer information Management
모바일검침 Mobile meter reading

민원관리시스템 Civil complaint management system
민원접수 Complaint reception
민원결재Complaint handling
민원이력관리 History management
전자고지Electronic notice

정보기술 Information technology
AI
BigData
M.S.A
Cloud
Security
Mobile

3.2 Expected effect upon deployment

○ Through the introduction of the waterworks management information system, a high level of service is provided to citizens, and work process simplification and speed are provided in terms of work productivity and efficiency.

○ Ability to actively respond to environmental changes such as changes in laws and systems.

○ In terms of user convenience, improved convenience of settlement reports, improved utilization of information, and reduced work processing time by expanding and establishing links with internal/external systems.

○ Increase work efficiency and productivity through comprehensive business processing of the budget accounting system including asset management and double-entry bookkeeping.

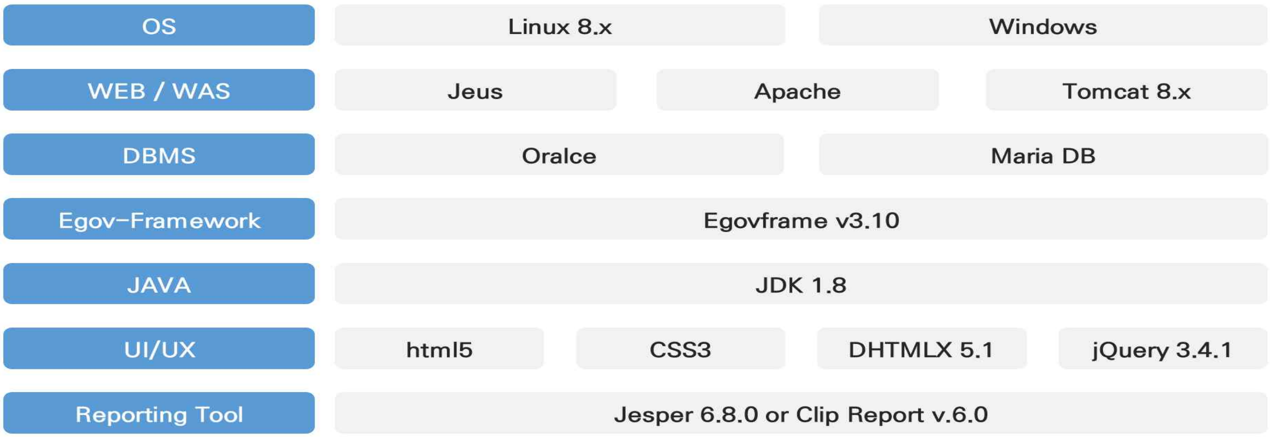
○ Reduction of data creation time and management cost by higher-level organizations and related organizations through automation of management system data processing.

○ Improving public trust by expediting the processing of fees and services to the public and responding efficiently.

4. Business details

4.1 Infra Environment on Kubernetes[2]

○ Cloud Service Environment (KISA/CSAP[3])



OS	Linux 8.x		Windows	
WEB / WAS	Jeus	Apache	Tomcat 8.x	
DBMS	Oralce		Maria DB	
Egov-Framework	Egovframe v3.10			
JAVA	JDK 1.8			
UI/UX	html5	CSS3	DHTMLX 5.1	jQuery 3.4.1
Reporting Tool	Jesper 6.8.0 or Clip Report v.6.0			

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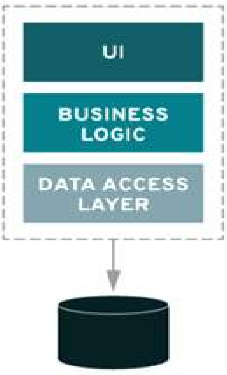
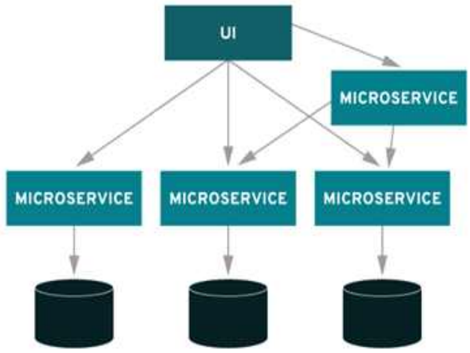
[2] Kubernetes is a portable, extensible, open-source platform for managing containerized workloads and services.

[3] A system that enables users to use cloud services with confidence by evaluating and certifying the compliance of information protection standards with respect to services provided by cloud service providers

○ Establishment of M.S.A environment based on Kubernetes (PaaS-Ta[4])

<table>
<tr><th></th><th colspan="2">e-Government Framework Environment</th><th>MSA Architecture</th></tr>
<tr><td>Config</td><td colspan="2">
</td><td>
</td></tr>
<tr><td rowspan="2">e-Gov</td><td>Advantages</td><td colspan="2">• Configurable as a single server
• Low cost with single server
• Ease of development source management due to development source integration
• Ease of processing for a single task</td></tr>
<tr><td>disadvantage</td><td colspan="2">• It is difficult to respond to all service failures with a single server
• Difficult to expand service</td></tr>
<tr><td rowspan="2">MSA architecture</td><td>Advantages</td><td colspan="2">• Easy to extend service
• Easy to respond to failures as servers are configured for each service
• Ease of processing for multiple tasks</td></tr>
<tr><td>disadvantage</td><td colspan="2">• High cost due to increased number of servers</td></tr>
</table>

4.2 Plan to carry out POC for stable deployment.

○ Efficient DB partitioning of physical and logical services of the system.

○ Minimize risk factors by acquiring developer experience according to changes in service call method.

○ Finding a way to break free from dependency on the database engine.

○ Oracle DB engine conversion to reduce operating costs (Maria, MySQL, etc.)

○ Container Separation: Container construction for each service applied

○ Scope of work: Conduct on-site tests for budget accounting of the contractor.

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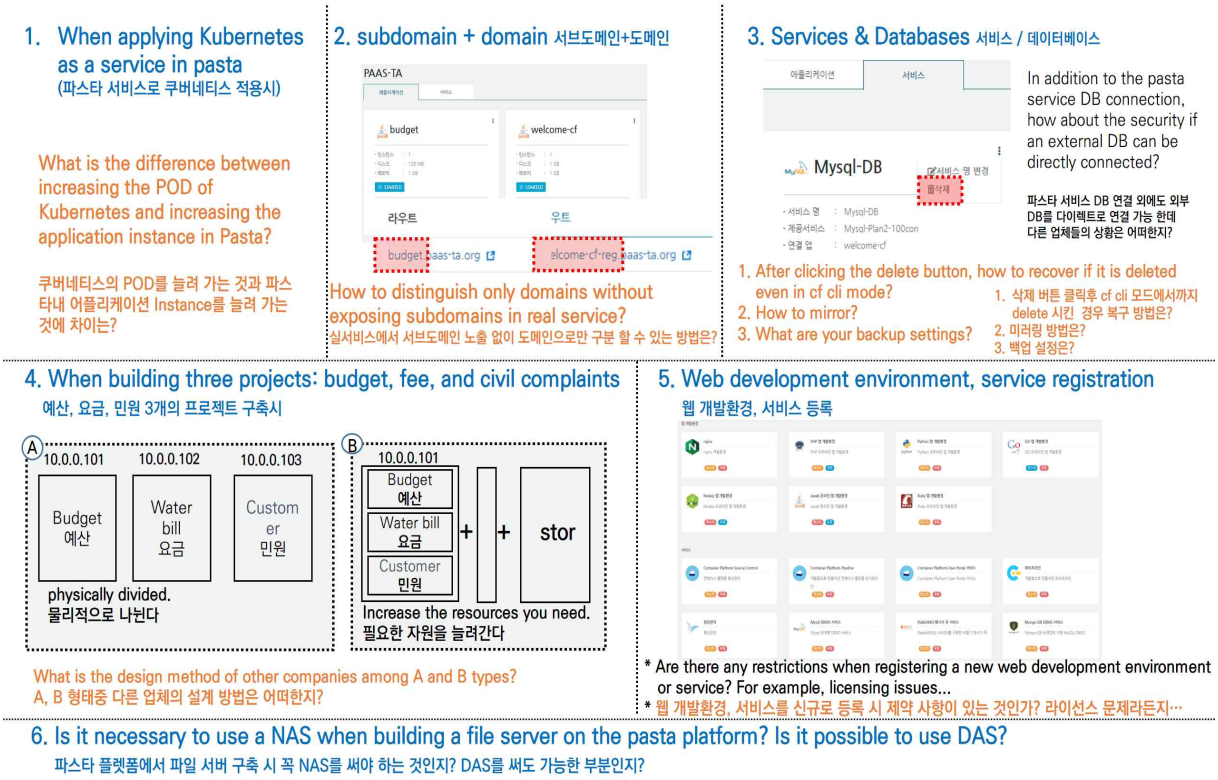
[4] “PaaS” in PaaS-Ta refers to PaaS (Platform as a Service) based on the open sources. "TA" means ‘get on’ or ‘ride’ in Korean, as in riding on PaaS.

4.3 K8s(PaaS-Ta) Operation Service POC(Proof of concept) Review Details



1. When applying Kubernetes as a service in pasta
(파스타 서비스로 쿠버네티스 적용시)

What is the difference between increasing the POD of Kubernetes and increasing the application instance in Pasta?

쿠버네티스의 POD를 늘려 가는 것과 파스타내 어플리케이션 Instance를 늘려 가는 것에 차이는?

2. subdomain + domain 서브도메인+도메인

PAAS-TA
애플리케이션
서비스
budget
welcome-cf
· 인스턴스 : 1
· 디스크 : 128 MB
· 메모리 : 1 GB
STARTED
· 인스턴스 : 1
· 디스크 : 1 GB
· 메모리 : 1 GB
STARTED
라우트
우트
budget.paas-ta.org
elcome-cf-reg.paas-ta.org

How to distinguish only domains without exposing subdomains in real service?
실서비스에서 서브도메인 노출 없이 도메인으로만 구분 할 수 있는 방법은?

3. Services & Databases 서비스 / 데이터베이스

애플리케이션
서비스
Mysql-DB
서비스 명 변경
삭제
· 서비스 명 : Mysql-DB
· 제공서비스 : Mysql-Plan2-100con
· 연결 앱 : welcome-cf

In addition to the pasta service DB connection, how about the security if an external DB can be directly connected?

파스타 서비스 DB 연결 외에도 외부 DB를 다이렉트로 연결 가능 한데 다른 업체들의 상황은 어떠한지?

1. After clicking the delete button, how to recover if it is deleted even in cf cli mode?
2. How to mirror?
3. What are your backup settings?

1. 삭제 버튼 클릭후 cf cli 모드에서까지 delete 시킨 경우 복구 방법은?
2. 미러링 방법은?
3. 백업 설정은?

4. When building three projects: budget, fee, and civil complaints
예산, 요금, 민원 3개의 프로젝트 구축시

A
10.0.0.101
10.0.0.102
10.0.0.103
Budget 예산
Water bill 요금
Customer 민원
physically divided.
물리적으로 나뉜다
B
10.0.0.101
Budget 예산
Water bill 요금
Customer 민원
+
+
stor
Increase the resources you need.
필요한 자원을 늘려간다

What is the design method of other companies among A and B types?
A, B 형태중 다른 업체의 설계 방법은 어떠한지?

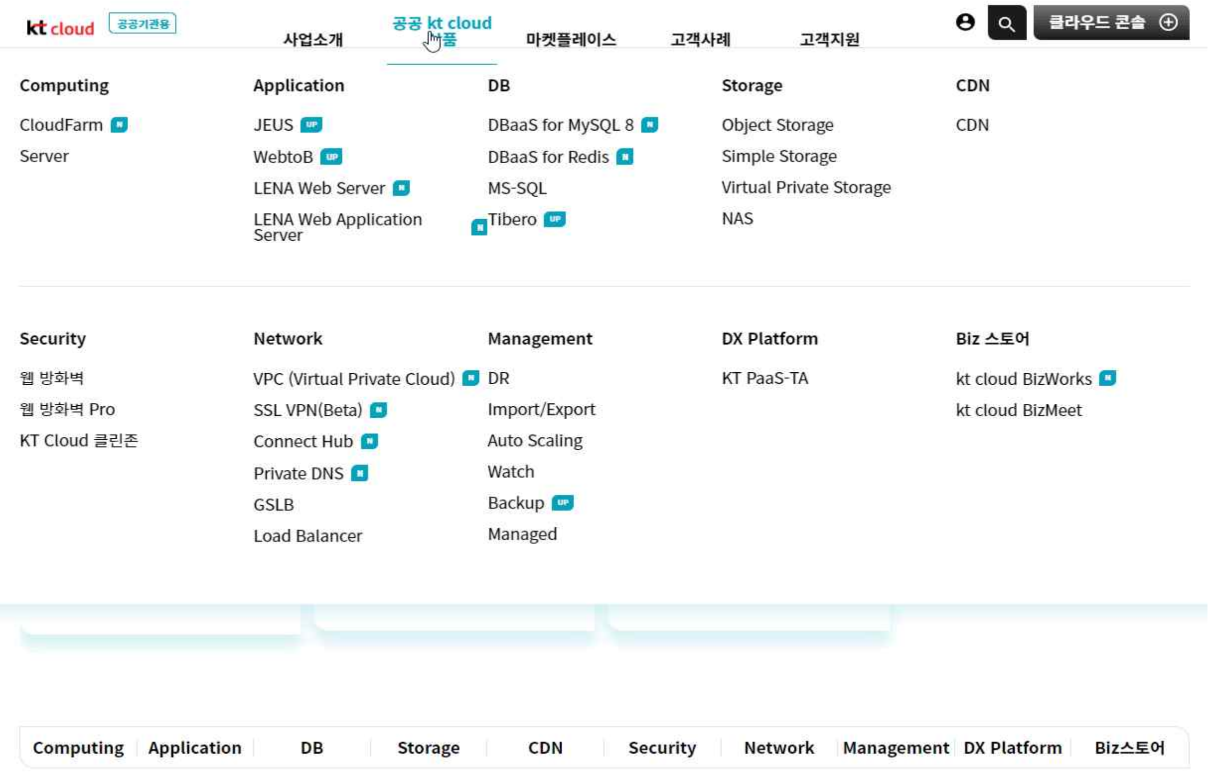
5. Web development environment, service registration
웹 개발환경, 서비스 등록

* Are there any restrictions when registering a new web development environment or service? For example, licensing issues...
* 웹 개발환경, 서비스를 신규로 등록 시 제약 사항이 있는 것인가? 라이선스 문제라든지…

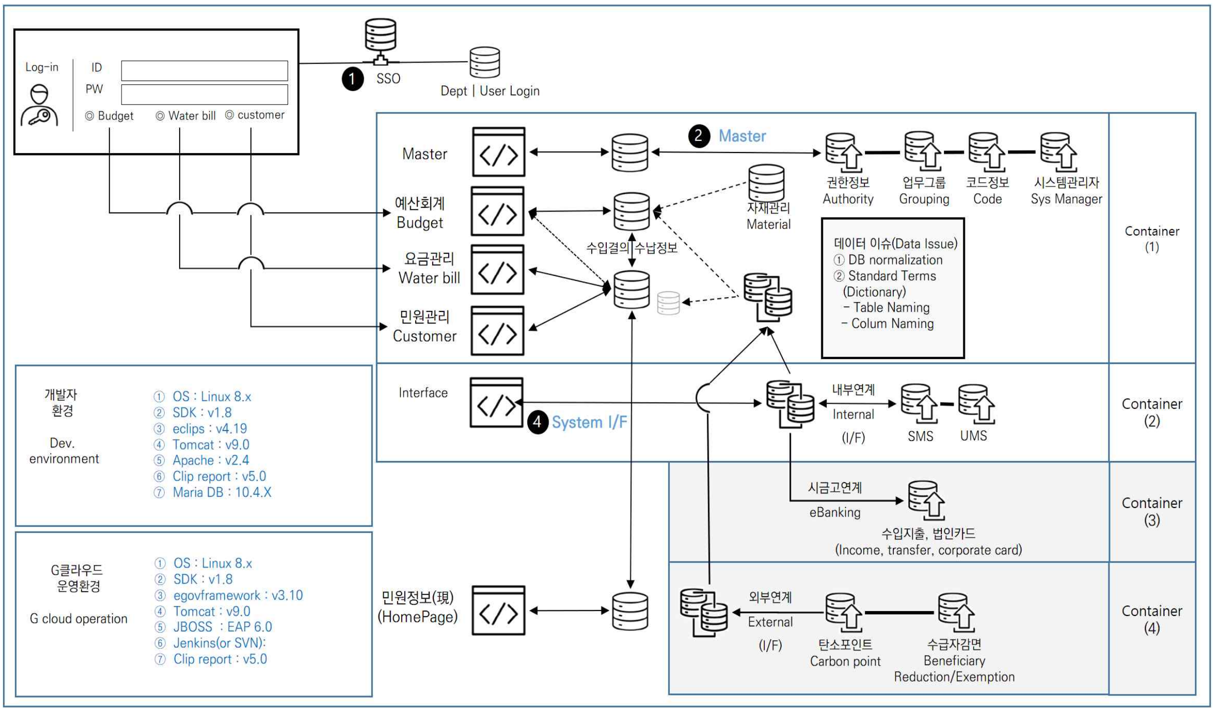
6. Is it necessary to use a NAS when building a file server on the pasta platform? Is it possible to use DAS?
파스타 플렛폼에서 파일 서버 구축 시 꼭 NAS를 써야 하는 것인지? DAS를 써도 가능한 부분인지?

As a result of reviewing the above 6 items, the introduction of k8s cloud service proves **feasible**.

○ K8s (KT PaaS-Ta) operating service example screen


kt cloud
공공기관용
사업소개
공공 kt cloud 상품
마켓플레이스
고객사례
고객지원
클라우드 콘솔
Computing
CloudFarm
Server
Application
JEUS
WebtoB
LENA Web Server
LENA Web Application Server
DB
DBaaS for MySQL 8
DBaaS for Redis
MS-SQL
Tibero
Storage
Object Storage
Simple Storage
Virtual Private Storage
NAS
CDN
CDN
Security
웹 방화벽
웹 방화벽 Pro
KT Cloud 클린존
Network
VPC (Virtual Private Cloud)
SSL VPN(Beta)
Connect Hub
Private DNS
GSLB
Load Balancer
Management
DR
Import/Export
Auto Scaling
Watch
Backup
Managed
DX Platform
KT PaaS-TA
Biz 스토어
kt cloud BizWorks
kt cloud BizMeet
Computing
Application
DB
Storage
CDN
Security
Network
Management
DX Platform
Biz스토어

4.4 K8s-based M.S.A Architcher Configuration Diagram


Log-in
ID
PW
◎ Budget
◎ Water bill
◎ customer
❶ SSO
Dept | User Login
Master
예산회계
Budget
요금관리
Water bill
민원관리
Customer
❷ Master
자재관리
Material
수입결의
수납정보
권한정보
Authority
업무그룹
Grouping
코드정보
Code
시스템관리자
Sys Manager
데이터 이슈(Data Issue)
① DB normalization
② Standard Terms
(Dictionary)
- Table Naming
- Colum Naming
Container
(1)
Interface
❹ System I/F
내부연계
Internal
(I/F)
SMS
UMS
Container
(2)
시금고연계
eBanking
수입지출, 법인카드
(Income, transfer, corporate card)
Container
(3)
개발자
환경
Dev.
environment
① OS : Linux 8.x
② SDK : v1.8
③ eclips : v4.19
④ Tomcat : v9.0
⑤ Apache : v2.4
⑥ Clip report : v5.0
⑦ Maria DB : 10.4.X
G클라우드
운영환경
G cloud operation
① OS : Linux 8.x
② SDK : v1.8
③ egovframework : v3.10
④ Tomcat : v9.0
⑤ JBOSS : EAP 6.0
⑥ Jenkins(or SVN):
⑦ Clip report : v5.0
민원정보(現)
(HomePage)
외부연계
External
(I/F)
탄소포인트
Carbon point
수급자감면
Beneficiary
Reduction/Exemption
Container
(4)

5. Conclusions and policy implications

5.1 Significance of business

○ Established **the first cloud service for a government agency** operated by a public official (budget management, water rate management, civil complaints)

○ Participation in government cloud policy

- Cloud Computing Advancement and User Protection Act

○ Active response to government cloud service policy changes

※ Yoon Seok-yeol's Cloud Policy

'Private Cloud First' Policy

The plan is to prioritize the application of the private cloud in public work, and to expand the number of digital services available for public work to more than 350. The public cloud and SaaS products will be directly used by the government or public institutions. Data can be utilized through a digital platform, and the existing government-led problem-solving method will be changed and implemented as a platform for public-private collaboration.

5.2 Enable Efficient use of infrastructure

- It will be a precedent for other government systems following the establishment of the M.S.A environment.
- Efficient resource management is possible whenever necessary by introducing K8s.
- Through the establishment of an open source-based environment, it is possible to establish a roadmap for each institution and escape from subordination to expected business operators after placing an order.