FreeBSD based Japanese Enterprise System
and
Unicage Development Method

BSD Consulting, Inc. Director /
ONGS Inc. CEO / FreeBSD committer
Daichi GOTO

Summary

summary

- Profile and introduction of my FreeBSD-related works
- How about USP Lab, rapid growing enterprise system development company
- How about Unicage development method, USP's original development method
- What I made for USP Lab
- FreeBSD based enterprise system and HPC
- A problem to be solved ASAP

Introduction

Introduction

- Daichi GOTO / 後藤大地　*1980〜*
- FreeBSD ports / src committer *unionfs, japanese ports*
- BSD Consulting, Inc. Director *young, new company*
- ONGS Inc. CEO my own company, very small company
- Enterprise system design / development / management and maintenance, web server design / development / management and maintenance, IT-related news / articles / magazine and books writing, IT-related seminar, IT-related consulting, etc

Introduction
FreeBSD-related jobs

- FreeBSD Daily Topics (ONGS works)
  http://gihyo.jp/admin/clip/01/fdt
- FreeBSD books, magazines and articles writing (ONGS works)
- FreeBSD H/W verification services and consulting services (BSDc and ONGS works)
- FreeBSD based enterprise platform constructions and maintenance (BSDc and ONGS work) etc

Introduction
FreeBSD Digital Books

- 実践 FreeBSD サーバ構築•運用ガイド, 2012

  Practical FreeBSD server building up and management guide

ONGS works

Introduction
FreeBSD Digital Magazines

- FreeBSD Expert 2012
  Digital Edition, 2012

- FreeBSD Expert 2013Q2
  writing is done. coming soon
  (maybe)

  ONGS works

Introduction
FreeBSD-related activities

- FreeBSD src, ports committer
- Attend to BSDCan, EuroBSDCon, DevSummit, AsiaBSDCon, VendorSummit and writing some reports for Japanese developers and users
- FreeBSD Seminar per month
- @daichigoto tweets FreeBSD-related news and events information

Introduction
FreeBSD Daily Topics

Introduction
FreeBSD Seminar

Japanese enterprise IT situation

Japanese enterprise IT situation
No IT sectors

- Many Japanese companies have no own IT sectors. They always outsource their system development, management and maintenance to IT vendors.
- Big companies depend on Big IT vendors.
- Middle-Small companies depend on commercial software packages.

Japanese enterprise IT situation
IT is import-dependent industry

- Japanese software industry is an import-dependent. Most softwares are not made in Japan.
- Domestic IT vendors like NEC, Hitachi and Fujitsu use imported and translated softwares from Oracle, SAP, Microsoft and so on.

Japanese enterprise IT situation
Sub-sub-sub...contractor structure

- Big IT vendors play as money manager
- Sub-contractors play as project manager
- Sub-sub-contractors write specifications in excel
- Sub-sub-sub-contractors write excel documents
- Sub-sub-sub-sub ... -sub...s write codes
- As a result : High costs and low efficiency

Japanese enterprise IT situation

as a result...

- Many enterprise system development projects look not working well. Too may costs, too many people, too many time, too many unnecessary documents, too many unnecessary source codes and too many stress for workers. Not happy.

Universal Shell Programming Laboratory

Universal Shell Programming Laboratory, Ltd.

- April 2005 established, Japan
- http://www.usp-lab.com/
- President is Nobuaki TOUNAKA / 當仲寛哲

- rapidly growing enterprise systems development small-middle size company
- sales accounting system, payroll accounting system, corporate system, CRM system, merchandising system, enterprise system self-manufacture etc

USP Lab
main customers

株式会社 良品計画 IDÉE

Hakayanagi Quality Life Partner

Pasela

マチのほっとステーション LAWSON

WORLD

三省堂書店 BOOKS SANSEIDO

ANA FESTA

TRIAL

SUPERMARKET 成城石井

THE BODY SHOP.

LOTTERIA

コープネット事業連合

It's BONANZA CITY ヨシヅヤ

CREATIVE Space TANAKA LIFE SHOP

CREATIVE LIFE STORE TOKYU HANDS

日本酒類販売株式会社

花王

Hankyu HANSHOKU

カメラのキタムラ

THE JAPAN AGRICULTURAL NEWS 日本農業新聞

USP Lab
main customers

- ウエルシアホールディングス株式会社、全日空商事株式会社、株式会社良品計画、株式会社ワールド、株式会社ローソン、株式会社阪食、株式会社成城石井、株式会社義津屋、株式会社東急ハンズ、株式会社ロッテリア、株式会社キタムラ、株式会社ニュートン、株式会社日本農業新聞、株式会社トライアルカンパニー、日本酒類販売株式会社、株式会社タカヤナギ、株式会社三省堂書店、田中商事株式会社 etc

Welcia Holdings, ANA FESTA, Ryohin Keikaku, World, Lowson, Hanshoku, Seijoishii, Yoshiduya, Tokyu Hands, Lotteria, Kitamura, Newton, Nihon Nougyo Shinbun, Trial company, Nihon Shuruihanbai, Takanagi, Sanseido, Tanakashouji etc

USP Lab
unique development tools

- They have some very unique tools to develop any enterprise systems in a day and age.
  The commands and a shellscript.
- They have specialized commands called “usp Tukubai” https://uec.usp-lab.com/
- “usp Tukubai” are 40~50 selective commands survived among from several thousands of commands they developed in past years of their businesses.
- It looks like the 40 years old UNIX-style system development.

USP Lab
their business rapidly growing

- Many business folks and developers, at first, feel disturbed and laugh at their development style to scorn
- However...

  1. USP develops enterprise systems in very quick (a few days in some cases) and system works very well
  2. Development cost is reasonable
  3. Development is very flexible
  4. Approach is very easy. At last, customer's company could do self-manufacture (many Japanese companies have no IT sectors, they loves outsourcing)

- And, they are growing rapidly.

USP Lab
shell programming research

- NEDO (New Energy and Industrial Technology Development Organization) - Practical fast information treatment by unicage development method and pipeline calculator
- Tokyo University Tamai lab - Enterprise information system self-manufacture
- Keio University Ohiwa lab - Unicage development method and Japanese programming
- Waseda University Yamana lab - Shellscripting fast data treatment method on multicore processor
- Nagoya University Kawaguti lab - Emergency data treatment system development by Unicage development method

Unicage Development Method

Unicage Development Method

- Software Development Method for enterprise system using Unix, text file, commands and a shellscript.
- Low Cost
- Easy to Program
- Fast Development time
- Fast Processing

Unicage Development Method
key tools: texts, commands, pipelines

- Inexpensive PC is base platform
- Data is white-space separated plain text called “field-formated text”
- Unix text processing commands (sed, awk, tr, grep, echo, cat, head, tail) and customized commands called “usp Tukubai”, joined by pipeline in a shellscript

Unicage Development Method
key tools: texts, commands, pipelines

Only 100 Common Commands

```
cp        Copy
find      File search
sort      Sort
awk       Perform operations
          on items
   :
   :
join0     Data matching
sm2       Sum up
waku      Add a border
ulock     Lock control
   :
bdate     Date management
```

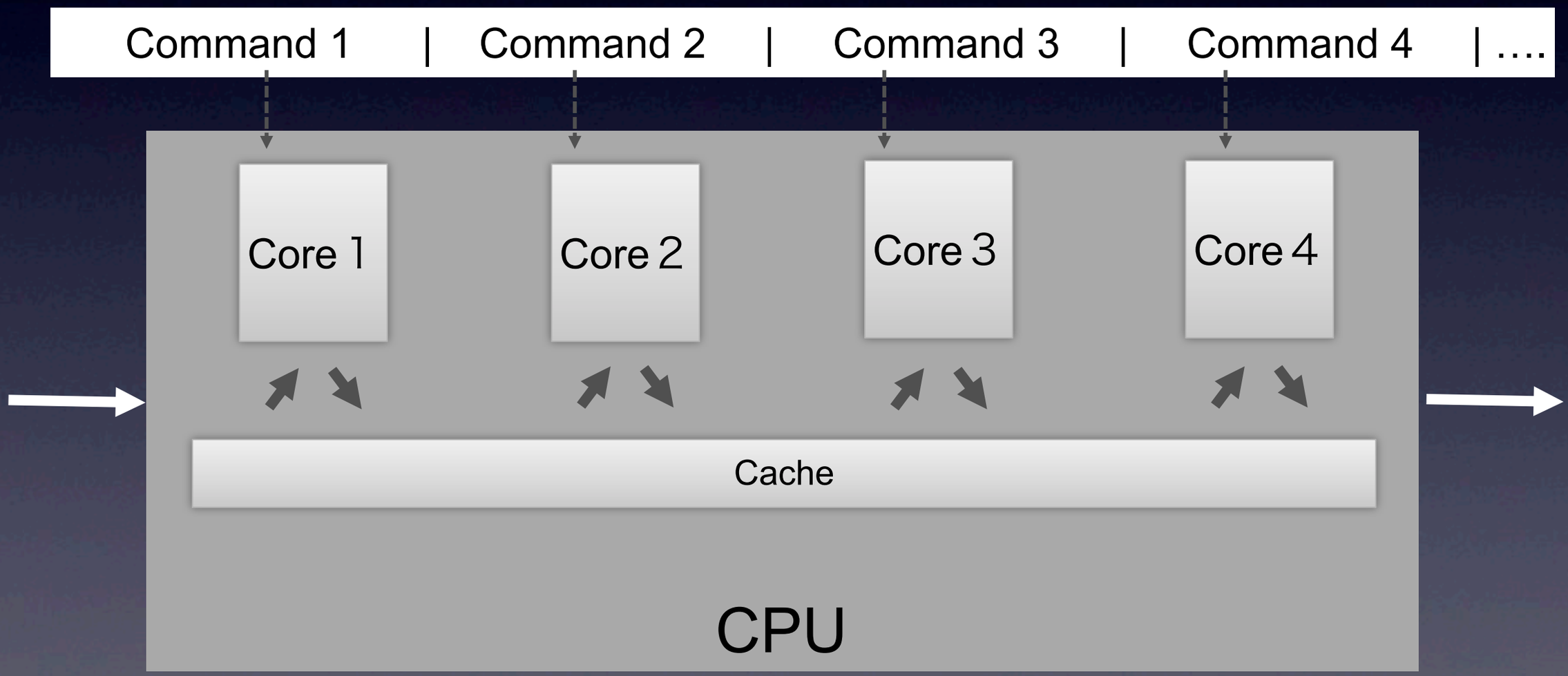
FreeBSD Commands

usp Tukubai Commands

Custom Commands

Unicage Development Method
key tools: texts, commands, pipelines

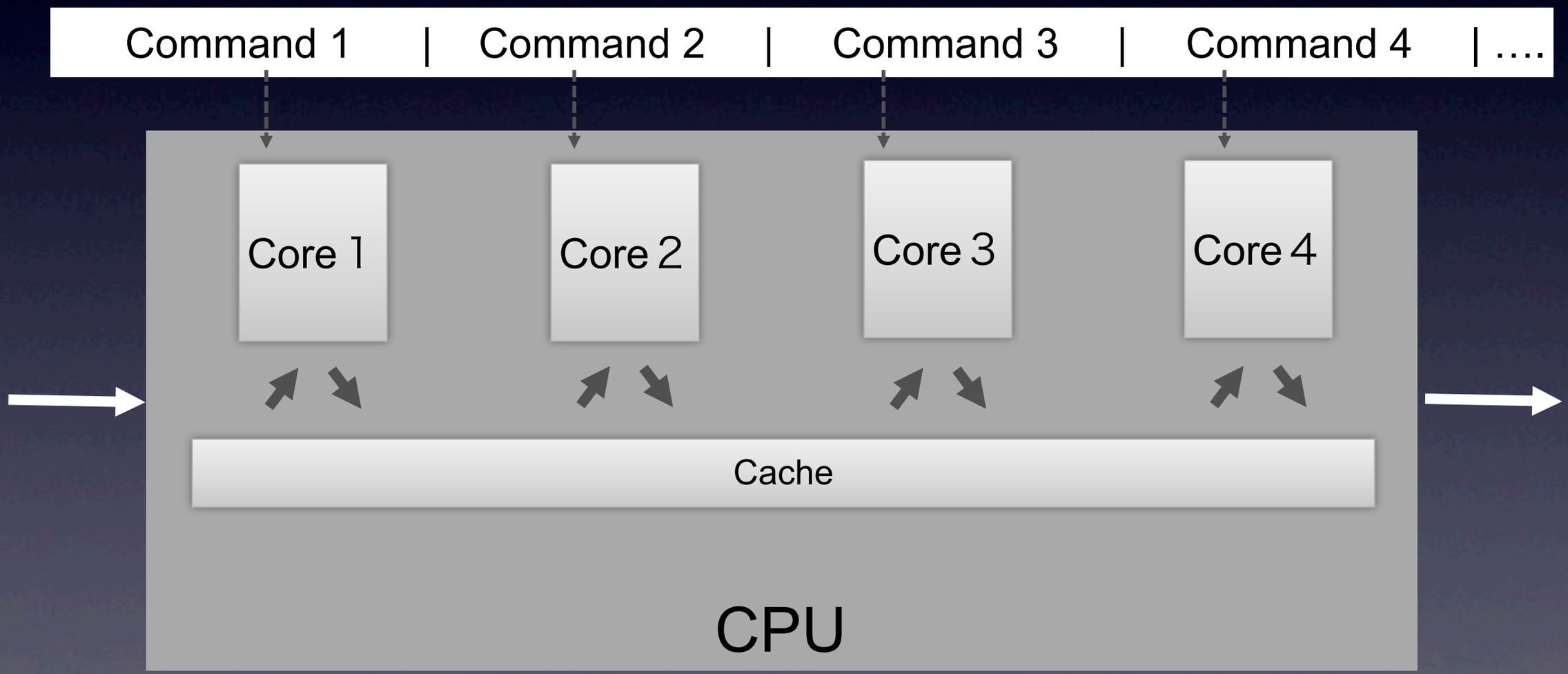
Pipeline Processing



From the "Unicage Development Method Technical Overview", 2013 USP Lab.

Unicage Development Method
scalability : multicore / many-core

Pipeline Processing : easy way to use multicore



From the "Unicage Development Method Technical Overview", 2013 USP Lab.

Unicage Development Method
key tools: usp Tukubai

Database Commands

join0,1,2:	Table join
gyo:	Count matching records
getfirst:	Get first matching row
getlast:	Get last matching row
retu:	Count columns

I/O Commands

cgi-name:	Read data from CGI-POST
mime-read:	Read MIME encoded data

Arithmetic Functions

plus:	Addition
divsen:	Divide by 1000
sm2:	Sum a field
marume:	Round a number
ratio:	Find a ratio
plus:	Sum all fields in a record

Formatting Commands

comma:	Add commas to number
mojihame:	Merge data into template
tcat:	Vertically concatenate
ycat:	Horizontally concatenate
map:	Transpose rows/columns
yobi	Get day of week
up3:	Merge files on key field

From the "Unicage Development Method Technical Overview", 2013 USP Lab.

Unicage Development Method
Open usp Tukubai

- USP Labs opened license free version of usp Tukubai "Open usp Tukubai" written in Python
- I imported to FreeBSD devel/open-usp-tukubai
- http://uec.usp-lab.com/ helps you

Unicage Development Method
Fast Development / Fast Processing

- No middleware.
  Shell uses kernel's feature (systemcalls)
  directory. pipe, fork, wait, open, ...
- Applications are very short (a couple dozen lines)
- usp Tukubai commands : a command has a feature, optimized for high performance.

Unicage Development Method
an application sample code 1

```
#!/bin/sh

join0 key=1 MASTER URE    |   # Join data
self 2 3 4 5              |   # Select field
hsort key=1/2             |   # Sort
sm2 1 2 3 4               |   # Sum up
sm4 1 1 2 2 3 4           |   # Intermediate total
self 1 2 4 3              |   # Select Field
sm5 1 3 4 4               |   # Final total
map num=1                 |   # Transpose
sed 's/A/Sales/g'         |   # Text search/replace
sed 's/B/Profit/g'        |   # Text search/replace
keta 4 6@NF-1             |   # Align rows
comma 3/NF                |   # Add commas
cat header -              |   # Attach header
tocsv > result                # Output to CSV
exit 0
```

From the "Unicage Development Method Technical Overview", 2013 USP Lab.

Unicage Development Method
an application sample code 2

```
#!/bin/sh

dd bs=$CONTENT_LENGTH | cgi-name > name    # Get information from web server
case "$(nameread MODE name)" in            # Branch based on processing mode
SEARCH)                                    # [Search]
    if ulock -r MST.LK; then               # Shared Lock
        nameread KEY name     |            # Get search key
        join0 key=1 - MST     |            # Search for master data
        mojihame -lLABEL html              # Export to HTML
    fi ;;
UPDATE)                                    # [Update]
    if ulock -w MST.LK; then               # Exclusive lock
        nameread -el "KEY|VAL" name > TRN.123   # Get key and value
        upl key=1 MST TRN.123 > MST.123    # Create update master
        ln -s MST.123 MST                  # Allow access with same name
        cat next_html                      # Output to next screen
    fi ;;
esac
exit 0
```

Unicage Development Method
Flexible

- Applications are very simple and easy to learn and customize

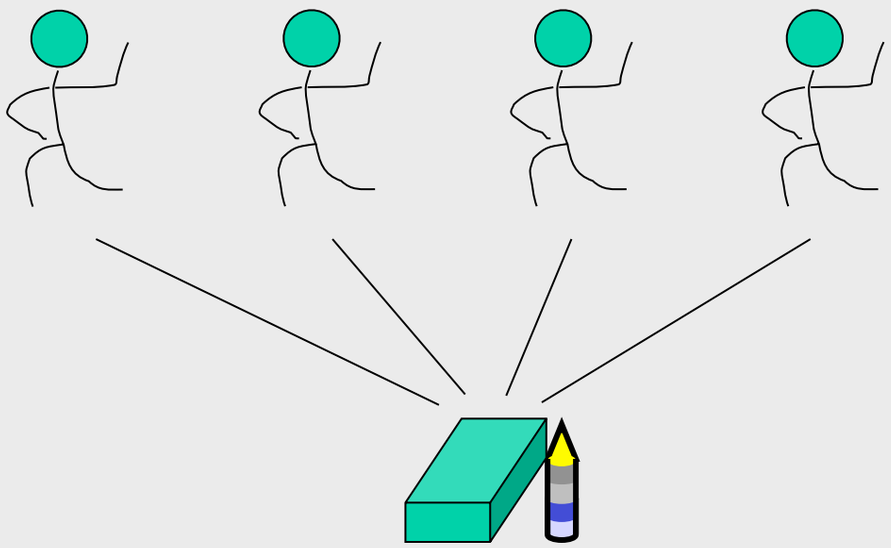
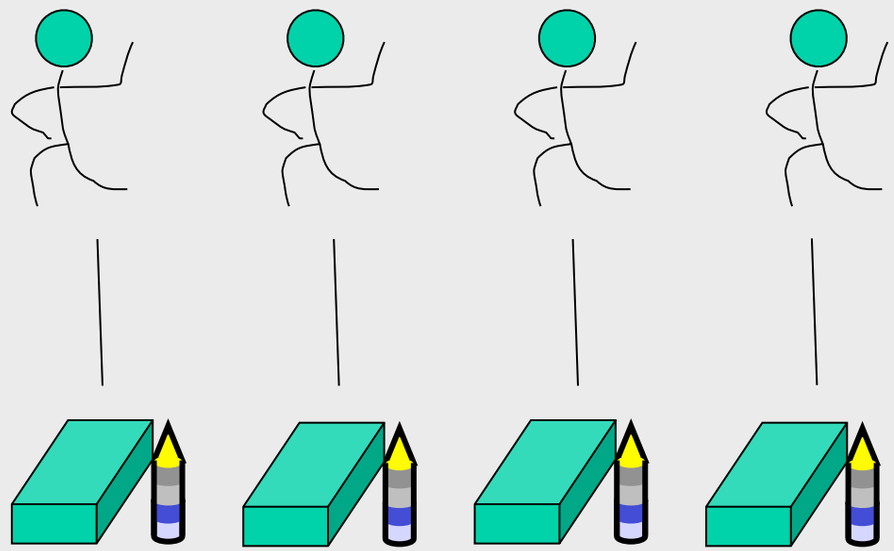
Unicage Development Method
Data Strategy: Separate

- "To Separate is to Understand"
  分ける(separate) / 分かる(understand)
  The kanji "分" has 2 meanings, one is to separate, other is to understand. It's judicious.
- Data separated by business, separated by organization, separated by software.

Unicage Development Method
Data Strategy: Distributed

- Data are copied to all software and distributed to everywhere.
- No overwrite. Applications just read a file and write into an another new file.
- Full distribution and non-overwrite system is robust for unexpected accident. Wrong data input, software bug or hardware bug. Developers can inspect easily because there are just only some text files and some little size shellscripts.
- Easy rollback

Unicage Development Method
Data Strategy: Distributed

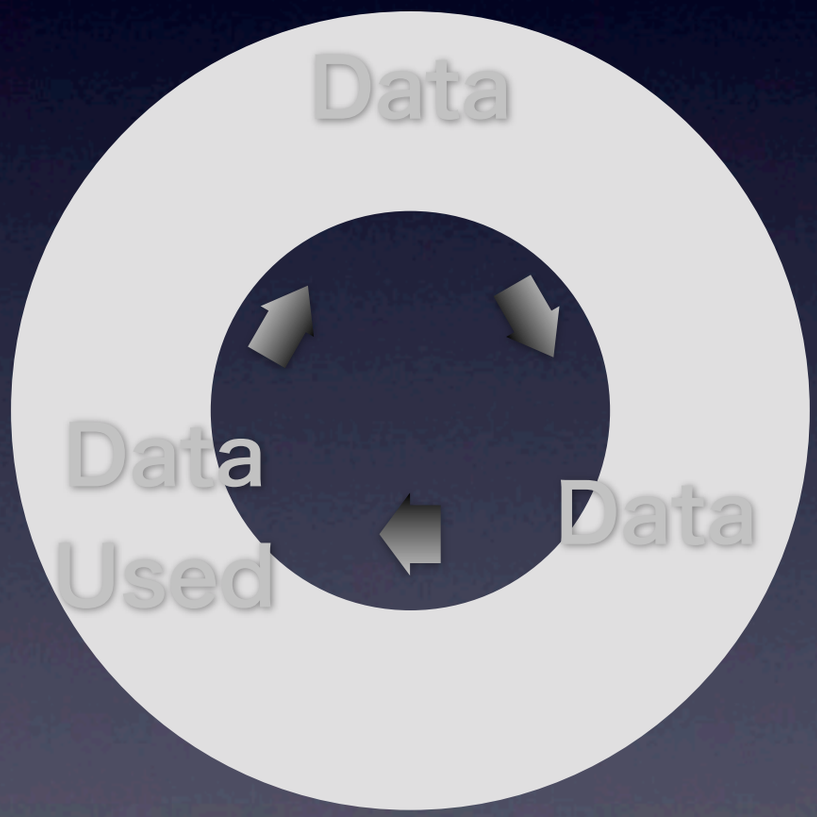
Traditional “Sharing” (centralized)	Full Sharing (distributed)
	
One change of spec affects everyone	One change of spec doesn’t affect others
High Load / Program is Complex	Low Load / Simple Program

From the “Unicage Development Method Technical Overview”, 2013 USP Lab.

Unicage Development Method
Data Flow

Input Script

POS
Order Data
Master Record, etc.



Output Script

Screen
Report, etc.

Update/Collate Script

Data merged
5W1H Collation
5 Layer Data Management, etc.

All three systems are created with shell scripts
Data transfer is all performed with File I/F

From the "Unicage Development Method Technical Overview", 2013 USP Lab.

Unicage Development Method
5 Layers Data Management

Level 1
(Event Data)

Raw Data (Unsynchronized)
Data created as the information is produced
(Must not be lost; replicated and backed-up robustly)

Level 2
(Confirmed Data)

Detail Data (Synchronized)
Raw data that has been formally imported into the system at a particular point in time

Level 3
(5W1H Data)

Level 2 data is organized and summarized in 5W1H units (Often called “Ultra-organization.” Does not depend on the application.

Level 4
(Application Data)

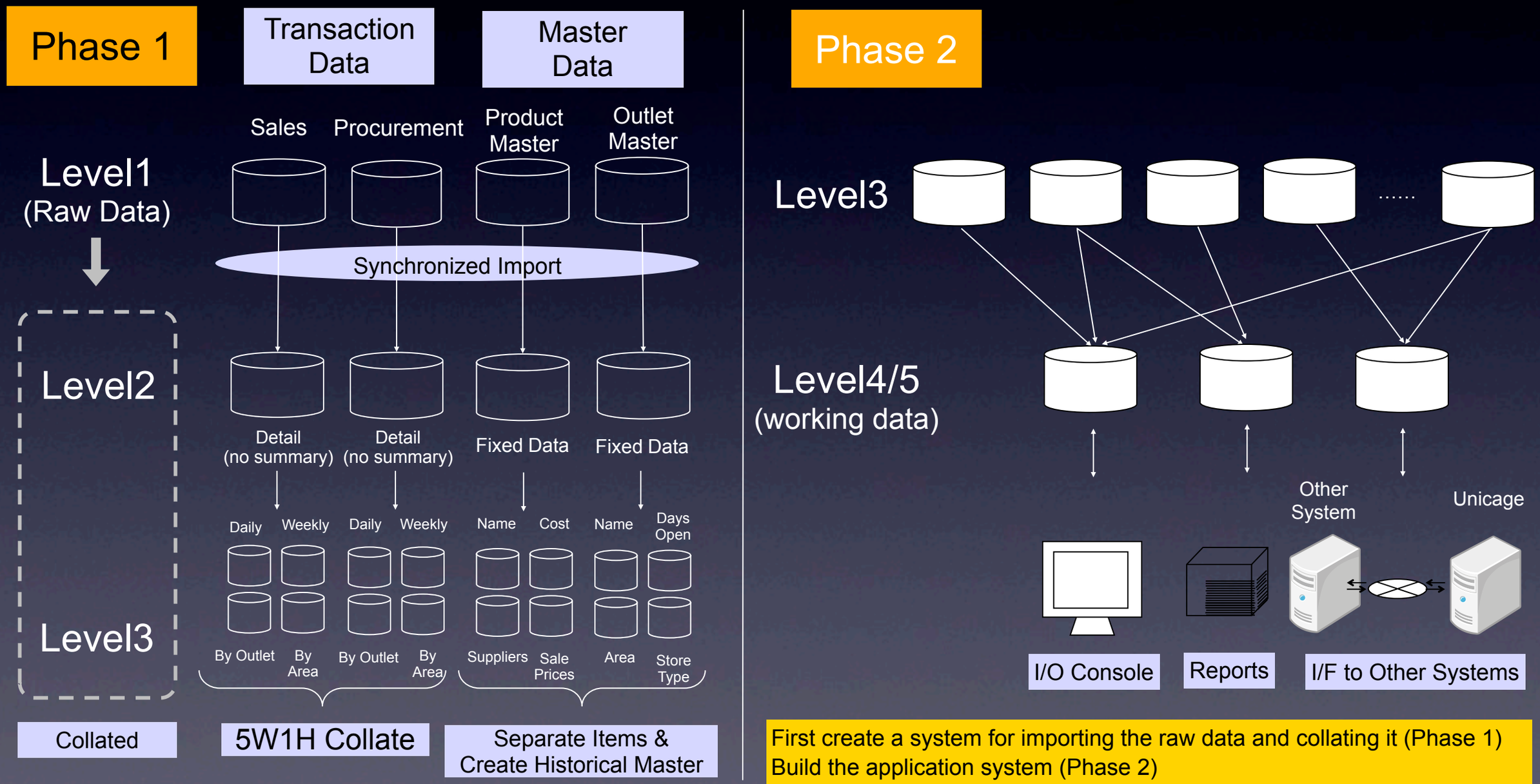
Data formatted to be easily processed by the application

Level 5
(Output Data)

Report Image Data (Excel, PDF) or Log

From the “Unicage Development Method Technical Overview”, 2013 USP Lab.

Unicage Development Method
5 Layers Data Management



From the "Unicage Development Method Technical Overview", 2013 USP Lab.

Unicage Development Method
Development Flow

70% Important for Business

Design Framework for Business

Can be Decided Early

Short Timeframe

Initial Development

Obtain Real Data
Develop, Test, Release

Can be designed only with the original data and output format design (Design Workload is Light)

Few Man-Hours

30% Important for Business

Design Useful Features

Based on Working Application so

Short Timeframe

Second Pass (Finishing)

Develop, Test,

Short Program
+
No Dependencies
↓
Feature Extension is Easy

Few Man-Hours

Short Program (Fast Development) + User Focus (Efficient Communication) + 2-Steps (Accurate Spec Design) = Low Cost Fast Response

From the "Unicage Development Method Technical Overview", 2013 USP Lab.

Unicage Development Method
Coding manners

Shell Scripts are extremely flexible so we must pay close attention to proper style when using Unicage.

- Script header style
- Comment style
- Variable and file naming rules
- Rules for naming temporary files
- One command per line
- Transfer data using files (not environment variables)
- Include processing is forbidden
- File layout style
- Execution log style
- Rules for naming files
- Output execution start and end times
- Generate a semaphore file
- Keep it short
- Separate script and data in complex IF statements
- Delete garbage files
- Don’t create versions (but make backups)
- Multi-level calls prohibited
- Overwrite the copyright
- Understand the size of the processing file

From the “Unicage Development Method Technical Overview”, 2013 USP Lab.

Unicage Development Method Documentation

1. Very Little Documentation is Required for Development
   - Configuration of data and programs is fixed, so only basic documentation is necessary.
   - Required documents are as follows:
     - Application I/O API specifications
     - Dimensions of source data
2. Documentation for Understanding the System is Practical
   - “System Purpose”, “Business Flow”, “Manuals” are needed.
   - Most information needed to understand the system can be obtained by looking at the system operation itself (examples below)
     - Data configuration and relationships
     - Application configuration and relationships
     - Batch schedule
     - Detailed specifications (written in the shell scripts)

From the “Unicage Development Method Technical Overview”, 2013 USP Lab.

Unicage Development Method Based on the Unix Philosophy

- Small is Beautiful
- One program (command) should only do one thing
- Prototyping should be as fast as possible
- Portability takes precedence over efficiency
- Data is stored as plain text
- Commands are used as “levers”
  (can be combined & reused)
- Applications are written in shell script
- All programs are designed as filters (pipes)

Unicage Development Method UEC

- http://uec.usp-lab.com/
- Web site for Unicage Engineers
- All contents are specialized for shellscript programming
- World's most crazy shellscript site

ush / BubunFS

what I made for USP

ush

ush

```
# uname -sr
FreeBSD 9.1-STABLE
# ush --version
Usage   : ush [-/+evx] [script [arg ...]]
        : ush --version
Version : Wed Nov 14 22:33:27 JST 2012
#
```

- ush - USP's Shell
- ash based customized shell, removed unnecessary features, added some new features including debug feature, exception handling, brace expansion and string handling
- ush is new USP's base platform

ush
coding robustness

- ush has no unnecessary feature to improve coding quality
- ush has no features leading to some security vulnerabilities
- ush has new features to improve coding speed and reading speed

ush
error handling

```
# ush
err handker() {
    echo error occured
}
true
false
error occured
( true | false | true )
error occured
exit
#
```

```
# ush -e
err handker() {
    echo error occured
}

( true | false | true )
error occured
#
```

ush

verbose output for debug

```
# cat SAMPLE.USH
#!/bin/ush -exv

err handler() {
    echo error occured
}
true
(true | false | true )
#
```

```
# ./SAMPLE.USH
#!/bin/ush -exv

err handler() {
    echo error occured
}
+5 err handler
true
+6 true
(true | false | true )
+7 true
+7 false
+7 true
+1 handler
+4 echo error occured
error occured
#
```

ush

no export, just only a few variables

```
# ush
export
export: not found
env
LANG=ja_JP.UTF-8
PATH=/z/daichi/Library/bin:/z/daichi/bin/:/sbin:/bin:/
usr/sbin:/usr/bin:/usr/games:/usr/local/sbin:/usr/
local/bin:/z/daichi/bin
PWD=/z/dev-ush/ush/spec
TERM=xterm-256color
HOME=/z/daichi
exit
#
```

ush

log command

```
# ush
log 2> LOG.ERROR.20130518
ls /COPYRIGHT
/COPYRIGHT
ls /COPYRIGHTs
uush
false
exit
# cat LOG.ERROR.20130518
ls: /COPYRIGHTs: No such file or directory
uush: not found
#
```

ush

brace expansion

```
# ush
echo {1..5}
1 2 3 4 5
echo {1..5}{a..d}
1a 1b 1c 1d 2a 2b 2c 2d 3a 3b 3c 3d 4a 4b 4c 4d 5a 5b 5c 5d
echo FILE.{1..3}{a,d}
FILE.1a FILE.1d FILE.2a FILE.2d FILE.3a FILE.3d
exit
#
```

ush

substring operation

```
# ush
name=PRODUCT.NAME
echo $name
PRODUCT.NAME
echo ${name.1.7}
PRODUCT
echo ${name.9.11}
NAME
echo ${name.-4.4}
NAME
echo ${name.-4}
NAME
exit
#
```

BubunFS

BubunFS

- A new file which is a part of some file without data copying I/O
- kldload BubunFS
- `ln -s original "apartof seek length"`
- e.g., 1,000,000 files from a 10GB file without data read/writing I/O

BubunFS

feature as kernel module

```
BOAM /home/usp/tmpfs% kldstat
Id Refs Address                Size     Name
 1   16 0xffffffff80200000 150ea58  kernel
 2    1 0xffffffff8170f000 5210     BubunFS.ko
 3    1 0xffffffff81812000 390e     ums.ko
 4    2 0xffffffff81816000 12074    ipfw.ko
 5    1 0xffffffff81829000 5016     ipdivert.ko
 6    1 0xffffffff8182f000 964c     if_bridge.ko
 7    1 0xffffffff81839000 4ef3     bridgestp.ko
 8    1 0xffffffff8183e000 9c89     tmpfs.ko
BOAM /home/usp/tmpfs%
```

BubunFS is implemented as kernel module.
You can switch on/off directory at run time.

BubunFS

command sample

```
BOAM /home/usp/tmpfs% ls -lh
-rw-r--r--  1 usp  usp   4.3G May  7 13:33 data.bank
BOAM /home/usp/tmpfs% head -5 data.bank
0000000 20130310 101034 1000 8000
0000000 20130410 094550 2000 10000
0000000 20130430 231015 -1000 9000
0000000 20130520 042353 3000 12000
0000000 20130709 081012 4000 16000
BOAM /home/usp/tmpfs% ln -s data.bank "a 0 34"
BOAM /home/usp/tmpfs% ls -l a*
lrwxr-xr-x  1 usp  usp  9  May 18 22:10 a 0 34 -> data.bank
BOAM /home/usp/tmpfs% cat a\ 0\ 34
0000000 20130310 101034 1000 8000
BOAM /home/usp/tmpfs%
```

BubunFS

how to implement

- BubunFS is systemcall hock magic implementation
- BubunFS implements all related systemcalls to put the BubunFS feature into place. BubunFS kernel module replaces some FreeBSD's default systemcalls with BubunFS's systemcalls at runtime.
- We choose to use symbolic link file as a trick of BubunFS because it's the most fastest one.

BubunFS

use case

- One big Master file (10GB)
- Some applications want to use a part of the MASTER file. e.x. 100 applications read the Master file | grep > 100-new-small-files ... very slow
- BubunFS can create some million small files in seconds

ush / BubunFS
next step

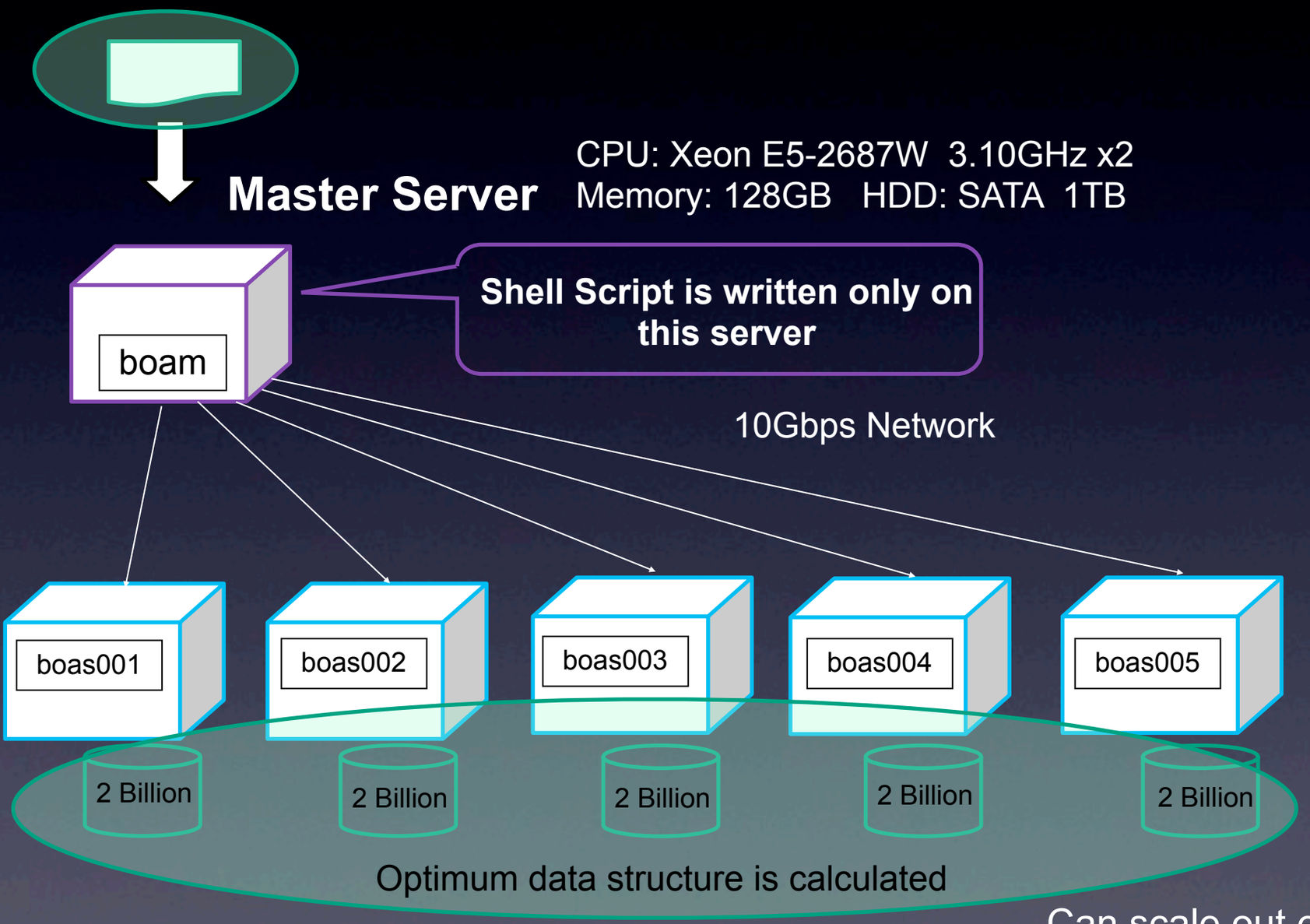
- ush2 - more debugging features, remote control, network programming
- GattaiFS - reverse feature of BubunFS. A file consisted by any other files.

uspBOA

usp BigData Oriented Architecture

- “usp BOA” FreeBSD based BigData processing appliance (PC based cluster) for USP Lab
- 1 master, 5 slaves PCs. 10GbE NIC connected network
- 1 billion records sort : 90sec, great cost-benefit
- 1 billion records search: 4sec, great cost-benefit

uspBOA
uspBOA Architecture



Slave Servers

5 PCs

Store massive data

Perform actual processing

CPU: Core i7-3960X 3.30GHz
Memory: 32GB
HDD: SATA 1TB

Can scale out easily as the amount of data grows…

From the "Big Data...Small pricetag", 2013 USP Lab.

uspBOA
1st BOA : failed

- 1st BOA cluster - I chose Mellanox Technologies InfiniBand ConnectX-II for network with OFED
- That works. Great
- But unstable. Useless
- We have no time to change kernel source code. So we chose to buy other devices

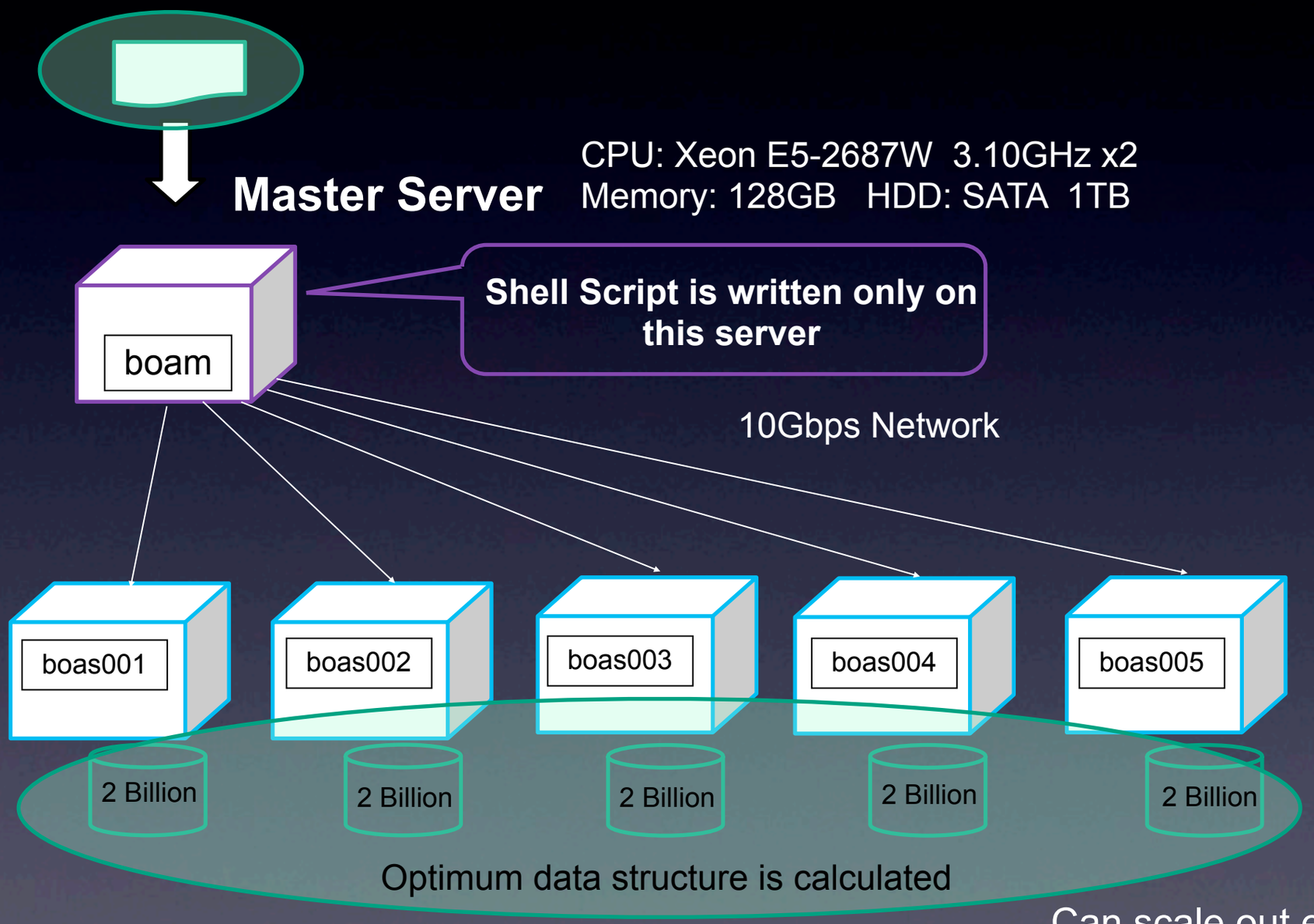
usp BOA
2nd BOA : not enough

- 2nd BOA cluster - I chose Intel X540-T2, and works well
- Good
- But we need more processors power, more impact.

uspBOA
3rd BOA : success

- 3rd BOA cluster - we replaced all master and slaves CPU to 6core/12thread Core i7-3960X 3.30GHz and Xeon E5-2687W 3.10GHz.
- Good. Enough impact

uspBOA
uspBOA (3rd) Architecture



Slave Servers

5 PCs

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Perform actual processing

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Can scale out easily as the amount of data grows…

From the "Big Data…Small pricetag", 2013 USP Lab.

uspBOA
an application sample

```
#!/bin/ush -x
#Example script for summing a large data set

clust-join1 slavefile1 key=1 master URE    |    # Data JOIN (Bigdata)
para-self 10 2/NF-1                        |    # SELECT(Bigdata)
clust-sm2 slavefile2 1 2 3 4               |    # SUM
sm4 1 1 2 2 3 4                            |    # Intermediate sum
self 1 2 4 3 5                             |    # SELECT
sm5 1 3 4 4                                |    # TOTAL
map num=1                                  |    # Transform
sed 's/A/Sales/g'                          |    # Text replace
sed 's/B/Profit/g'                         |
keta 4 6@NF-1                              |    # Format columns
comma 4 5                                  |    # Insert commas
cat header -> result                            # Output with header
exit 0
```

"slavefile" contains the names of the slave servers and the number of parallel processes

uspBOA Benchmarks

Process	Description	Speed
1. Select (para-grep)	Select all records starting with the text “123” from among 1 billion records using 10 parallel processes	3 secs.
2. Sort (clust-qsort)	Sort 1 billion random records in ascending order using 40 parallel processes on 5 slave servers	97 secs.
3. Sum (clust-sm2)	Sum key fields in 1 billion random records using 40 parallel processes on 5 slave servers	35 secs.
4. Mathematical Operations (clust-awk)	Perform mathematical calculations between fields on 1 billion records using 40 parallel processes on 5 slave servers	22 secs.
(clust-lcalc)	Perform precision floating-point operations	67 secs.
5. Join (clust-join1)	Perform a join operation on 1 billion records using 40 parallel processes on 5 slave servers. The master server is relatively small.	37 secs.
6. Complicated Operations (clust-shell)	Distribute 1 billion records by key block units and perform several calculations (key sumup, average, round, literal) using 40 parallel processes on 5 slave servers	17 secs.

From the “Big Data Software Appliance Simple, High-Speed Big Data Processing using Shell Scripting and uspTukubai”, 2013 USP Lab.

uspBOA Benchmarks

Process	Description	Speed
1. Big Data Select (apli-select)	Perform a matching select on 10,000 transactions (join and exclude) from among 10 billion records distributed across the slave servers	4.5 secs.
2. Big Data Update (Add & Change, Delete, Sum) apli-update apli-delete apli-sumup	2. Big Data Update (Add & Change, Delete, Sum) apli-update apli-delete apli-sumup	5.5 secs.
3. Big Data Search (apli-search)	Search account holder data based on Rank, Gender, Geographical Region, Age Group, Length of Membership and Minimum Average Score from among 10 billion records distributed across the slave servers	1.2 secs.

From the "Big Data...Small pricetag", 2013 USP Lab.

uspBOA
other examples

1 Batch Processing (Leading Credit Card Company)	**Processing of daily transaction details on 60,000,000 credit card accounts** OLD: COBOL Program running on Large Server (15hrs. 29mins) ⬇ NEW: UNICAGE Program running on 5 PCs (1hr. 56mins)
2 Complex ETL (Leading Investment Bank)	**Data Creation for DB Loading of 30,000,000 daily transaction records** OLD: JAVA＋PostgreSQL (90 minutes) ⬇ NEW: Unicage Program running on 1 PC (91.58 seconds)
3 Complex ETL (Large Electric Utility)	**Preprocessing of 10GB of Smart Meter data** OLD: JAVA on HPUX Itanium 1.6GHz/2Core (15 hours) ⬇ NEW: Unicage Program running on 1 PC (FreeBSD 9.1) (4 mins 16 secs)
4 Large Data Search (Biggest Search Engine in Korea)	**50.3 Billion Log Records from 5 years (19.2TB)** 10 Types of SQL Searches translated to Unicage Search Time: 0.227 sec - 4.763 sec

From the "Big Data...Small pricetag", 2013 USP Lab.

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Bigdata case studies using Unicage

(1) **Replacement of Batch Processing System**

(Major Credit Card Company)

(2) **Complex ETL (Investment Bank)**

(3) **Complex ETL (Electric Power Utility)**

(4) **Search of Large Data Set (Korean Search Engine)**

From the "Big Data...Small pricetag", 2013 USP Lab.

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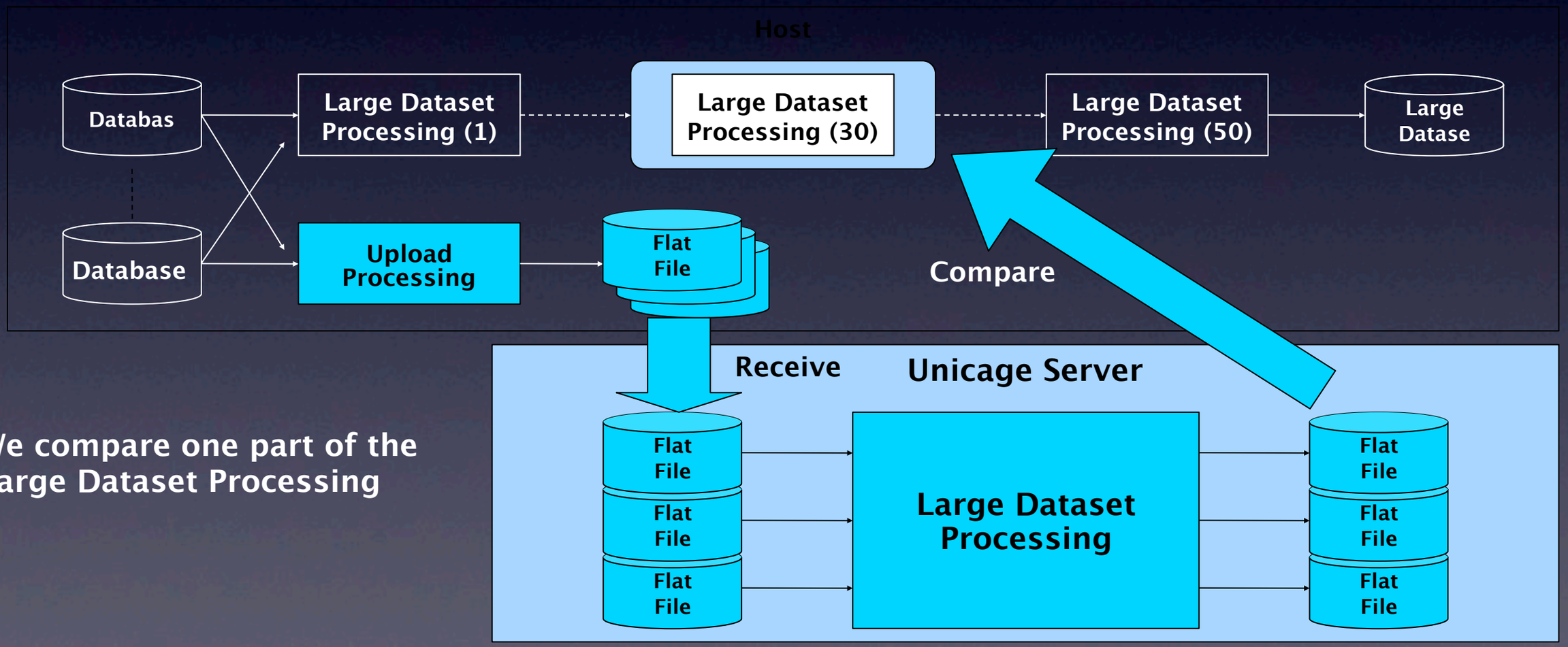
(I) Replacement of Batch Processing System

(Major Credit Card Company)

Large data set is processed on the host. This processing will be ported to Unicage.

We receive the data that needs processing from the host, Unicage performs some processing, then compare.



We compare one part of the Large Dataset Processing

From the "Big Data...Small pricetag", 2013 USP Lab.

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Processing Speed

- Processing time was reduced to 1/8 of the COBOL system (116.00/929.69=12.4%)
- Unicage was measured running on 5 x86 servers (6-core CPU x 2, 48GB RAM)
- If the number of servers is increased and processing is distributed, even faster processing is possible.

	COBOL	Unicage (Single x86 Server)	Unicage (Five x86 Servers)
Processing Time	929.69 mins. (15 hrs. 29 mins.)	313.58 mins. (5 hrs. 13 mins.)	116.00 mins. (1 hr. 56 mins.)
Hardware	Host •Initial Investment over $1M •Maintenance Fee also High	Single x86 Server •Dual 6-core CPUs •48GB RAM •2 x HDD (SATA 2TB) •Initial Investment $10K •Maintenance Fee is Low	Five x86 Servers •Dual 6-core CPUs •48GB RAM •2 x HDD (SATA 2TB) •Initial Investment $50K •Maintenance Fee is Low

From the "Big Data...Small pricetag", 2013 USP Lab.

uspBOA
Development Productivity

Using COBOL
24 processes and 7 jobs required, so development took 3 months.

Using Unicage
Coding: 5 days
Testing: 5 days
Performance Tweaking: 3 days

- **Developed by a Unicage engineer with 5 years experience in 13 days.**

	COBOL	Unicage
Number of Processes	7 Jobs & 24 Processes	11 Shell Scripts
Development Time	3 Months	13 days
Lines of Code	3,645	981

From the "Big Data...Small pricetag", 2013 USP Lab.

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(2) Complex ETL (Investment Bank)

- **Using the Unicage development method, we will perform reformatting of data so that it is in a format that can be loaded into the transaction storage database.**
- **We will then compare processing time.**

Transaction Log

Hierarchical Multi-Layout

Record Types (approx. 100)

Data to be Loaded

A	Parent	Child1	Grandchild1−1
A	Parent	Child1	Grandchild1−2
A	Parent	Child1	Grandchild2−1
B	Parent	Child1	
B	Parent	Child2	
C	Parent	Child1	Child2

Layout resolves the Parent/Child/ Grandchild relationships

Execution Speed using Java+ PostgreSQL is about 90 minutes

From the "Big Data...Small pricetag", 2013 USP Lab.

uspBOA
Processing Speed

Development/Testing Environment

Computer	Desktop PC (Intel Core i7 processor, 16GB RAM)
Operating System	FreeBSD 9.0 Release#0
Shell Commands	USP Unicage Enterprise Version

Application	Details	Records	Lines of
PROCESS-MASTER	Top Shell		29
PROCESS-001	Exception Processing 1	8,327	8
PROCESS-002	Exception Processing 2	117,838	9
PROCESS-003	Exception Processing 3	81	11
PROCESS-004	Exception Processing 4	5,028	19
PROCESS-005	Exception Processing 5	332	14
PROCESS-006	Normal Processing	27,614,260	6
		29,015,393 (4.36 GB)	96

Execution Speed:
Real: 91.58 sec
User: 132.85 sec
Sys: 22.53 sec

From the "Big Data...Small pricetag", 2013 USP Lab.

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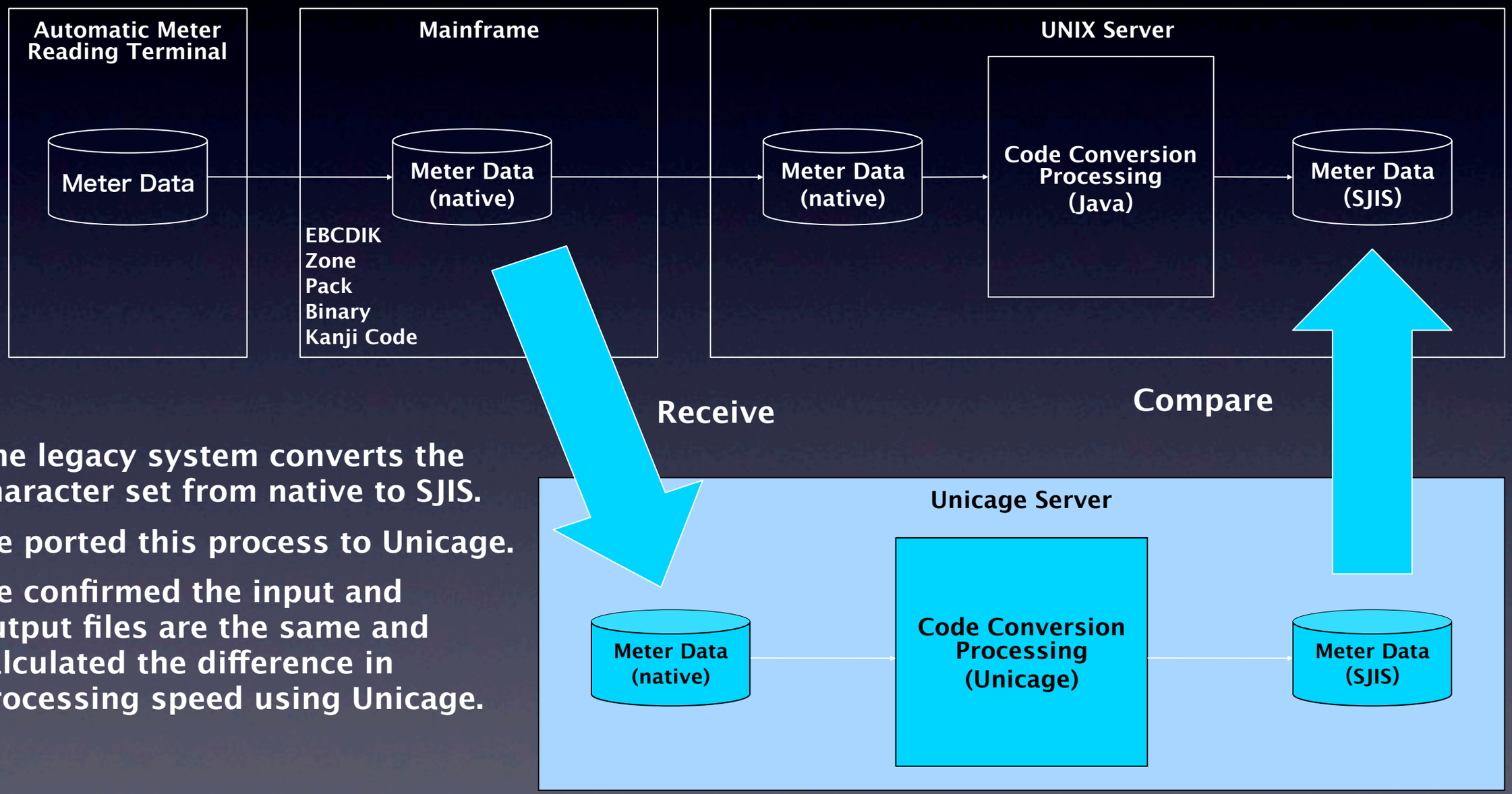
(3) Complex ETL (Electric Power Utility)

Character set conversion of host data (from native to SJIS)



The legacy system converts the character set from native to SJIS.

We ported this process to Unicage.

We confirmed the input and output files are the same and calculated the difference in processing speed using Unicage.

From the "Big Data...Small pricetag", 2013 USP Lab.

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Processing Speed

We tested on 2GB, 5GB and 10GB data sets.

We used the following server environment:

- Java: HP-UX, Itanium 1.60GHz 2core, 4GB
- Unicage: FreeBSD, Core i7 4core, 16GB, SATA (2TB)

Data Amount	2GB 7,240,555 records	5GB 18,095,303 records	10GB 36,178,437 records
Java	3hrs 7mins 53secs	7hrs 30mins	15 hrs
Unicage	43.411secs	1 min 49.085secs	4mins 16.906secs
Difference	11273/43.411= 259x faster	27000/109.085= 247x faster	54000/256.906= 210x faster

From the "Big Data...Small pricetag", 2013 USP Lab.

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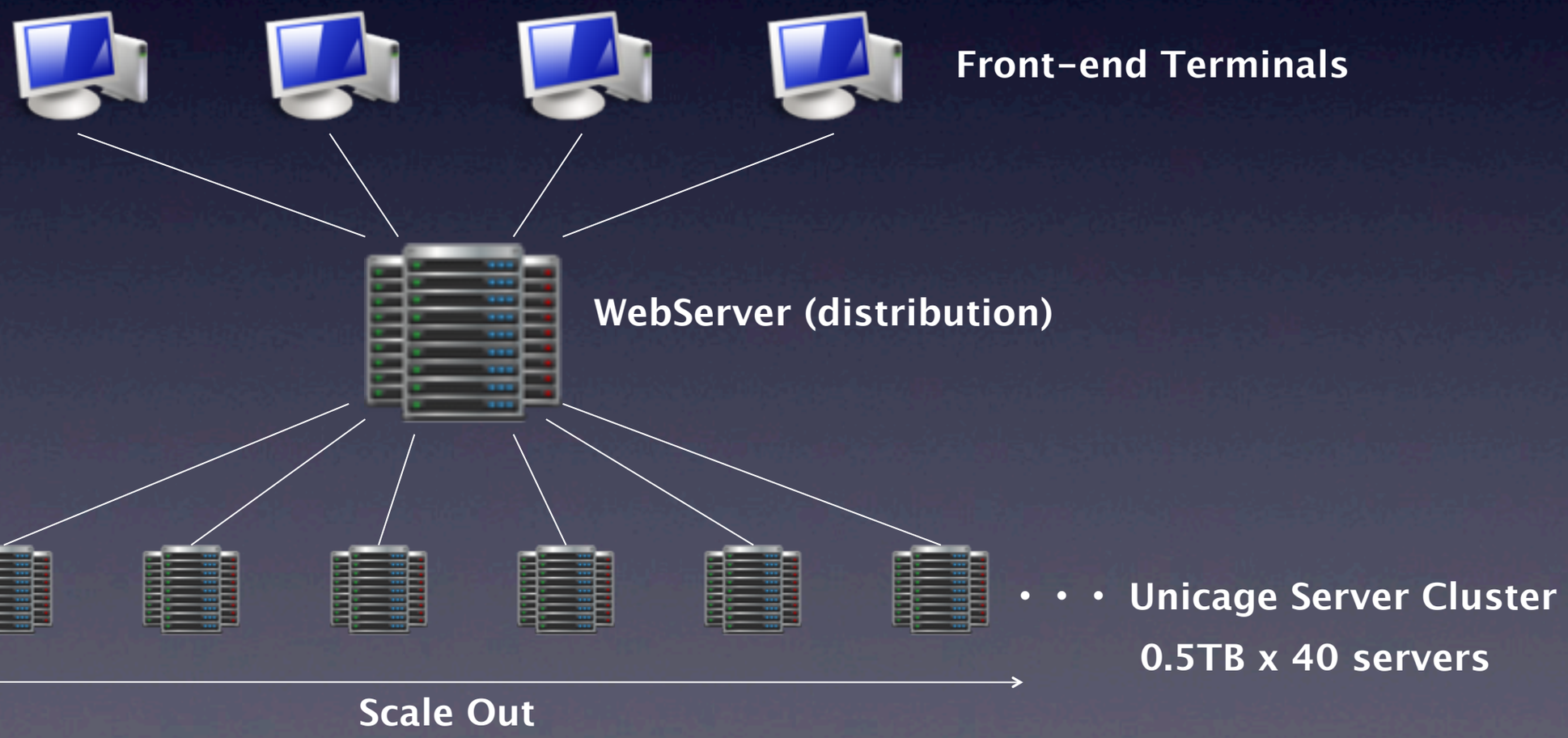
(4) Search of Large Data Set (Korean Search Engine)

Analysis of search logs from a major search engine site
Analysis based on text search and user IP address search

【Configuration】 **Expected data: 10.8GB/day x 365 days x 5 years = 19.2TB (27,610,000 records) (50 Billion**



From the "Big Data...Small pricetag", 2013 USP Lab.

uspBOA
SQL and Shell Programming

B3: Count number of records for each C_QUERY_NOSP, C_USER
B4: Count number of records for each C_USER, output counts over 30
B5: Output C_QUERY_NOSP list using conditions C_DATE and C_USER
B6: Count number of records for each C_REQ_FRM, output row counts in descending order
B7: Count number of records for each C_CONNECTION
B8: Count number of records for each C_QUERY_NOSP using conditions C_DATE and C_CONNECTION
B9: Count number of records for each C_QUERY_NOSP with C_CONNECTION‘X’ over 500
B10: Count number of records for each C_QUERY_NOSP with unique C-SESSION1 over 3
B11: Count number of records for each C_QUERY_NOSP that don’t occur on a specific date
B12: Count number of records with C_IP of 3 or higher and count number of records with unique C_QUERY_NOSP

From the “Big Data...Small pricetag”, 2013 USP Lab.

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SQL and Shell Programming

Shows equivalent shell script for each SQL code

```
B3 【SQL】:
select C_QUERY_NOSP, C_USER, count(*)
 from SEARCHLOG
 where C_DATE='2006-09-18'
```

```
B3 【USP】:
cat ${lv3d}/L3.DAY      |
awk '$4=="20060918"     |
self 23 16              |
dsort key=1/2           |
```

```
B9 【SQL】:
select A.q1, A.cnt1 as a1, B.cnt2 as
   a2 from
(select C_QUERY_NOSP as q1, count(*)
   as cnt1
  from searchlog
  where C_DATE='2006-09-18' and
   C_CONNECTION='X'
  group by C_QUERY_NOSP having
```

```
B9 【USP】:
cat ${lv3d}/L3.DAY                    |
awk '$4=="20060918"&&$14!="X"'        |
self 23                               |
dsort key=1                           |
count 1 1                             > $tmp-b
cat ${lv3d}/L3.DAY                    |
awk '$4=="2006-09-18"&&$14=="X"'      |
self 23                               |
dsort key=1                           |
count 1 1                             |
```

From the "Big Data...Small pricetag", 2013 USP Lab.

BSDc for Enterprise

BSDc for Enterprise
BSD Consulting, Inc.

- Established 1st June, 2012
- wholly owned subsidiary of USP Lab.
- short name, BSDc
- President: Nobuaki TOUNAKA / 當仲寛哲
  Director: Daichi GOTO / 後藤大地

BSDc for Enterprise
2 years ago

- President Tounaka have involved me as a FreeBSD consultant 2 years ago.
- USP found that FreeBSD is better choice for them as base platform.
  Until this time, they used CentOS and bash. I push them FreeBSD and ash.
- I developed the customized shell (ush) and specialized filesystem for their business (BubunFS).

BSDc for Enterprise
customers needed us

- a certain USP's customer hesitated to take FreeBSD as their base platform.
- They said, because of the lack of the company for support of FreeBSD, they could not choose FreeBSD.
- Exactly, we lacked FreeBSD support company.
- So, we established "BSD Consulting, Inc." for our business.

- FreeBSD Supporting and Consulting services
- Providing FreeBSD Information in Japanese
- FreeBSD H/W verification service
- FreeBSD Seminar services

BSDc for Enterprise
FreeBSD information in Japanese

- Most japanese can not understand English.
- My English is lesser, but others are terrible.
- Folks attended AsiaBSDCon 2013 already know that, uh?
- Release note, Errata, Security Advisory in Japanese are valuable contents.

BSDc for Enterprise
H/W verification

- Japanese domestic server H/W vendors lack of FreeBSD support, because of the lack of FreeBSD support company
- If H/W vendors say “our products work with FreeBSD 9.1-RELEASE”, that’s good for all FreeBSD users and customers

BSDc for Enterprise
NEC Express5800 Verification

- They changed their on-bard NIC chipset from Intel to Broadcom because of the cost a year ago
- They choose the new MegaRAID card that does not work with mfi
- They needed some patches

BSDc for Enterprise
NEC Express5800 Verification

- FreeBSD didn't work on NEC's new Express5800. Their customer got angry.
- BSDc and NEC have a contract about FreeBSD support and H/W verification.
- some Express5800 series will work with FreeBSD.
- patches, documents and information will be open on BSDc website.

BSDc for Enterprise
NPO for enterprise

- We started to establish two organizations at June 2012. One is BSDc, other is NPO for *BSD "BSD Research (BSDr)"
  - chairman : Sato-san (aka hrs)
  - will be established at Summer, 2013
  - core business : AsiaBSDCon, BSD Certification, *BSD documents translation

BSDc for Enterprise
BSDc and BSDr

- We thought that we need a fair and impartial certified organization to promote FreeBSD to enterprises company
  - BSD Certification / BSD Certification Group is qualify
  - NPO cooperates with BSD CG, and provides BSD Certification in Japanese

BSDc for Enterprise
translation ongoing

- Japanese Documents are critical for all Japanese FreeBSD users
- NPO for *BSD are trying to translate important FreeBSD relative documents into Japanese

A problem to be solved ASAP

A problem to be solved ASAP
InfiniBand driver and OFED

- HPC needs InfiniBand driver. 10GbE works fine. But InifiniBand transports 3.2 times faster than 10GbE.
- In fact, we are constructing new uspBOA with Linux, because of InfiniBand.

A problem to be solved ASAP
InfiniBand driver and OFED

- We have tried to improve OFED on FreeBSD last 2~3 months
- In the end, it failed. At last we realized that we were implementing all Linux NAPI in the FreeBSD kernel. It looks like a wrong approach.
- We are considering next approach. If you have any ideas, please contact me.

A problem to be solved ASAP
InfiniBand driver and OFED

- We need InfiniBand drivers. The lack of InfiniBand drivers give RadHat/CentOS some advantage as common HPC platform.
- Should we contact to Mellanox Technologies?
- Should we suggest to FreeBSD Foundation to develop latest OFED subsystem?
- Current big concern. Big business showstopper

Question?