Creating Knowledge from IT Events

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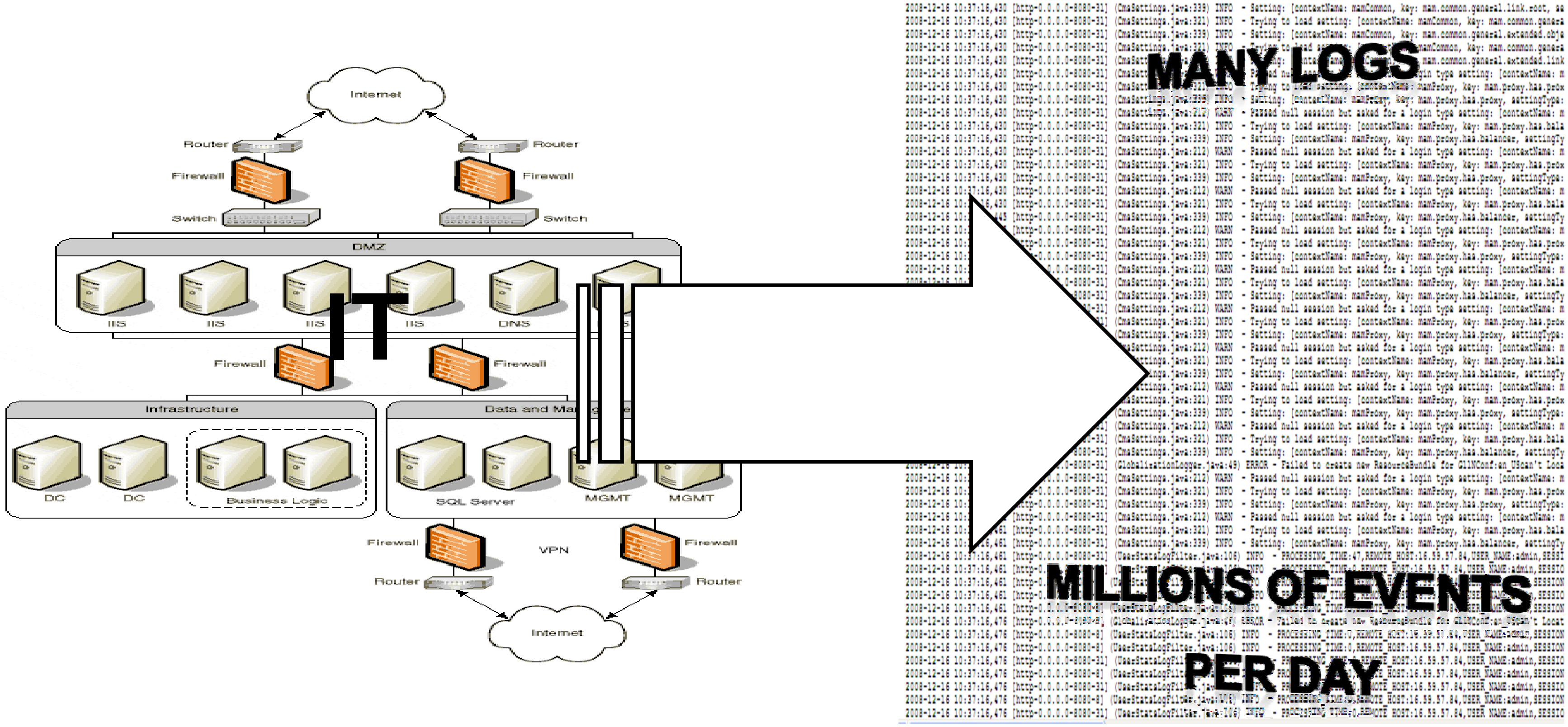
HP-Labs

With: Michal Aharon, Gilad Barash, Eli Mordechai, Arik Itskovic, Rafael Dekar

Event Logs in the IT environment



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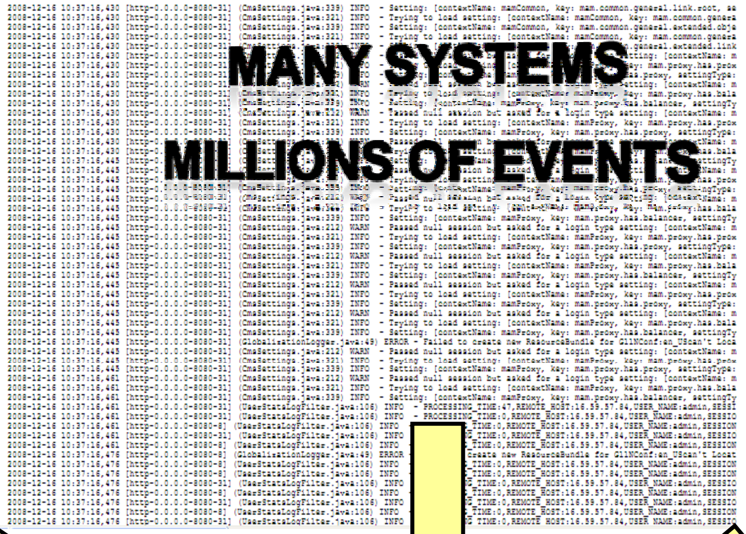
```

- Each System component generates events and error logs

- These are used to detect and troubleshoot problems in systems

Event Logs : The Problem



MANY SYSTEMS

MILLIONS OF EVENTS

```
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```

Huge volume of data is not amenable for human consumption

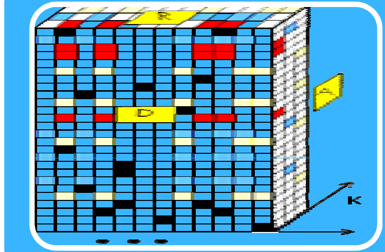
Documents related to events not linked to them

Semi-Structured text data not meant for automated consumption

Technology Roadmap

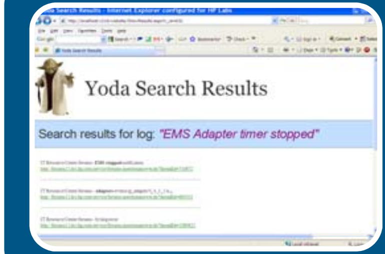
Create Dictionary of Event Types

- Transforms raw text logs to machine readable form
- Novel text clustering algorithm



Create Dictionary of Processes

- Group event types that characterize system behavior
- PARIS Algorithm: Principal Atom Recognition In Sets



Yoda Search Results

Search results for log: *"EMS Adapter timer stopped"*

Create Knowledge from Documents

- Search, rank and summarize external and internal sources
- Information association and quality

Event logs in raw form

```
12/1/2008 12:34:03 failed to retrieve the meta data of project ‘null0’ the session auth has failed.
12/1/2008 12:35:03 failed to get licenses for project session the session auth has failed.
12/1/2008 12:40:31 error processing request from 192.111.22.33 data starts with 0 \00000023\0 conststr
12/1/2008 12:44:03 unexpected failure while trying to ping user session #44444 the session auth has failed
12/1/2008 12:50:03 failed to retrieve the meta data of project ‘null1’ the session authentication has failed.
12/1/2008 12:50:05 unexpected failure while trying to ping user session #33333 the session auth has failed
12/1/2008 12:50:23 failed to get licenses for project session the session auth has failed.
12/1/2008 12:55:09 failed to get licenses for project session the session auth has failed.
12/1/2008 12:56:22 error processing request from 192.222.22.55 data starts with 0 \00000014\0 conststr
12/1/2008 12:56:56 Failed to retrieve the meta data of project ‘null3’ the session auth has failed.
12/1/2008 12:57:03 error processing request from 193.111.26.33 data starts with 0 \00000512\0 conststr
12/1/2008 12:57:25 error processing request from 192.111.22.43 data starts with 0 \00000014\0 conststr
```

Let’s Rearrange the Messages…

failed to retrieve the meta data of project **‘null0’** the session auth has failed.
failed to retrieve the meta data of project **‘null1’** the session auth has failed.
Failed to retrieve the meta data of project **‘null3’** the session auth has failed.

ID 1

Variable Word

failed to get licenses for project session the session auth has failed.
failed to get licenses for project session the session auth has failed.
failed to get licenses for project session the session auth has failed.

ID 2

error processing request from **192.111.22.33** data starts with 0 **\00000023\0** conststr
error processing request from **192.222.22.55** data starts with 0 **\00000512\0** conststr
error processing request from **192.111.22.43** data starts with 0 **\00000014\0** conststr

ID 3

Variable Word

Variable Word

unexpected failure while trying to ping user session **#44444** the session auth has failed
unexpected failure while trying to ping user session **#33333** the session auth has failed

ID 4

Variable Word

Template Discovery:

Assign IDs to Event Types

4 templates

Requirements for Template Discovery

1. Online
   - Produce immediate value
2. Consistent
   - Template assignment of a message should remain consistent over time
3. Efficient
   - Keep up with incoming message rates

Template Discovery Algorithm:

Incremental Text Clustering

- Step 1: “Rough” clustering:
  - Creating/Assigning events to root clusters

- Step 2: Cluster refinement:
  - Splitting root clusters

Output: Forest of clusters

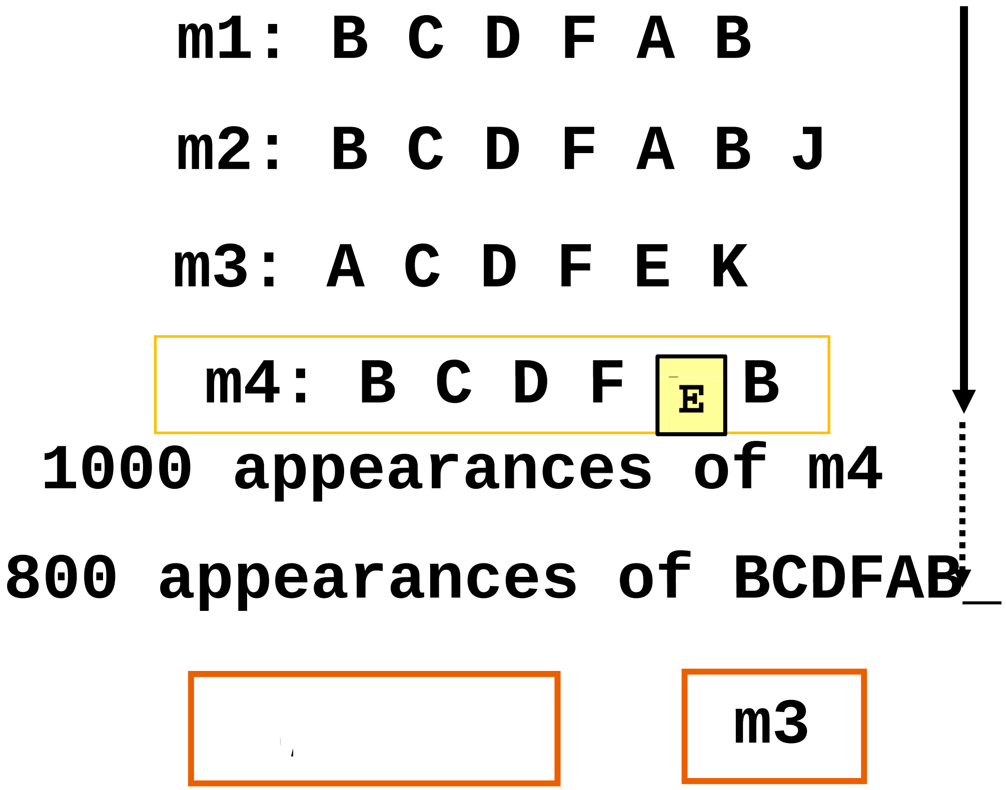
Template discovery algorithm

$$D_{\cos}(A,B) = \frac{Match(a_i, b_j)}{\sqrt{|A| \cdot |B|}}$$

Min Similarity Threshold: 0.6

=0.83

Clustering example:



```
m1: B C D F A B

m2: B C D F A B J

m3: A C D F E K

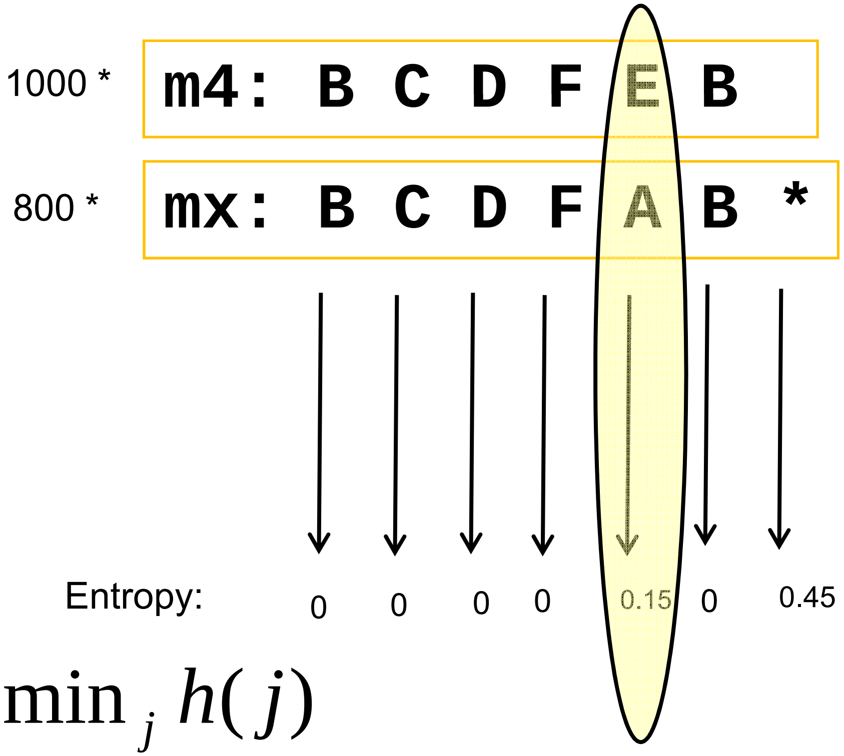
m4: B C D F E B

1000 appearances of m4

800 appearances of BCDFAB_
```

m3

Entropy Calculation for Split



1000 * m4: B C D F E B

800 * mx: B C D F A B *

Entropy: 0 0 0 0 0.15 0 0.45

$$h(j) = -\sum_{k=1}^{n} P_{kj} \bullet \log(P_{kj})$$

$$\arg\min_j h(j)$$

$$\text{where } \varepsilon < h(j) < \mathit{threshold}$$

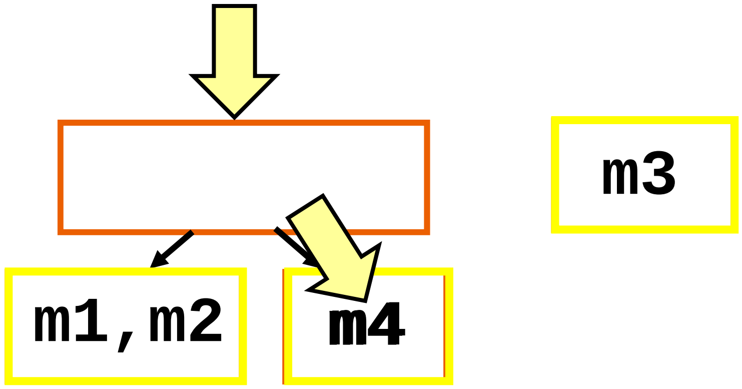
Template discovery algorithm

$$D_{\cos}(A,B)=\frac{Match(a_i,b_j)}{\sqrt{|A|\cdot|B|}}$$

=0.66

Clustering example:

```
m1:  B C D F A B
m2:  B C D F A B J
m3:  A C D F E K
m4:  B C D F E B
mxx: B C D F E D
```



Results

- Datasets

Source	Number of events	Number of distinct events
Business App 1	**4,210,513**	**153,619**
Printer Press	**11,204**	**5,631**
Windows Events	**66,102**	**25,340**
Business App 2	**483,768**	**70,102**

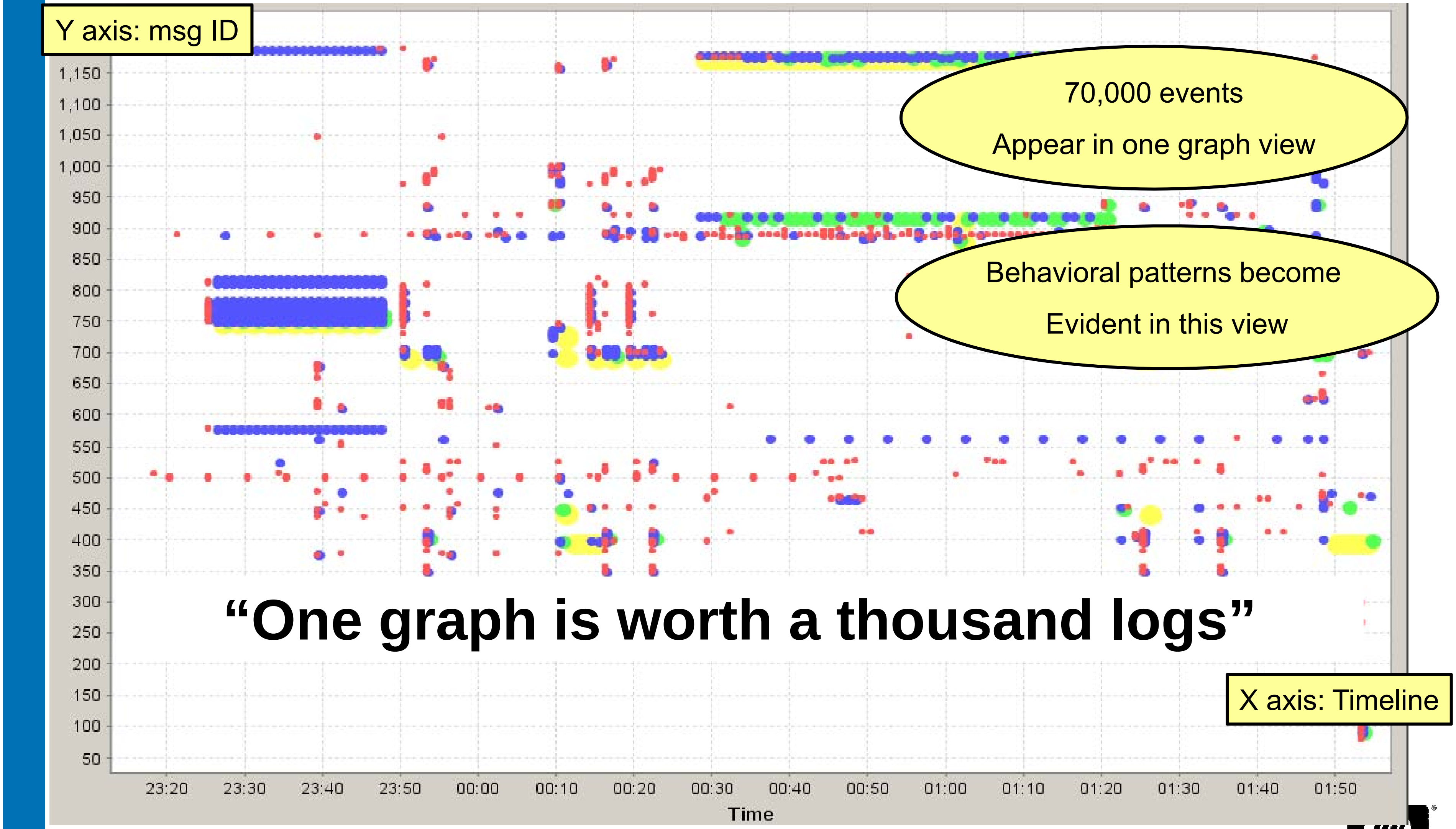
Results

- Template identification

Source	Number of events	Number of distinct events	Number of clusters (templates)
Business App 1	**4,210,513**	**153,619**	**4,193**
Printer Press	**11,204**	**5,631**	**204**
Windows Events	**66,102**	**25,340**	**476**
Business App 2	**483,768**	**70,102**	**1,115**

Representation Accuracy: 95%

Visualizing the logs: Business App 2 Event Timeline



Y axis: msg ID

70,000 events

Appear in one graph view

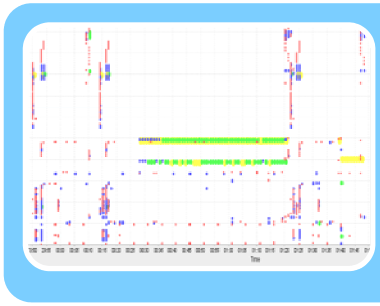
Behavioral patterns become

Evident in this view

“One graph is worth a thousand logs”

X axis: Timeline

Technology & Innovation Roadmap



Create Dictionary of Event Types

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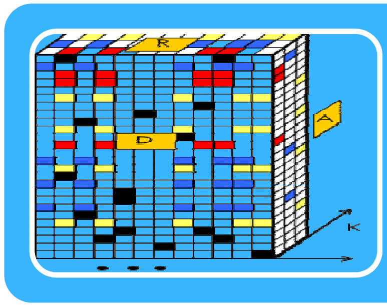
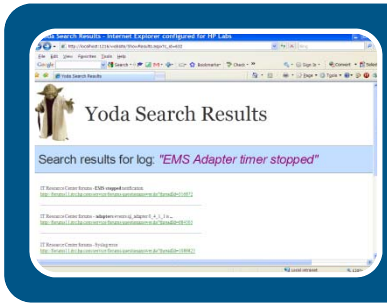
- Novel text clustering algorithm



Create Dictionary of Processes

- Group event types that characterize system behavior
- PARIS Algorithm: Principal Atom Recognition In Sets


Yoda Search Results - Internet Explorer configured for HP Labs
File Edit View Favorites Tools Help
Yoda Search Results

Yoda Search Results

Search results for log: *"EMS Adapter timer stopped"*

IT Resource Center forums - **EMS stopped** notification

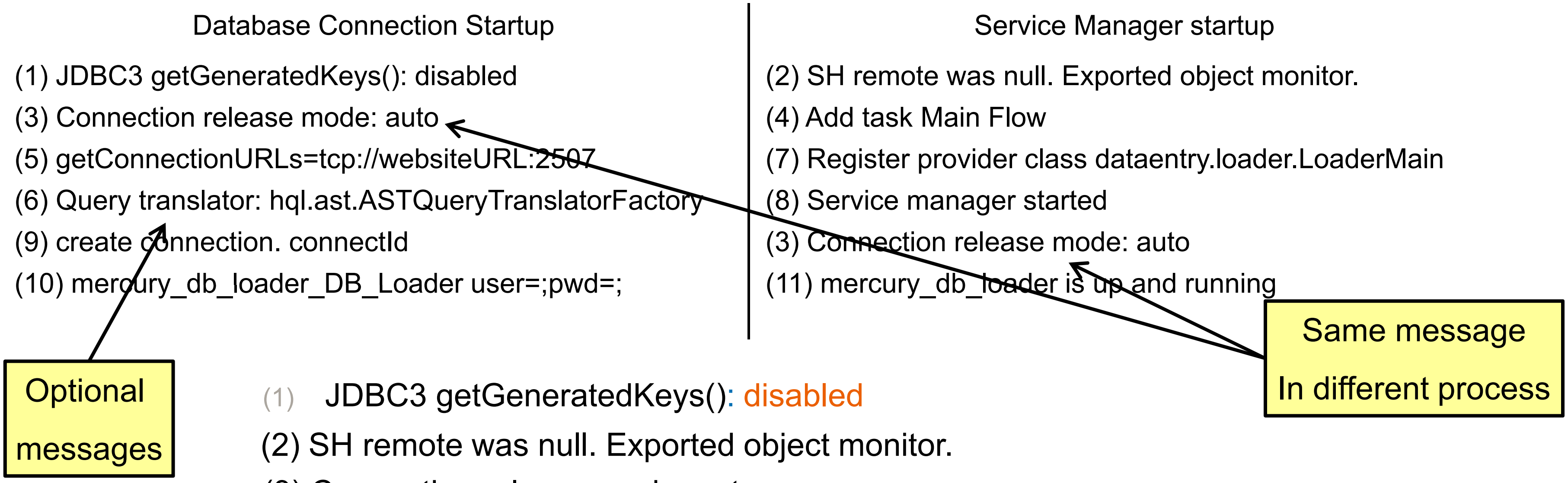
IT Resource Center forums - **adapters** events ...

IT Resource Center forums - Syslog error

Create Knowledge from Documents

- Search, rank and summarize external and internal sources
- Information association and quality

The Problem
Discovering Process Patterns



Database Connection Startup

(1) JDBC3 getGeneratedKeys(): disabled

(3) Connection release mode: auto

(5) getConnectionURLs=tcp://websiteURL:2507

(6) Query translator: hql.ast.ASTQueryTranslatorFactory

(9) create connection. connectId

(10) mercury_db_loader_DB_Loader user=;pwd=;

Service Manager startup

(2) SH remote was null. Exported object monitor.

(4) Add task Main Flow

(7) Register provider class dataentry.loader.LoaderMain

(8) Service manager started

(3) Connection release mode: auto

(11) mercury_db_loader is up and running

Optional messages

Same message In different process

(1) JDBC3 getGeneratedKeys(): disabled

(2) SH remote was null. Exported object monitor.

(3) Connection release mode: auto

(4) Add task Main Flow

(5) getConnectionURLs=tcp://websiteURL:2507

(6) *Query translator: hql.ast.ASTQueryTranslatorFactory*

(7) Register provider class dataentry.loader.LoaderMain

(8) Service manager started

(9) create connection. connectId

(10) mercury_db_loader_DB_Loader user=;pwd=;

(3) Connection release mode: auto

(11) mercury_db_loader is up and running

Challenges:

1. Pattern Interleaving
2. Noisy events
3. Non-determinism
4. 1-to-many mapping between event and process.

Principal tom Recognition

In S

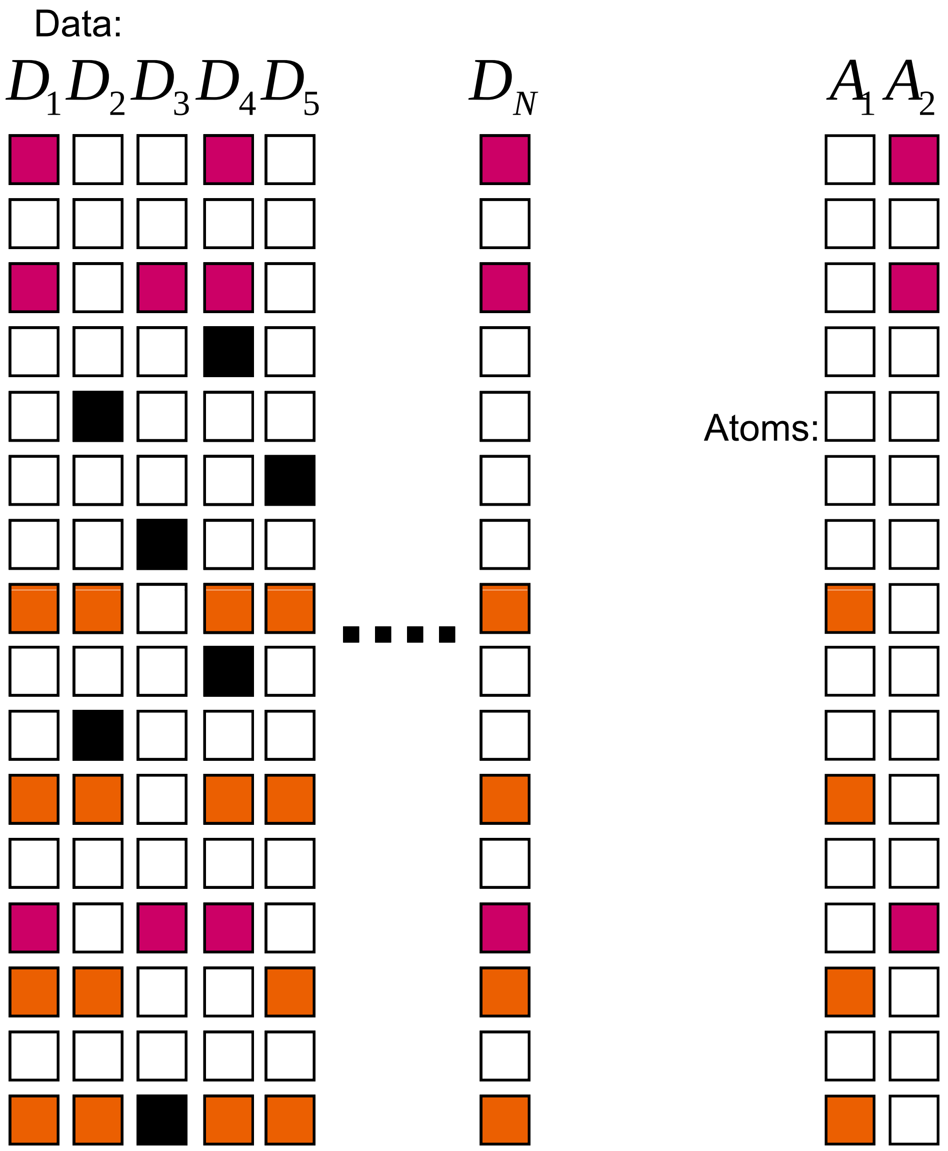
PARIS

Data:

D_1	D_2	D_3	D_4	D_5		D_N
■	□	□	■	□		■
□	□	□	□	□		□
■	□	■	■	□		■
□	□	□	■	□		□
□	■	□	□	□		□
□	□	□	□	■		□
□	□	■	□	□		□
■	■	□	■	■	....	■
□	□	□	■	□		□
□	■	□	□	□		□
■	■	□	■	■		■
□	□	□	□	□		□
■	□	■	■	□		■
■	■	□	□	■		■
□	□	□	□	□		□
■	■	■	■	■		■

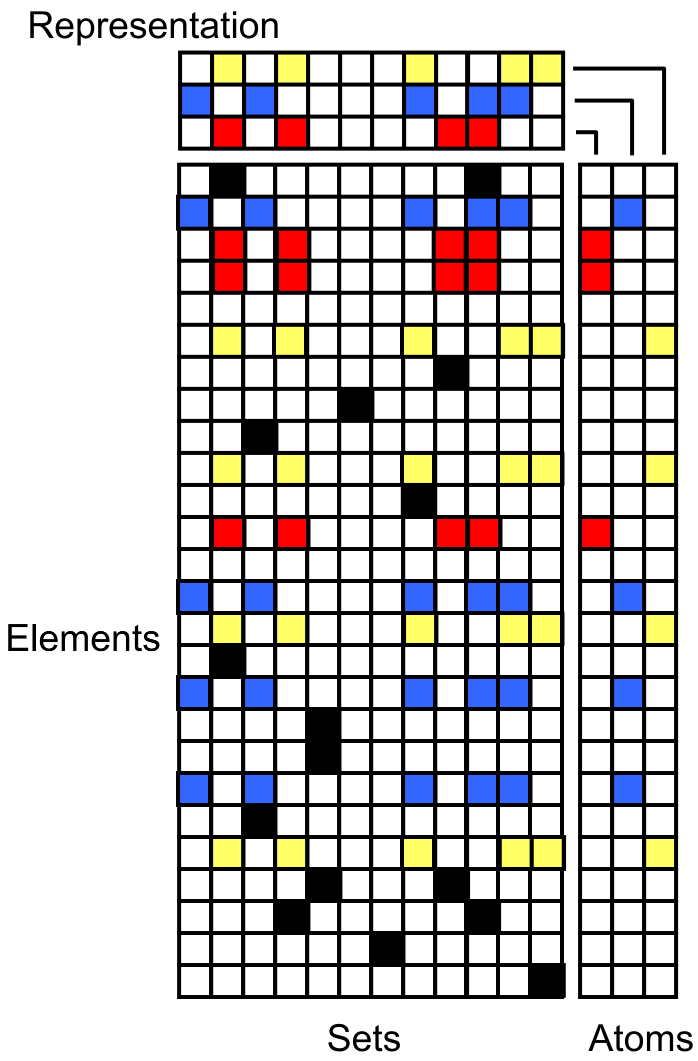
- Gets as input a large number of sets, that are assumed to have some mutual characterization.

PARIS



- Gets as input a large number of sets, that are assumed to have some mutual characterization.
- Detect principal sets of elements that tend to appear together in the data.
- Overcome non-exact repetitions
- Ignore additional noise

PARIS: Requirements



- Representation error must be small, but not necessarily zero.
- Representation should serve some sense of compression of the data (sparsity).
- Minimal number of atoms (K).

PARIS Cost Function

Minimize the representation error of the data.

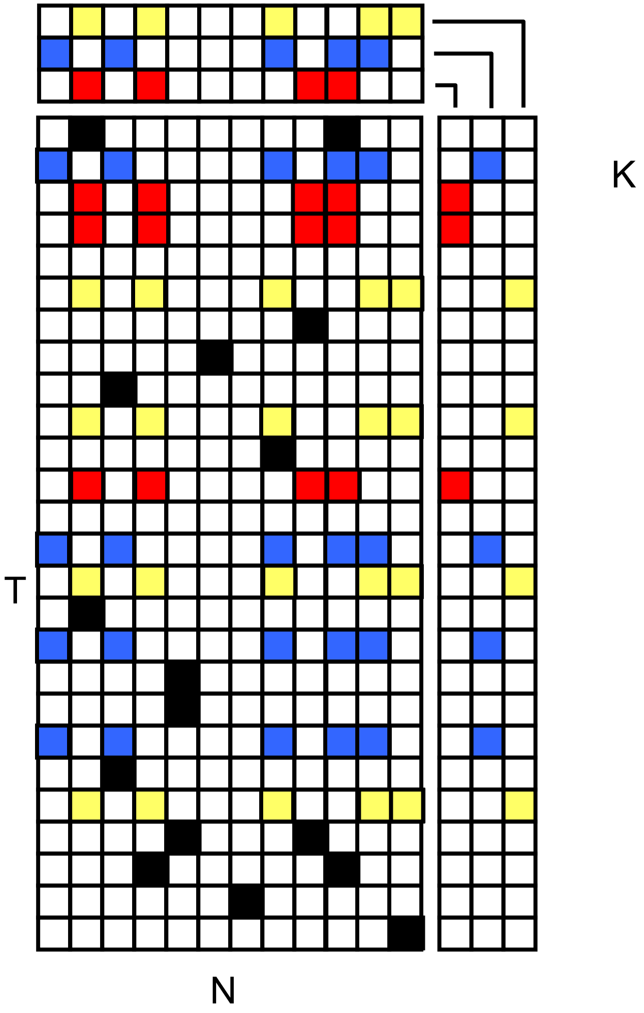
$$PCF = \underset{A,R}{\arg\min}\left(\sum_{i=1}^{N} d_r\left(D_i, R(A,R_i)\right)\right) + \left(\sum_{i=1}^{N} \mu_i \left|R_i\right|\right) + \left(\tau\left|A\right|\right)$$

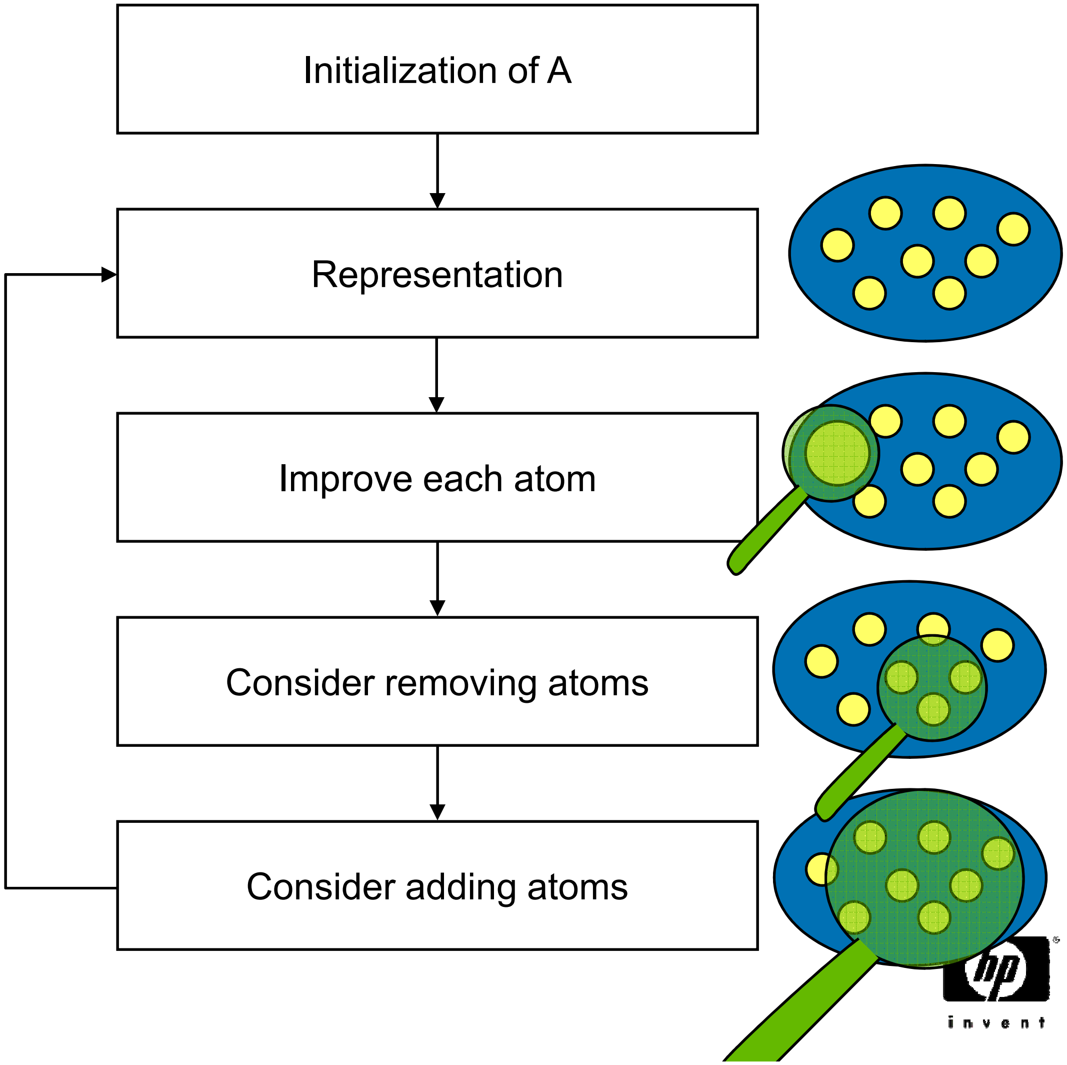
Minimize the size of the representation (compression).

Minimize the number of principal atoms.

- Representation error must be small, but not necessarily zero.
- Representation should serve some sense of compression of the data (sparsity).
- Minimal number of atoms (K).

PARIS algorithm





Initialization of A

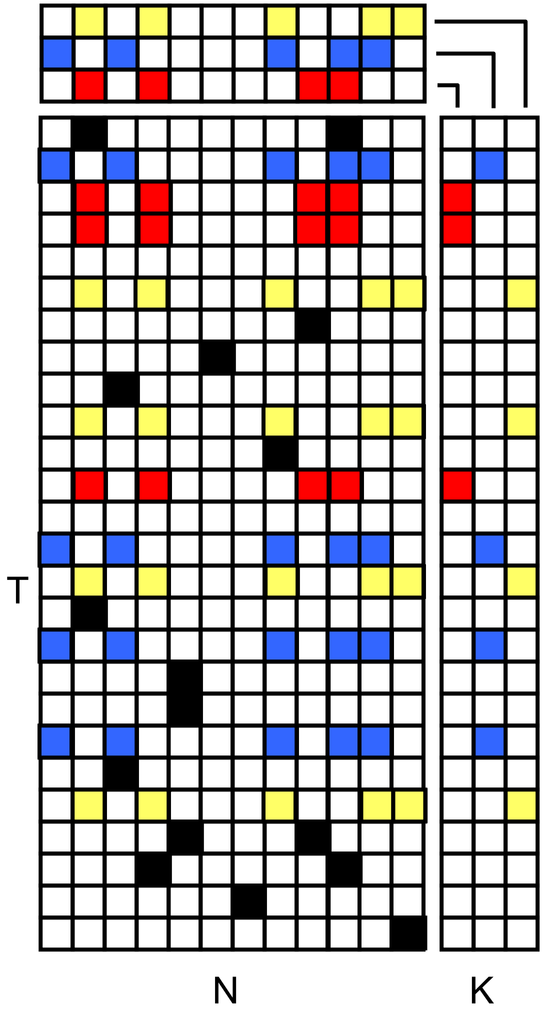
Representation

Improve each atom

Consider removing atoms

Consider adding atoms

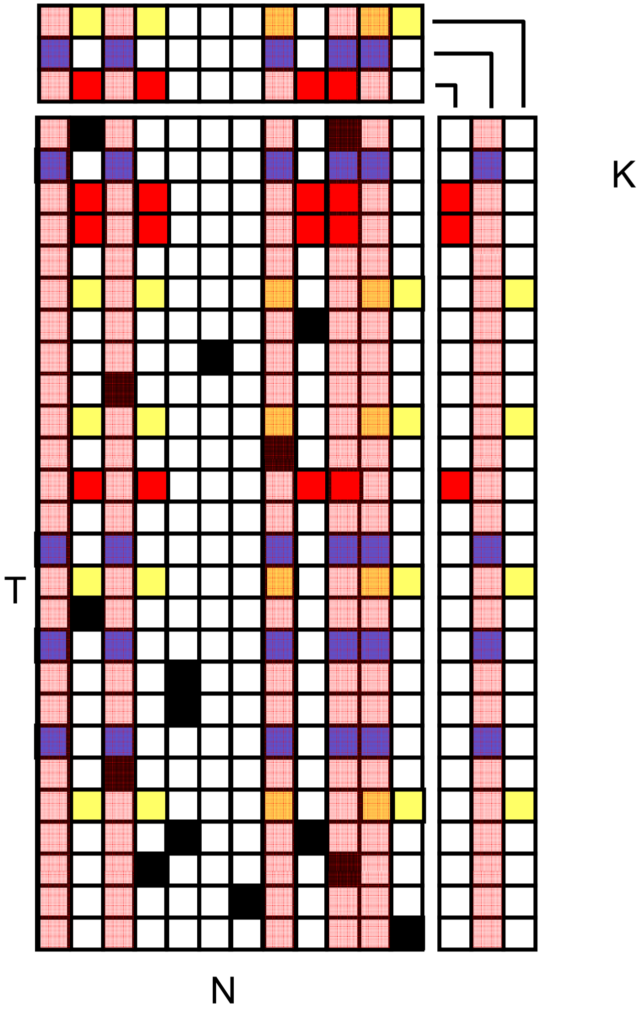
Representation



- Fixing A, we find a representation for each data set $\boldsymbol{D_i}$.

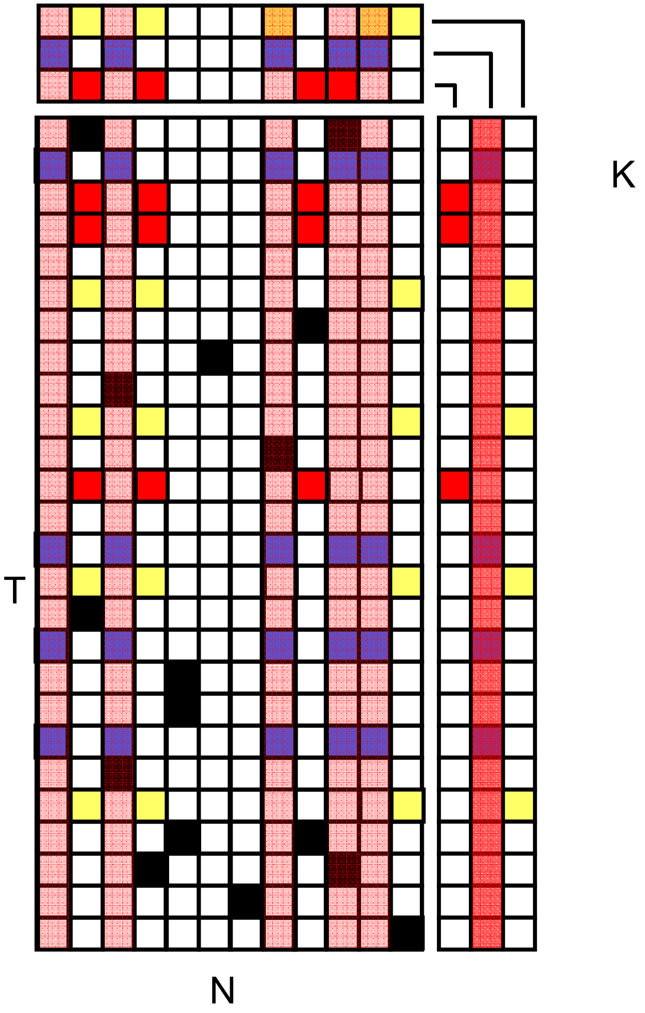
- Problem provably NP-Hard
- Solution: Greedy algorithm

Single Atom Improvement



- For each $1 \leq j \leq K$, we fix all other atoms and update $\boldsymbol{A_j}$ and its relevant part in the representation.

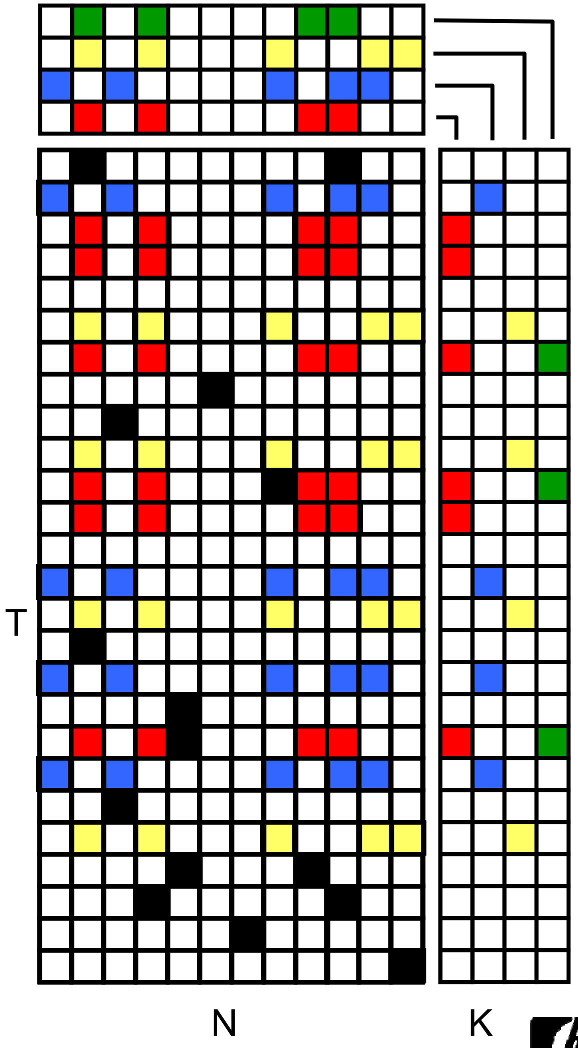
Single Atom Improvement



- For each $1 \leq j \leq K$, fix all other atoms and update ***A**$_j$* and its relevant part in the representation.

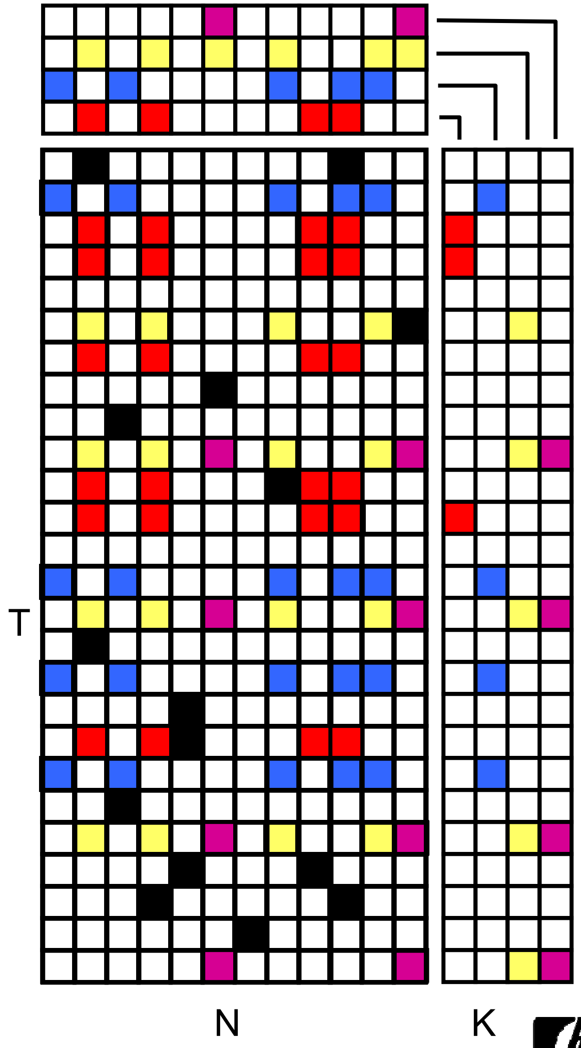
Removing Atoms

- We consider small sets of atoms and consider union of atoms or removing atoms in the following cases:
  - A set of atoms that tend to appear together in most representations can be united .
  -



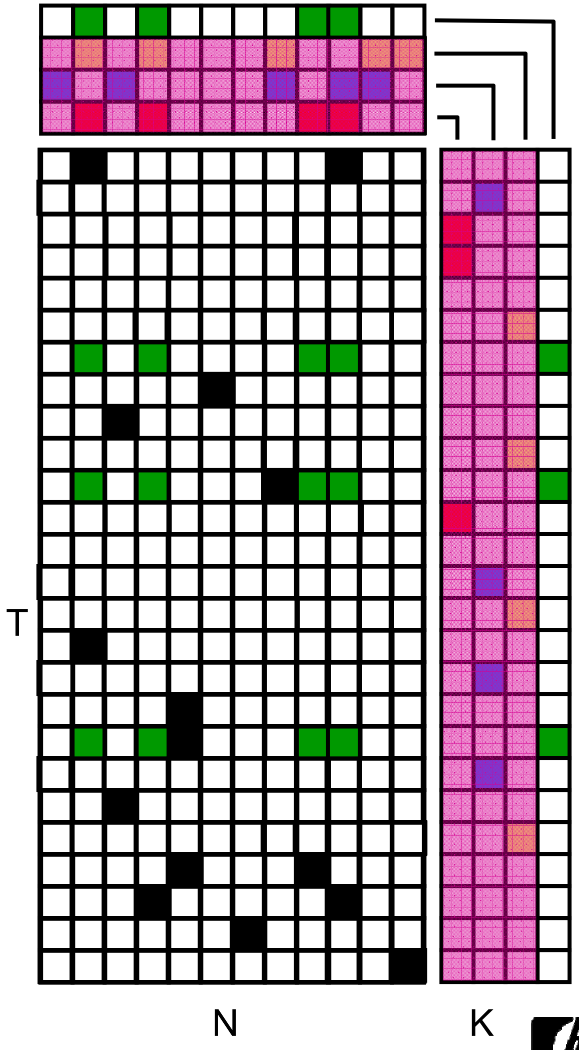
Omitting Atoms

- We consider small sets of atoms and consider union of atoms or dismiss atoms in the following cases:
  - A set of atoms that tend to appear together in most representations can be united .
  - A set of atoms that share many common elements and represent distinct sets of data sets can be united.



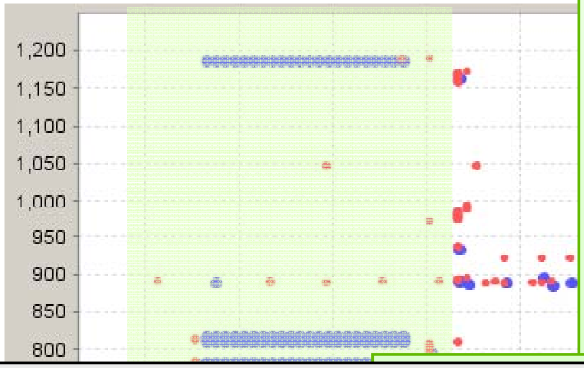
Adding atoms

- We detect regularities in the overall representation error.
- New atoms are designed to represent these regularities.



PARIS Result: Correct Process Identification

Buss App 2 Logs



Application Failure State

Atom ID: 12

- **890** Failed creating SiS sample
- **924** Failed processing http reques report_ss_samples, from remote **Failed to acquire lock for publ**
- **1183** Failed processing http reque report_transaction, from remoteh **Failed to acquire lock for publ**

Atom ID: 27

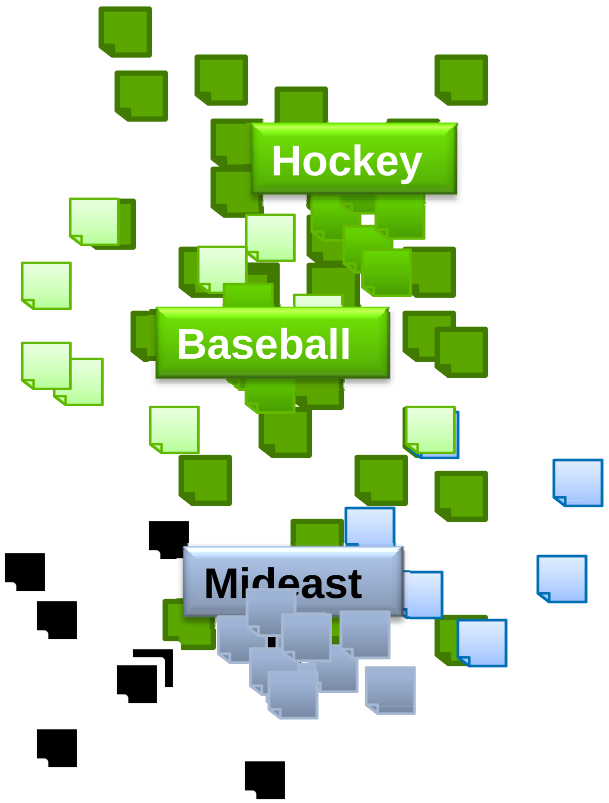
- **734** User operation - stop nanny
- **748** message_broker STOPPED
- **753** Input main(String[] args:
- **754** Going to call WrapperManager.start(new Main(), args)
- **755** Initializing Spring files
- **757** Path for spring files is E:\HPBAC\conf\supervisor\spring
- **759** Loading spring file
- **764** NannyConfig
- **768** Autodetecting user-defined JMX MBeans
- **769** Bean with name 'nannyManager' has been autodetected for JMX exposure
- **770** HTTP adapter port is 11021
- **771** Succeeded adding html adapter
- **772** manager thread loop started.
- **773** Verifying time diff between cpp (local machine) and Java.
- **774** Log file of time diff is: E:\HPBAC\tools\TimeDiff\time_diff.log
- **776** Run java time diff
- **780** Trying to initialize Properties Manager**792** Config server check passed
- **793** Prerequisites have been met
- **794** start() Nanny Manager
- **795** Nanny Manager need to start all services?:true
- **796** Going to start all services.
- …

Service Restart

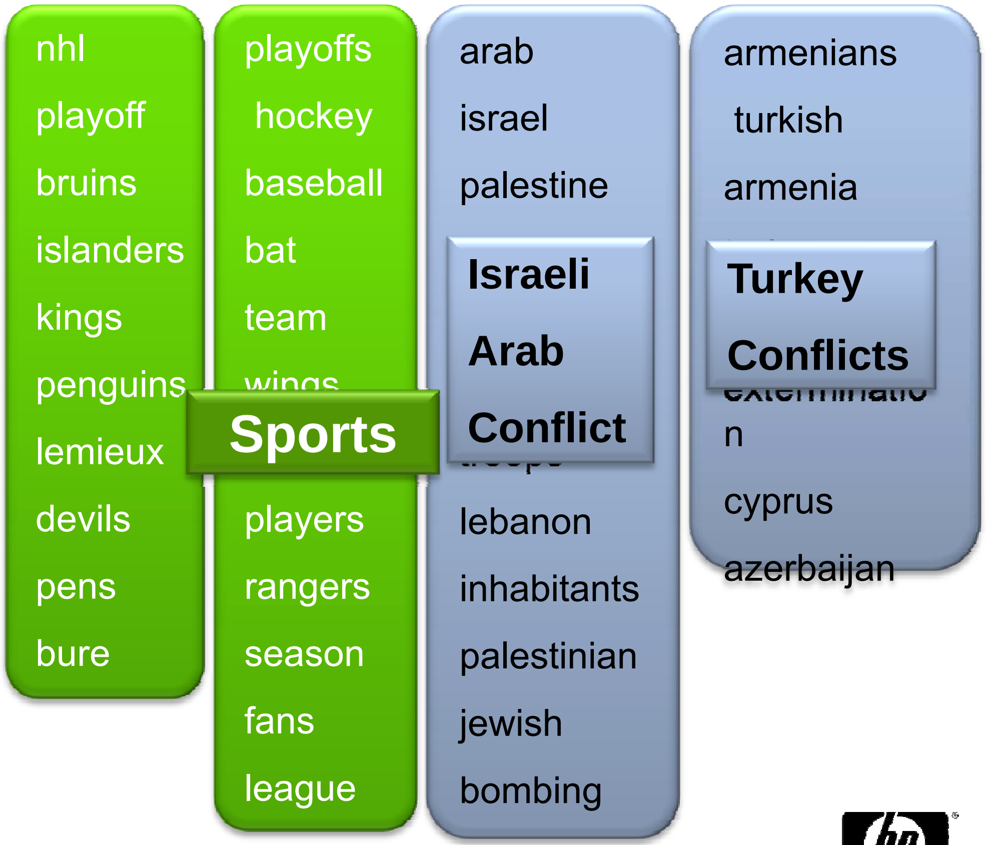
PARIS Result: Document Representation

Newsgroup data set:

Document corpus labeled to 20 topics



Atoms



nhl
playoff
bruins
islanders
kings
penguins
lemieux
devils
pens
bure

playoffs
hockey
baseball
bat
team
wings
players
rangers
season
fans
league

Sports

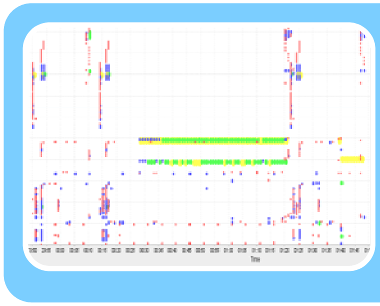
arab
israel
palestine
troops
lebanon
inhabitants
palestinian
jewish
bombing

Israeli Arab Conflict

armenians
turkish
armenia
extermination
cyprus
azerbaijan

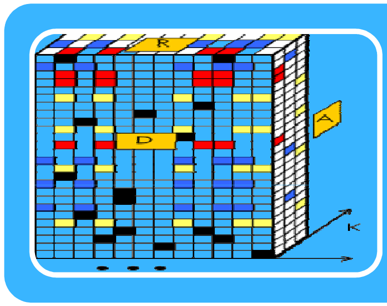
Turkey Conflicts

Technology & Innovation Roadmap



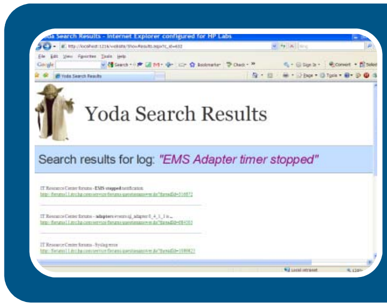
Create Dictionary of Event Types

- Transforms raw text logs to machine readable form
- Novel text clustering algorithm



Create Dictionary of Processes

- Group event types that characterize system behavior
- PARIS Algorithm: Principal Atom Recognition In Sets


Yoda Search Results - Internet Explorer configured for HP Labs
File Edit View Favorites Tools Help
Google
Search
Bookmarks
Check
Sign In
Convert
Select
Yoda Search Results
Page
Tools
Local intranet

Yoda Search Results

Search results for log: *"EMS Adapter timer stopped"*

IT Resource Center forums - **EMS stopped** notification

http://forums11.itrc.hp.com/service/forums/questionanswer.do?threadId=[illegible]

IT Resource Center forums - **adapter** events gi_adapter 0_4_1_1 is ...

http://forums11.itrc.hp.com/service/forums/questionanswer.do?threadId=[illegible]

IT Resource Center forums - Syslog error

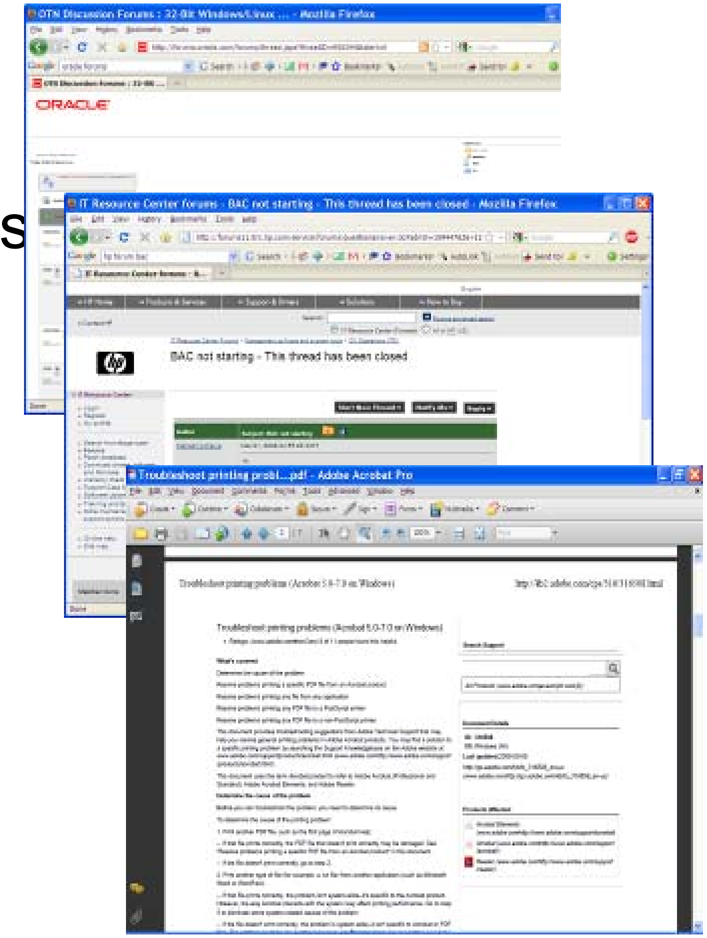
http://forums11.itrc.hp.com/service/forums/questionanswer.do?threadId=[illegible]

Create Knowledge from Documents

- Search, rank and summarize external and internal sources
- Information association and quality

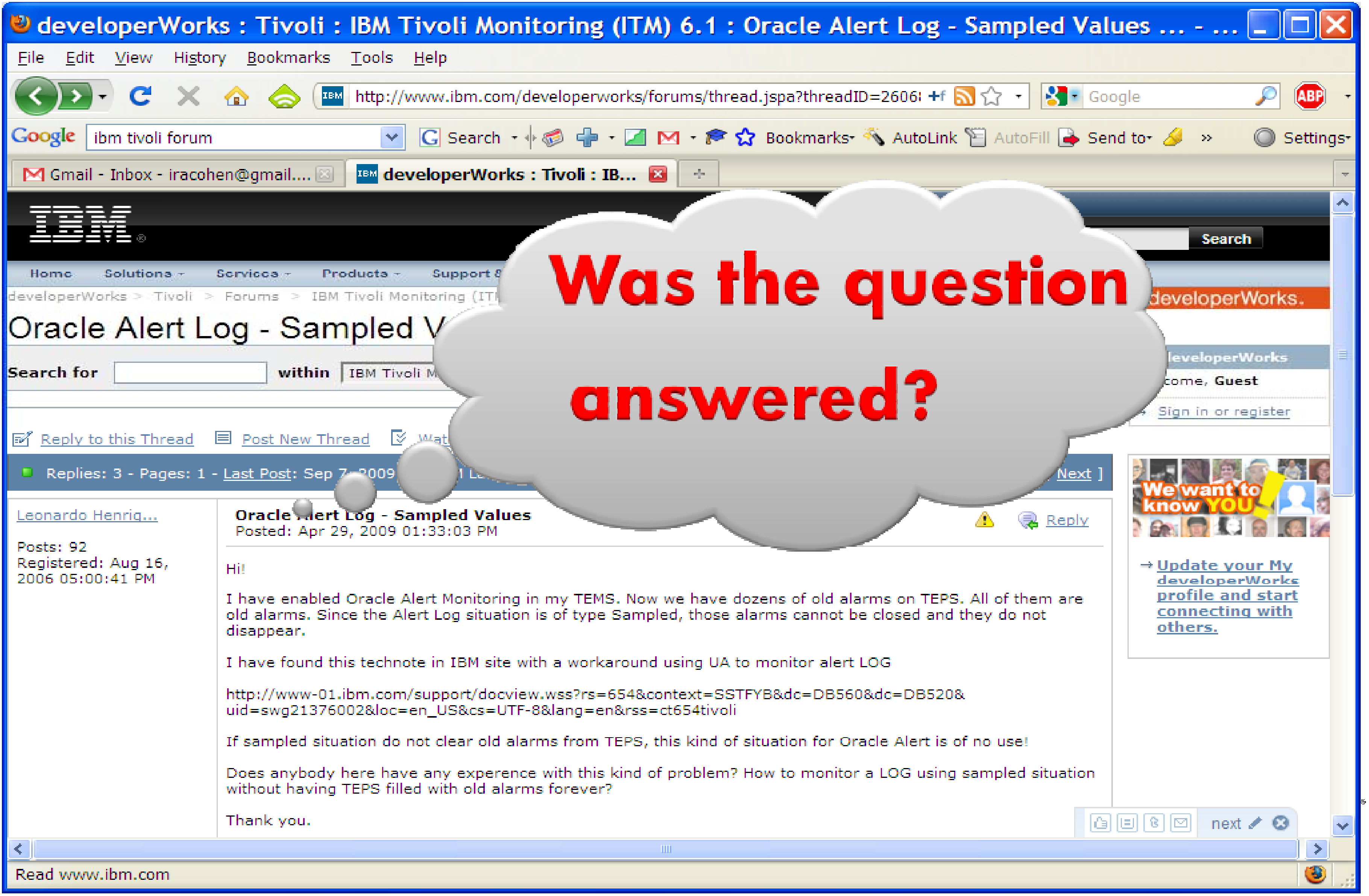
Information Extraction from documents/wikis/forums

- Uses:
  - Link to events and problem periods
  - Create knowledge on problem types
  - Extract resolutions


OTN Discussion Forums : 32-Bit Windows/Linux ... - Mozilla Firefox
ORACLE
IT Resource Center forums - BAC not starting - This thread has been closed - Mozilla Firefox
BAC not starting - This thread has been closed
Troubleshoot printing probl...pdf - Adobe Acrobat Pro
Troubleshoot printing problems (Acrobat 5.0-7.0 on Windows)

- Innovation:
  - Relevancy of knowledge sources
  - Quality of information
  - Concept extraction
  - Document clustering

Quality of Information


developerWorks : Tivoli : IBM Tivoli Monitoring (ITM) 6.1 : Oracle Alert Log - Sampled Values ... - ...
File Edit View History Bookmarks Tools Help
http://www.ibm.com/developerworks/forums/thread.jspa?threadID=2606
Google
ibm tivoli forum
Search
Bookmarks
AutoLink
AutoFill
Send to
Settings
Gmail - Inbox - iracohen@gmail....
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Solutions
Services
Products
Support
developerWorks > Tivoli > Forums > IBM Tivoli Monitoring (ITM
developerWorks.
Search for
within
IBM Tivoli M
developerWorks
Welcome, Guest
Sign in or register
Reply to this Thread
Post New Thread
Replies: 3 - Pages: 1 - Last Post: Sep 7, 2009
Next]
We want to know YOU
Update your My developerWorks profile and start connecting with others.
Reply
next
Read www.ibm.com

Oracle Alert Log - Sampled V

Leonardo Henriq...

Posts: 92
Registered: Aug 16, 2006 05:00:41 PM

Oracle Alert Log - Sampled Values
Posted: Apr 29, 2009 01:33:03 PM

Hi!

I have enabled Oracle Alert Monitoring in my TEMS. Now we have dozens of old alarms on TEPS. All of them are old alarms. Since the Alert Log situation is of type Sampled, those alarms cannot be closed and they do not disappear.

I have found this technote in IBM site with a workaround using UA to monitor alert LOG

http://www-01.ibm.com/support/docview.wss?rs=654&context=SSTFYB&dc=DB560&dc=DB520&uid=swg21376002&loc=en_US&cs=UTF-8&lang=en&rss=ct654tivoli

If sampled situation do not clear old alarms from TEPS, this kind of situation for Oracle Alert is of no use!

Does anybody here have any experence with this kind of problem? How to monitor a LOG using sampled situation without having TEPS filled with old alarms forever?

Thank you.

Was the question answered?

Was the question answered? : Results

Extract

- Collected 5500 Oracle forum threads, 1300 IBM forum threads
- Extracted 10 features

Train

- Training classifiers on threads from one domain, testing on the other

Classif
y

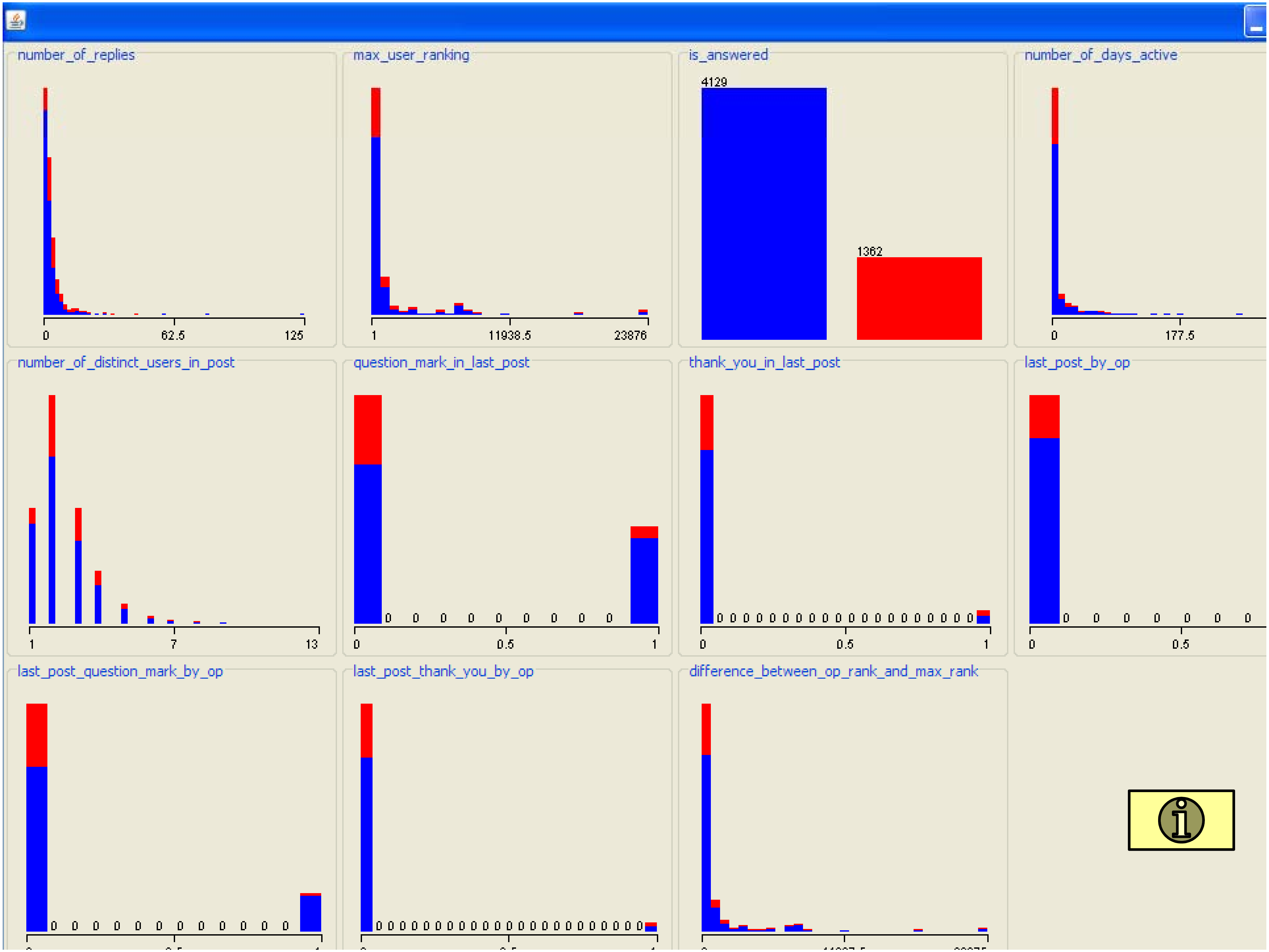
Train/Test	Oracle	IBM
Oracle	90%	85%
IBM	79%	97%

Summary

- Presented system for creating knowledge from events
- Exploring uses in other domains, e.g., PARIS for collaborative filtering
- System currently being tested in various IT environments
- Publications available (ECML’09, HP-Labs Tech reports)

Thank you

Q&A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0
62.5
125
max_user_ranking
1
11938.5
23876
is_answered
4129
1362
number_of_days_active
0
177.5
number_of_distinct_users_in_post
1
7
13
question_mark_in_last_post
0 0 0 0 0 0 0 0 0
0
0.5
1
thank_you_in_last_post
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0
0.5
1
last_post_by_op
0 0 0 0 0 0 0
0
0.5
last_post_question_mark_by_op
0 0 0 0 0 0 0 0 0 0 0 0
last_post_thank_you_by_op
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difference_between_op_rank_and_max_rank