Trouble ticket and incident correlation

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Subject history

- Current ENOC mission area includes receiving and processing NREN's TT flow to be aware of potential network connectivity problems that can affect EGEE operation.
- Smart and proper interpretation of TT content is essential for ENOC as mediator between NREN and EGEE end users.
- Statistical trouble ticket (TT) matching approach was proposed at the beginning of EGEE III to facilitate finding correlation of TT content to a part of possibly affected EGEE infrastructure.
- Statistical matching approach finds correlations between NREN's TT content and real observed EGEE node connectivity status. Such correlations observed for a long period are forming a knowledge database.
- Starting from Dec 2008 statistical matching prototype was established in RBNET. It has been colleting EGEE node reachability status in terms of: `fine,moderate,bad,unreachable.`
- Principles of this approach as well as first obtained results was reported in EGEE'08, UF'09, DSA2.1. The details are summarized in the technical paper "…".

Statistical TT matching principles

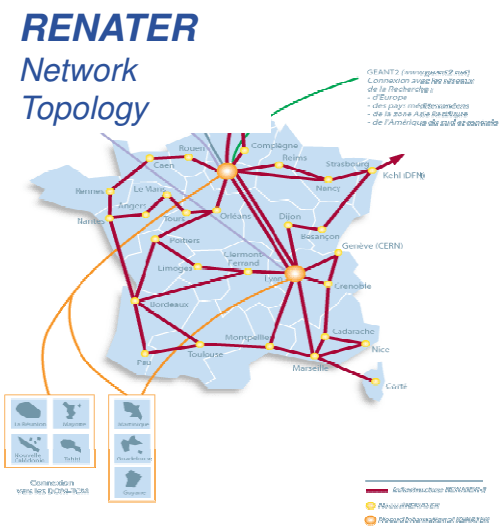
- **NREN's trouble ticket is interpreted as a vector of essential attributes. Currently the following attributes are used:**
  - ***Problem Interval*** – begin/end time of problem as reported by NREN
  - ***Problem Location*** – short string describing where the problem arises in terms of NREN's identification scheme.
  - ***Problem Kind*** – tag describing the problem in unified ENOC classification scheme. Currently this field does not practically used since it is not established during TT preprocessing.
- **Site connectivity history is summarized in alert database. An alert is represented as interval and severity.**
- **NREN's TT are matched against NREN's site alerts forming so called "hit statistic".**
  - Hit = [Ticket_ID, Location, SITE, Alerts_Severity]
  - <= from ticket ===> <==== from alert ===>
  - The hit take place if a site has alerts during a TT time interval.
  - The hit inherits a severity of hardest alert in the group.
- **Hit statistic is grouped by:**
  - ***Location***. For each Location in the ticket we track: all TT and TT with hits.
  - ***Site-Location***. For each site we track: number of hits observed for particular severity.
- **Metrics extracted from hits statistics and used in TT analysis:**
  - **Counts**(Location) – number of tickets seen for this location.
  - **Ratio**(Location) – percentage of TTs with hits for a particular location.
  - **SiteImpact** (Site-Location) – probability to get an alert for particular site if we see TT with particular location. This metric is tracked separately for different severities.

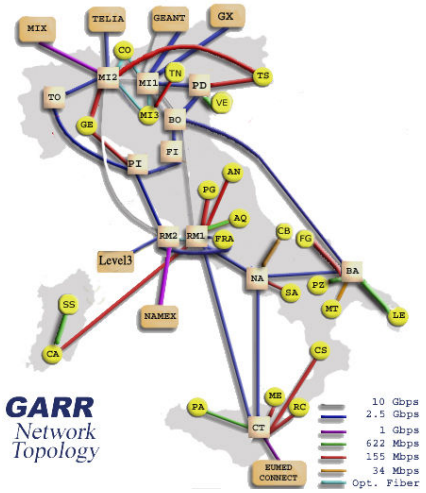
Increasing matching accuracy techniques

- **Purifying initial TT and Alert data:**
  - TTs and alerts with likely intervals only are taken into account (~ 15min – 4hour).
- **Detecting group connectivity events**
  - Monitoring intermediate points. I.e. Pinger-to-GEANT uplink and NREN-to-GEANT uplinks.
  - Check global number of simultaneous active alerts.
  - Check number of simultaneous active alerts per NREN.
- **Apply TT and alert interval padding.**
  - Extend TT and alert time intervals by small configurable parameter (0-15min). This allows to reduce time errors (e.g. system clock offset or TT human mistakes).
- **Put in correspondence data from several alert system located in different places (still pending).**

Input data: NREN complexity

Typical NREN topology is a rather complex that makes difficult human TT interpretation. This complexity also prevents storing and maintaining detail NRENs topologies in NOD database





Number of unique locations seen in NRENs allows to estimate NREN topology complexity

NREN	Ticket
GARR	243
HEANET	143
RENATER	135
REDIRIS	88
HUNGARNET	60
E2ECU	38
NORDUNET	30

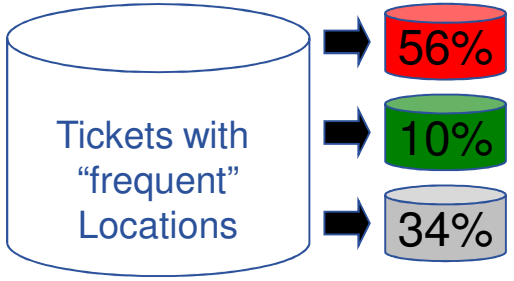
Matching Results (1)

- **Initial believe of statistical matching as a reliable method to map all essential ticket locations to list of affected sites turned out to be inconsistent.**
- Main reason – very weak statistic data. Locations with hits count > 1 are seldom
- Matching results for GARR from Jan 2009 to Aug 2009 as example are figured below.

LOCATION	*Ticket_Hits/Ticket_Counts*	*Site*	*Impact (%)*	*Significance (%)*	*Valid*
IT / POP-CA -- POP-RM	1/3	INFN-CAGLIARI	33	33	Yes
IT / HSH-VICO EQUENSE	1/3	SPACI-CS-IA64	20	38	?
IT / INFN - NAPOLI	1/3	INFN-T1	33	55	No
		INFN-CNAF	33	57	No
IT / ASI - TORINO --	1/3	INFN-LNL-2	33	88	No
		INFN-PADOVA	33	88	No
		INFN-MILANO	33	73	No
		ITB-BARI	33	50	No
IT / UNI-NAPOLI PARTH	1/4	INFN-ROMA2	33	27	No
		INFN-CAGLIARI	33	33	No
IT / UNI-ROMA-LUSPIO	1/4	INFN-BOLOGNA	25	71	?
		INFN-T1	25	55	?
		INFN-CNAF	25	57	?
		PPS-CNAF	25	50	?
IT / POP-PD1 -- POP-M	1/6	INFN-TRIESTE	17	24	Yes

Matching Results (2)

But current matching results can be used as a part of TT processing workflow.
As shown on the table below only **34%** of tickets with repeated locations was left" "under the question" for GARR, HEANET and RENATER



Commit as EGEE agnostic

Matched to EGEE sites

Still under the question

Group N	Location Group	NREN			SUM	Number of TT since Jan 2009	Remarks for group
		GARR	HEANET	RENATER			
1	Total number of locations	243	143	135	521	1526	Since Jan 2009
2	**Seen 2 or more times**	**46**	**37**	**86**	**169**	**1041**	**Set of tickets we consider**
3	Seen 3 or more times	21	22	67	110	863	Suitable for statistical approach
4	**Seen 3 or more times with no hits**	**15**	**18**	**54**	**87**	**582**	**Can be considered as EGEE agnostic**
5	Seen 3 or more times with hits	6	4	13	23	281	Candidates for statistical TT matching
6	**Reliably matched to EGEE sites**	**0**	**3**	**6**	**9**	**107**	**Criteria: Location-Site object has 3 or more hits**
7	"Grey zone" Need further/alternative processing	31	16	26	73	352	=Group2-Group4-Group6

Matching Results (3)
Details for matched locations

RENATER	
LOCATION	SITE-LOCATION
FR / STRASBOURG	IN2P3-IRES
FR / MARSEILLE	IN2P3-CPPM
FR / JUSSIEU	IPSL-IPGP-LCG2
FR / GRENOBLE	IN2P3-LPSC
FR / NANTES	IN2P3-SUBATECH
FR / ORSAY	IPSL-IPGP-LCG2

HEANET	
LOCATION	SITE-LOCATION
IE / DIAS	cpDIASie
IE / IT TRALEE	giITTRie
IE / GEANT	giITTRie
	cpDIASie
	giNUIMie

GARR
-- NONE --

Matching detail for strong criteria (Location-Site has >=3 hits) are shown above.
We can see 100% matching accuracy.

Matching Results (4)
Details for locations in “grey zone”

The list of locations left in grey zone for RENATER

FR / CAYENNE-FTLD	FR / PARIS-2
FR / CRETEIL	FR / PARIS1
FR / AFNIC	FR / CERIMES
FR / CSI	FR / UNIVERSITE PARIS 10
FR / TELEHOUSE2 -INTERXION1 CIRCUIT	FR / INRA
FR / PARIS1-ORSAY	FR / INA
FR / CLERMONT-FERRAND	FR / PARIS2
FR / CADARACHE	FR / NICE-CADARACHE
FR / GEANT-E2E	FR / BESANrON-STRASBOURG
FR / PARIS-NOUMиA	FR / LYON1-NICE
FR / PARIS1-LYON1	FR / PAU-TOULOUSE
FR / TOURS - ORLиANS	FR / NANTES-ANGERS
FR / LE MANS - TOURS	FR / KOUROU-CSG

Conclusions

- **Main practical results:**
  - 76% of repeated locations was considered as “EGEE agnostic” or mapped to EGEE sites
  - All mapped repeated locations (10%) were with 100% accuracy
- **The reasons for TT matching fails.**
  - Weak TT statistic.
    - Only small part of locations was suitable for matching (ticket counts >=3). Part with ticket count >= 4 was really negligible.
  - Not perfect node status detection.
    - Matching was performed using data from Smokeping and DownCollector. Smokeping had «not so good» uplink and DownCollector can not track multilevel node status detection.
- **NREN can improve the content of their tickets**
  - Short and accurate location (RENATER format is a good example)
  - Short problem severity tag.
- **Matching results can be used as part TT processing in conjunction with lexicographical and manual location matching.**
- **Further directions:**
  - Tune and improve matching criteria.
  - Go to combining statistical matching with other methods.
  - Renew Smokeping config and move it to “good” location.
  - Add multi-pinger TT processing functionality.