



Enabling Grids for E-science

# LHCOPN operations Presentation and training CERN's session

1- Goals and general overview of operational model

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[www.eu-egEE.org](http://www.eu-egEE.org)



- **Goal**
- **Overview**
- **Actors**
- **Information repositories**
- **Events management**
  - Incident
  - Maintenance
  - Change
- **Grid interactions**
- **Processes tools**

- **Everything documented and maintained on**
  - <https://twiki.cern.ch/twiki/bin/view/LHCOPN/OperationalModel>

- **Smartly manage LHCOPN at L3 delivering best network service as possible to WLCG**
- **LHCOPN objectives**
  - T0 – T1 traffic
    - T1 – T1 traffic as best effort
      - *T1-T1 links primary goal: T0-T1 backups links*
    - + Backup through generic IP
- **LHCOPN is key block of infrastructure around WLCG**

- **No particular MoU on LHCOPN operations, part of WLCG MoU signed by T1s**

- <http://lcg.web.cern.ch/LCG/MoU/Goettingen/MoU-Goettingen-18MAR09.pdf>

- Page A.3.2 (T0), A.3.4 (T1s)

- For T0:

<sup>5</sup> (time running)/ (scheduled up-time)

<i>Service</i>	<i>Maximum delay in responding to operational problems</i>			<i>Average availability<sup>5</sup> measured on an annual basis</i>	
	Service interruption	Degradation of the capacity of the service by more than 50%	Degradation of the capacity of the service by more than 20%	During accelerator operation	At all other times
Raw data recording	4 hours	6 hours	6 hours	99%	n/ a
Event reconstruction or distribution of data to Tier-1 Centres during accelerator operation	6 hours	6 hours	12 hours	99%	n/ a
Networking service to Tier-1 Centres during accelerator operation	6 hours	6 hours	12 hours	99%	n/ a
All other Tier-0 services	12 hours	24 hours	48 hours	98%	98%

For T1s:

<i>Service</i>	<i>Maximum delay in responding to operational problems</i>			<i>Average availability<sup>5</sup> measured on an annual basis</i>	
	Service interruption	Degradation of the capacity of the service by more than 50%	Degradation of the capacity of the service by more than 20%	During accelerator operation	At all other times
Acceptance of data from the Tier-0 Centre during accelerator operation	12 hours	12 hours	24 hours	99%	n/ a
Networking service to the Tier-0 Centre during accelerator operation	12 hours	24 hours	48 hours	98%	n/ a
Data-intensive analysis services, including networking to Tier-0, Tier-1 Centres outwith accelerator operation	24 hours	48 hours	48 hours	n/ a	98%
All other services <sup>6</sup> – prime service hours <sup>9</sup>	2 hour	2 hour	4 hours	98%	98%
All other services <sup>6</sup> – outwith prime service hours <sup>9</sup>	24 hours	48 hours	48 hours	97%	97%

<sup>5</sup> (time running)/ (scheduled up-time)

- **Raw conclusion**

- T0:

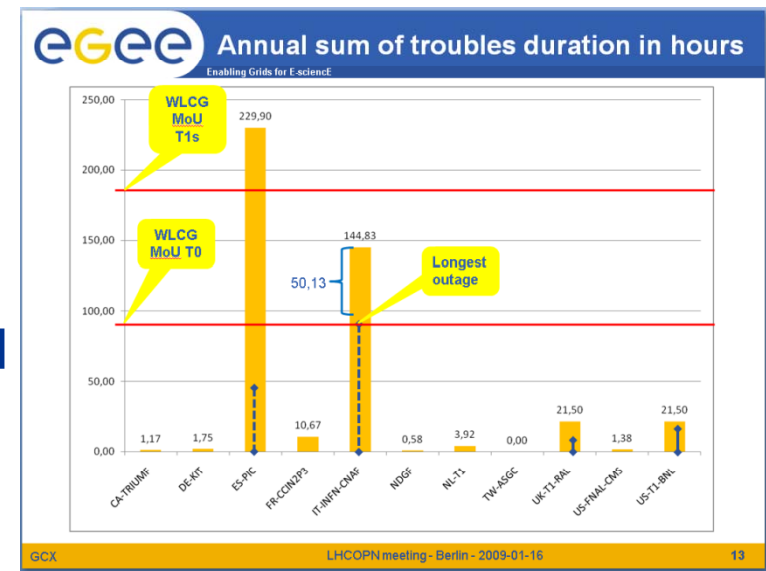
- Response delay: 6 hours
    - Unexpected downtimes: 3.65 days/year ~ 87 hours

- T1s

- Response delay: 12 hours
    - Unexpected downtimes: 7.3 days/year ~ 175 hours

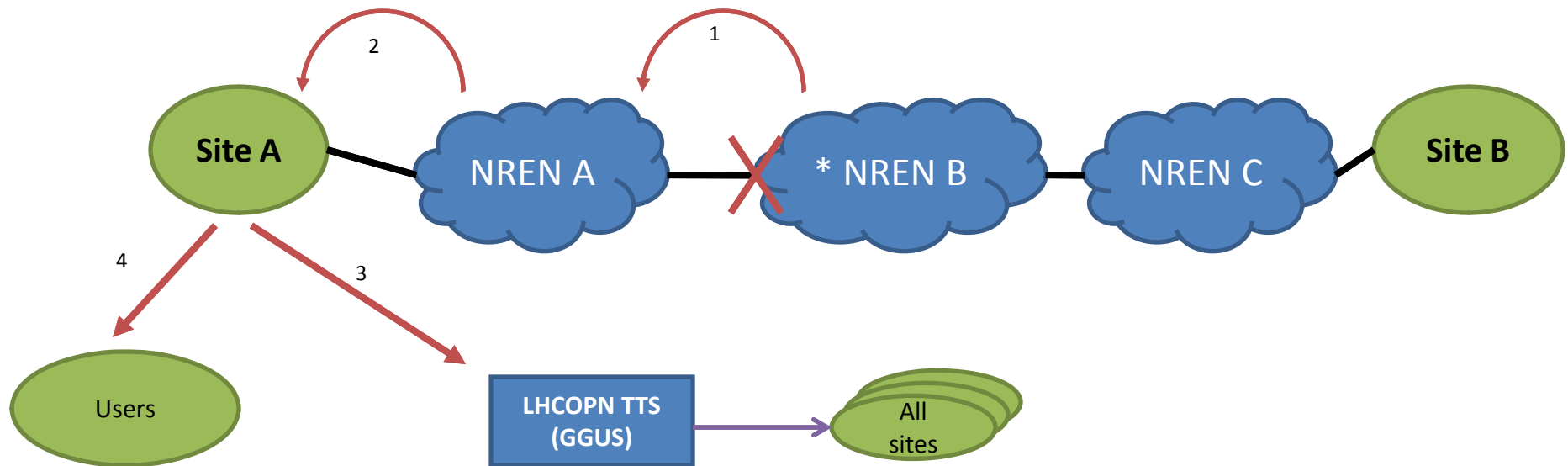
- **This seems really achievable**

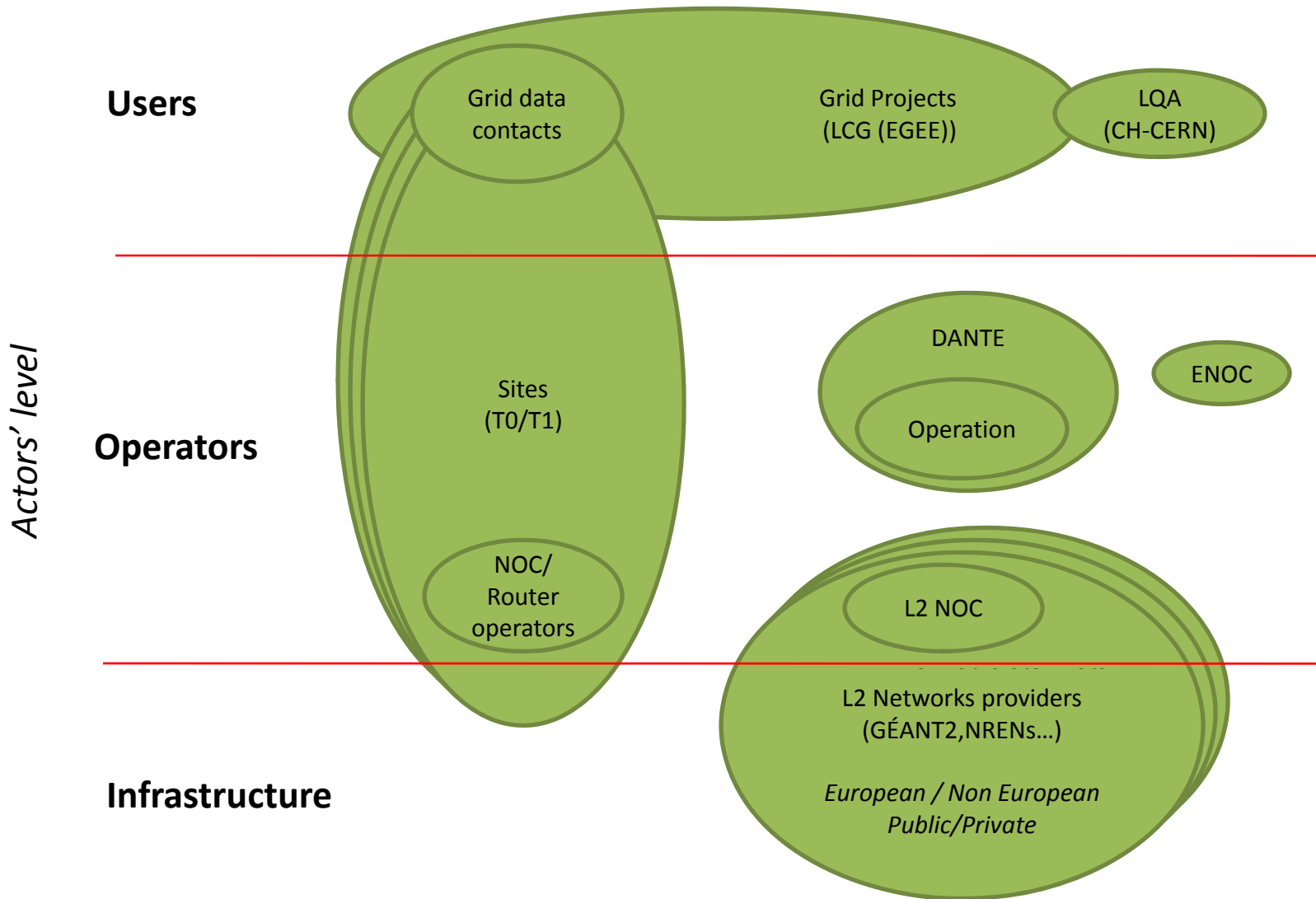
- Cf. <https://edms.cern.ch/document/982588/>
    - But true scheduled downtimes previously not correctly handled
  - Delays in announcements to be respected...

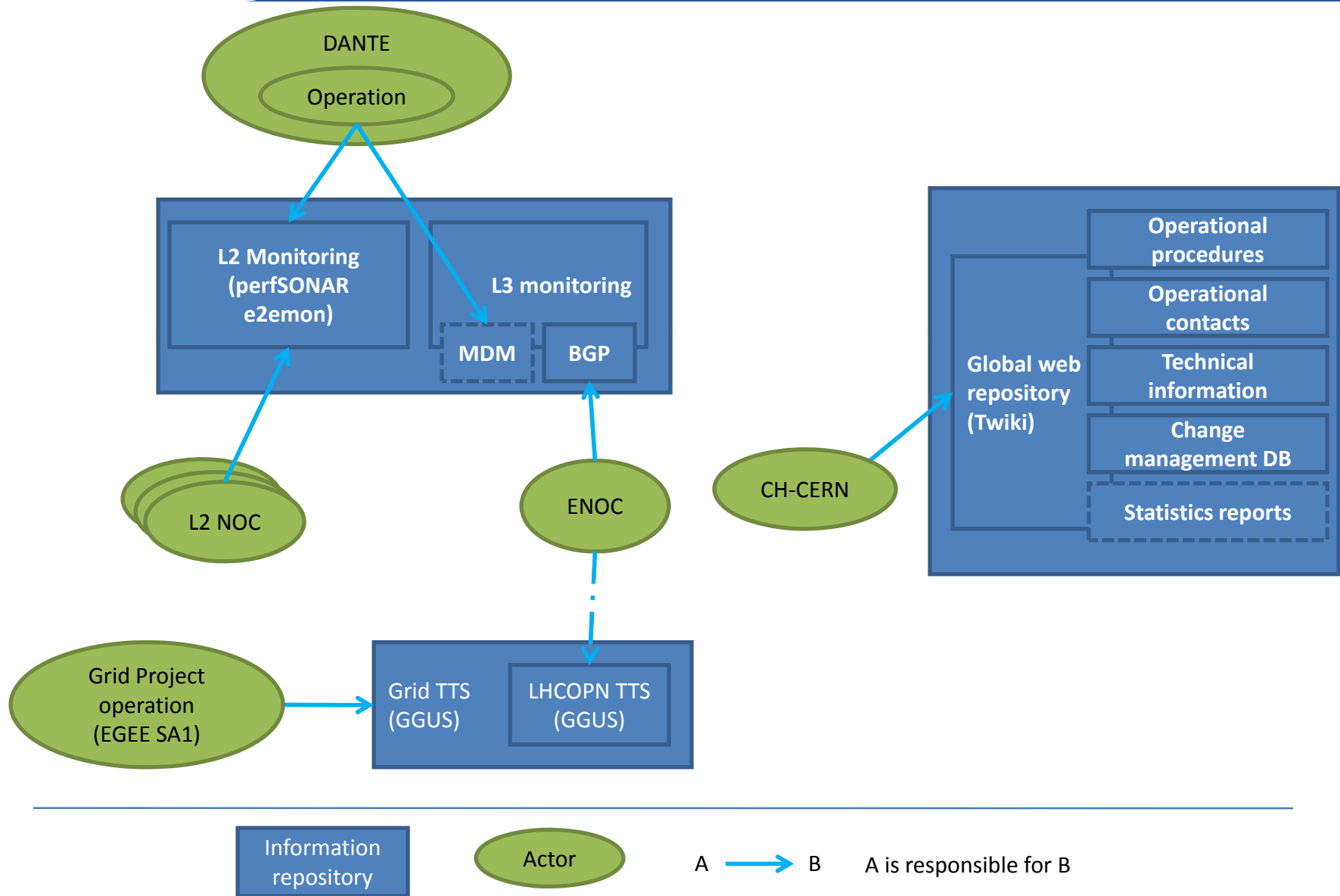


- **Federated operational model with key responsibilities on sites**
  - Interaction with network providers
  - Management of network devices on sites
  - Interaction with the Grid
  
- **Some information centralised**
  - Serialisation of fault resolution and avoid duplicated information
  - TTS, web repository...









- **Any events**
  - more than 1 hour
  - or more than 5 times an hour
  - Should have a ticket in the TTS
- **Otherwise could be silently handled**
  - But good to report them (statistics, cross checking...)

- **Incident**
  - Unscheduled event
  - Generic process when cause and location unknown
- **Maintenance**
  - Scheduled event
- **Change**
  - Scheduled change on the infrastructure
  - Implemented by a maintenance if it impacts!

- **LHCOPN built as L2 paths ending on sites**
  - True, some exceptions...
- **Shortcuts**
  - L2: OFF-SITE: optical level, fibre cuts in NREN, etc.
  - L3: ON-SITE: Router down, power cut, BGP flaps, filtering, IOS upgrade etc.

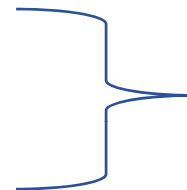
- 6 key processes to handle 3 kinds of event

Complexity



- **Incident management**

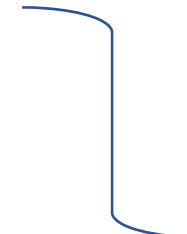
- Global Problem management processes
- 1) L3 incident management
- 2) L2 incident management
- *Escalated incident management*
  - (~ trouble > 1 week)



**Unscheduled**  
(Minimum for on duty people...)

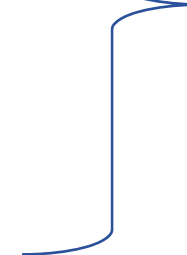
- **Maintenance management**

- 3) L3 maintenance management
- 4) L2 maintenance management



- **Change management process**

- 5) L3 change management
- 6) L2 change management



**Scheduled**

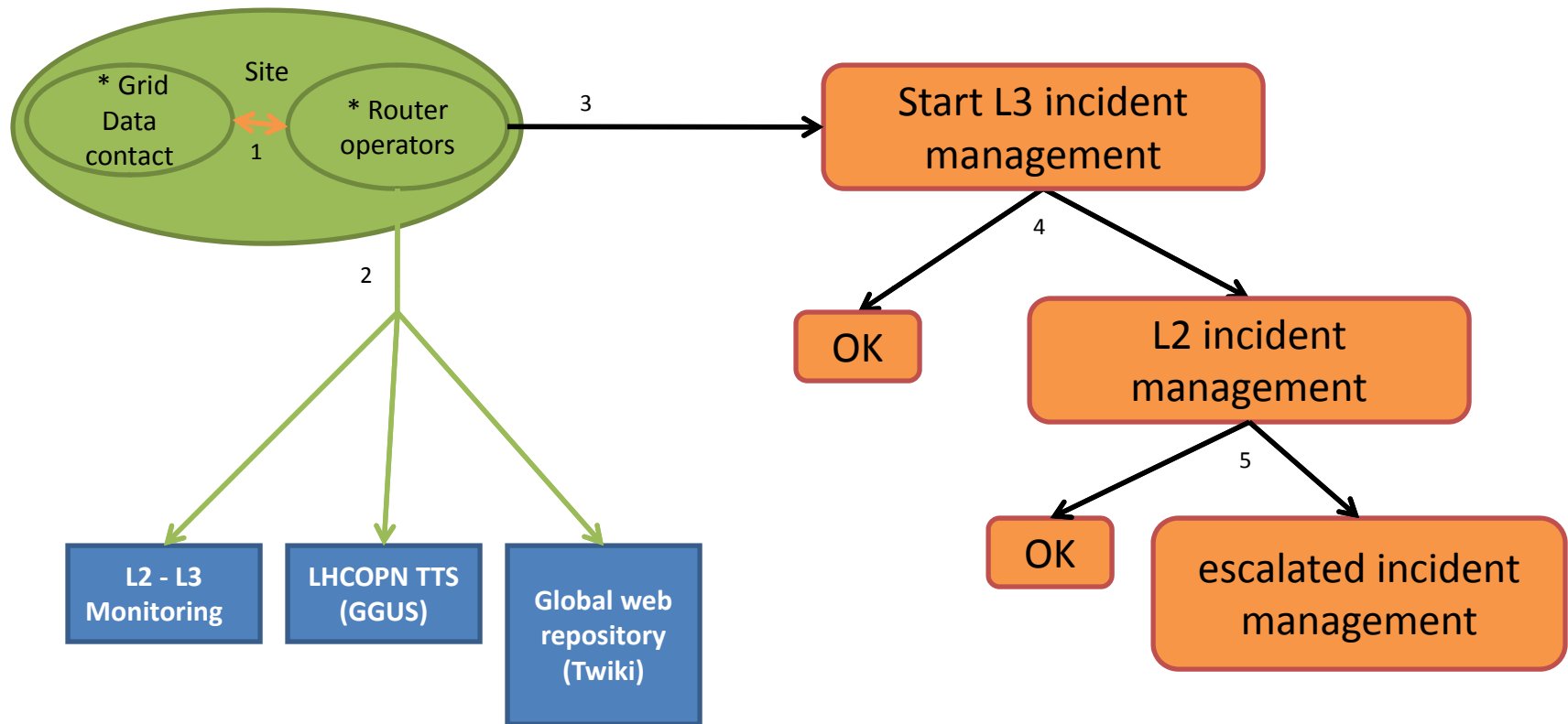
- **Change to broadcast and document the change**
- **Any change with a impact should be implemented with an associated maintenance**





- **Incident**
  - L2: Dark fibre outage
  - L3: Router down, BGP filtering, bad routing
- **Maintenance**
  - L2: Fibre rerouted, fibre to be cleaned
  - L3: Scheduled power cut on site, IOS upgrade
- **Major change**
  - L2: New LHCOPN link
  - L3: New IP addresses, prefixes, filtering

- **Router operator**
  - People acting on sites' network devices
- **Network provider**
  - NRENs, GÉANT2 etc.
- **Grid data contact**
  - Role supported by each sites
  - Typicaly FTS and Dcache managers etc.

- Outages on links between T0 and T1 are of **responsibility of T1s** (who ordered the link)
- *Responsibility for outages on T1-T1 links are being investigated*
- Responsibility for GGUS' ticket **is on the site which the ticket is assigned to**
  - Only one entity responsible at any time
    - Avoid the no one move effect



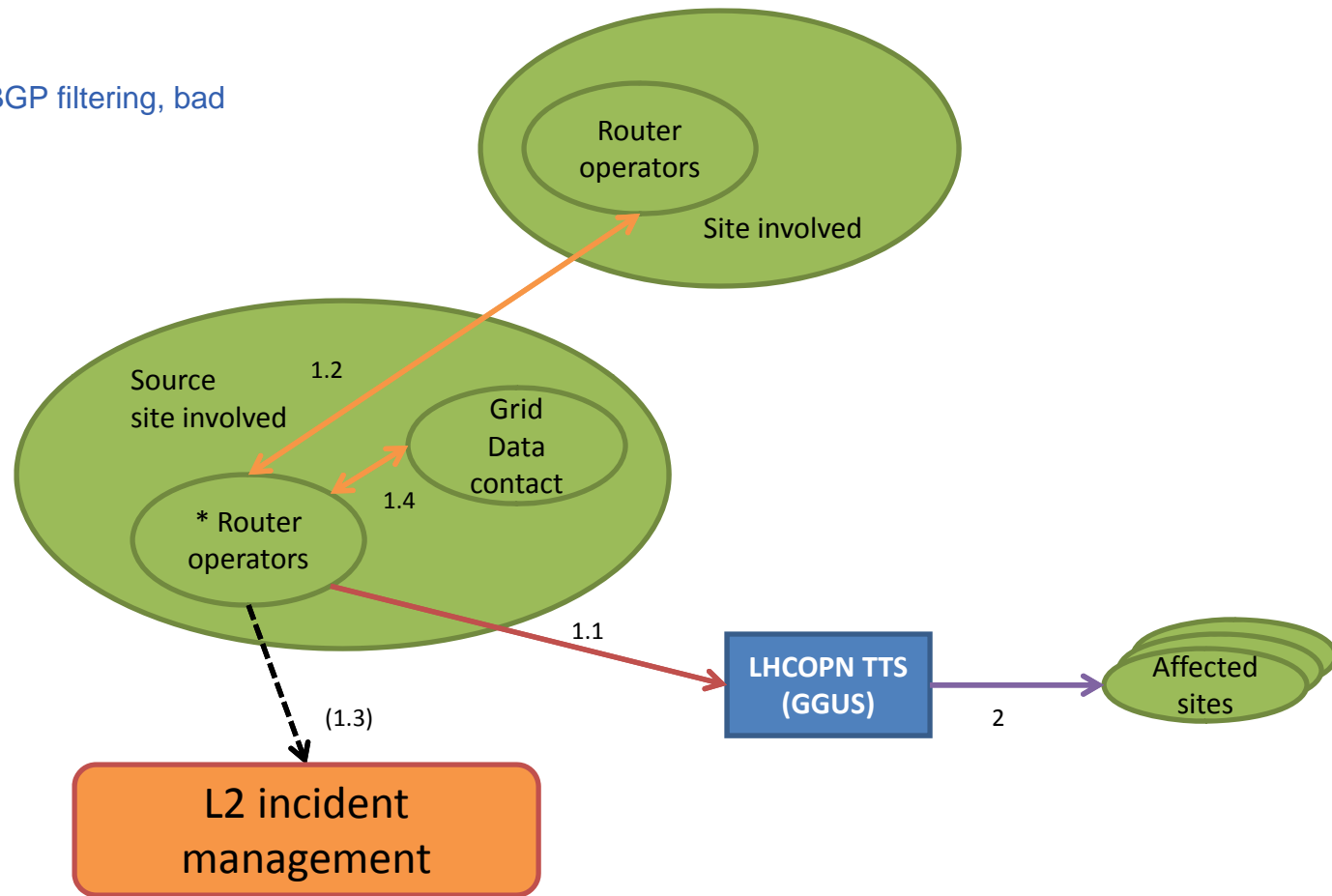
A  B A reads B

A  B A goes to process B

A  B A interacts with B

# 1.1 Incident management

Scope: Router down, BGP filtering, bad routing...

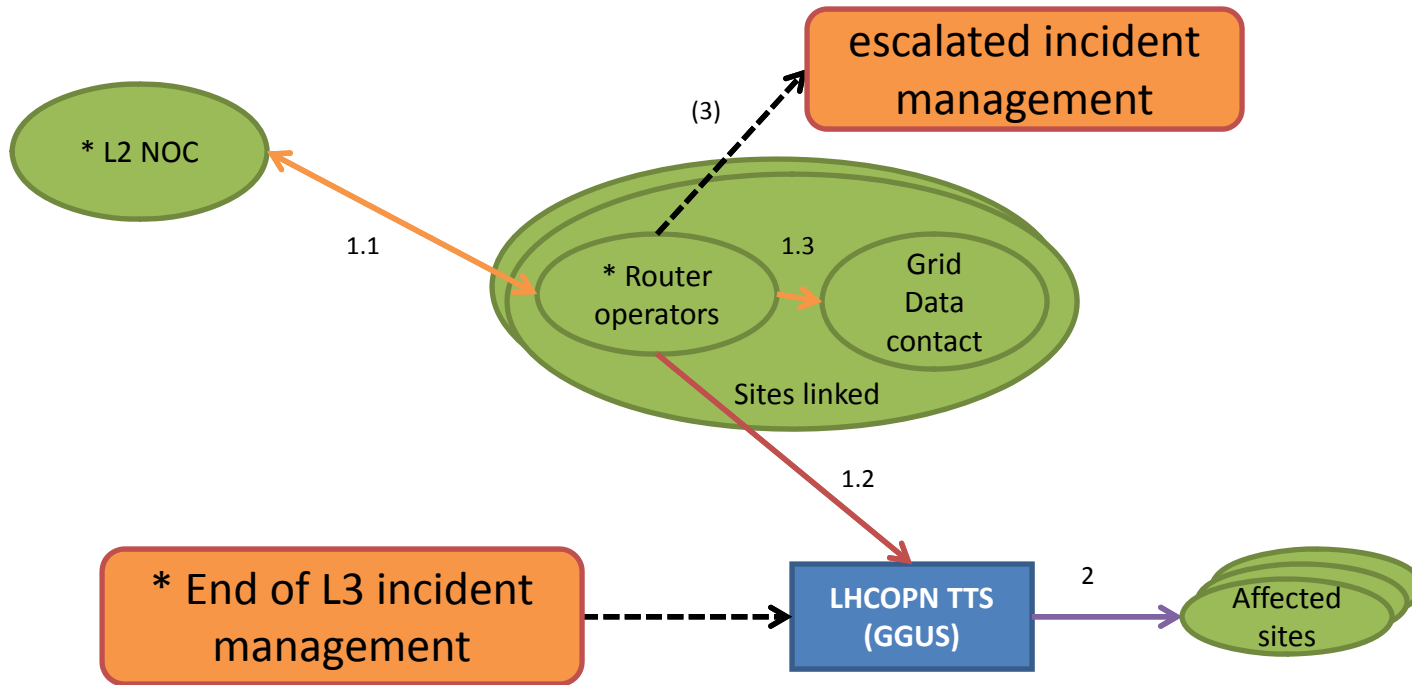


A → B A interacts with B    A → B A notifies B

A → B A goes to process B    A → B A reads and writes B

- 1. Incident registration: Put a GGUS ticket into the TTS**
- 2. Warn Grid data contact and give them reference of network ticket**
- 3. Update it**
- 4. Close it**

Scope: Dark fibres outages...



A → B A interacts with B    A → B A notifies B    A → B A reads and writes B

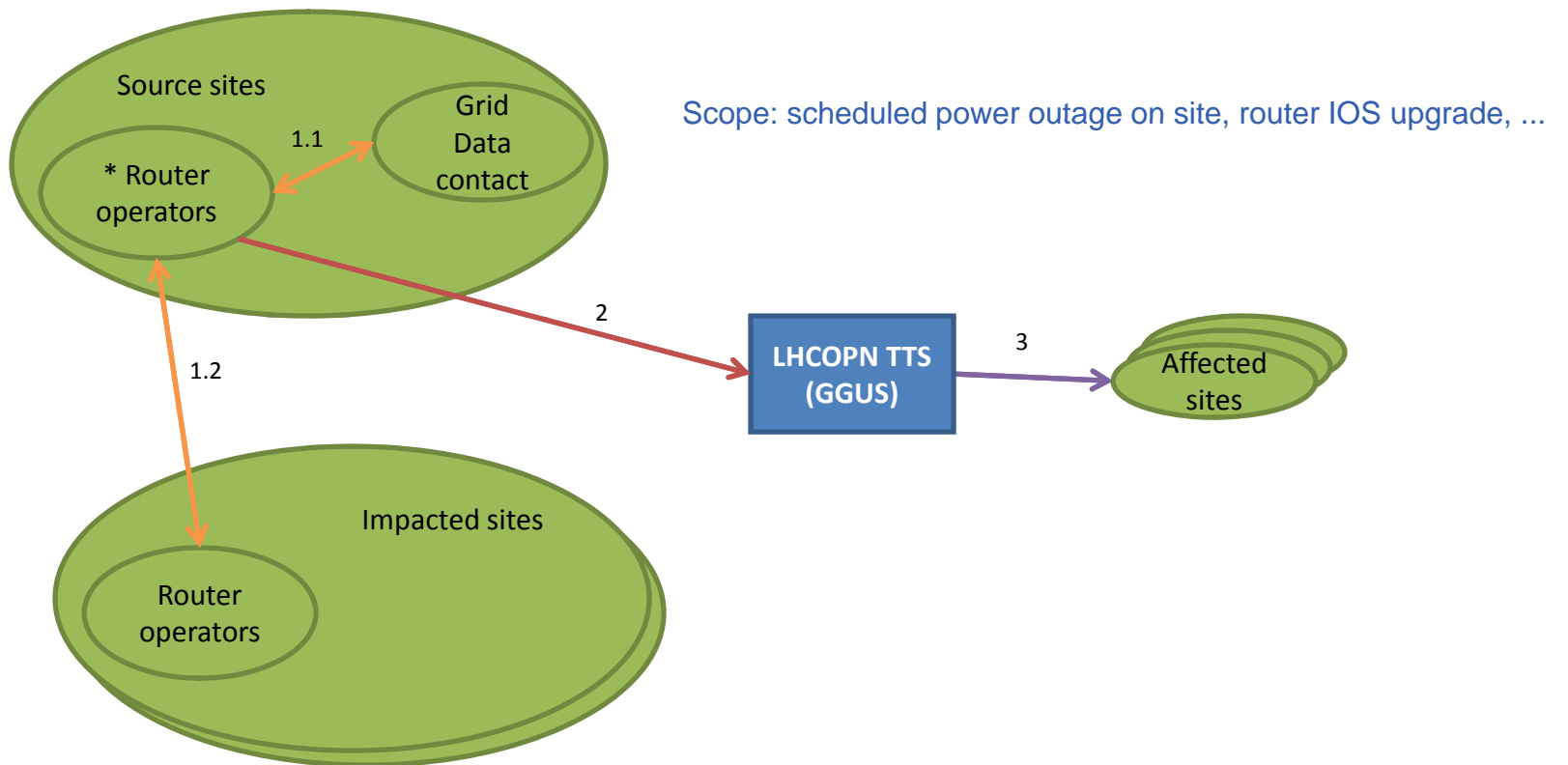


1. **Start Generic process**
2. **Start L3 incident management**
  - Nothing at CH-CERN, should be L2 related
3. **Then go to L2 incident management**
  1. See with RENATER NOC what happens
    - Maybe open a ticket to their NOC
  2. Put a ticket in the LHCOPN TTS
  3. Warn Grid data contact (and give them ticket #)
  4. Follow

## 1.2 Maintenance management

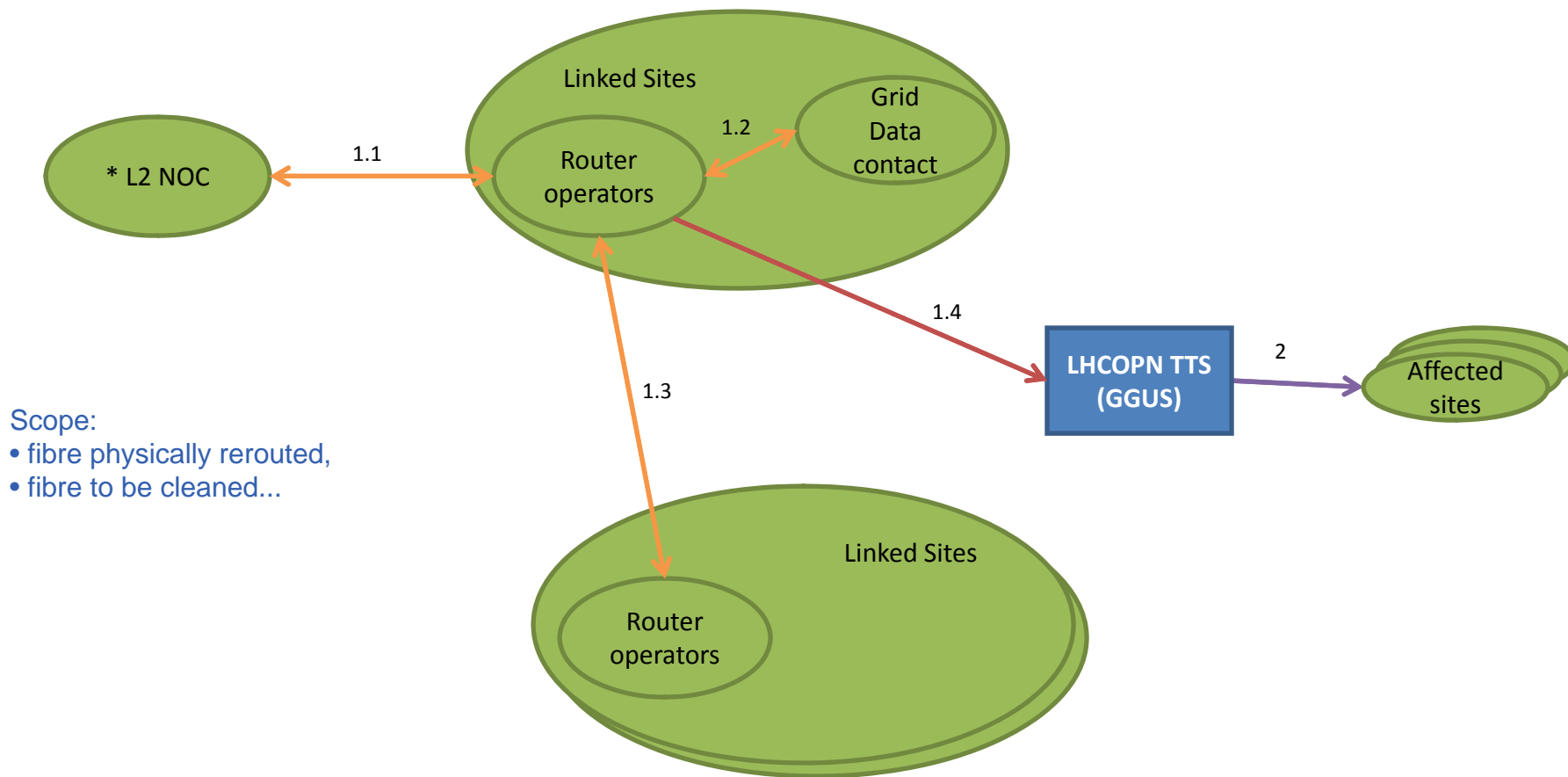
Impact duration	Notice window
More than 1 hour	1 week
Less than 1 hour	2 days
No impact	1 day

Otherwise events might be computed in statistics as Incident...



A → B A interacts with B      A → B A notifies B      A → B A reads and writes B

- Impact > 1h, maintenance window = 1w
- Warn Grid data contact and see if ok
- (Ask DE-KIT and CH-CERN if no overlapping event foreseen)
- Put a ticket about in the TTS
  - Yes one week in advance
  - Give ticket # to Grid data contact
- Update, follow, close ticket the D-day



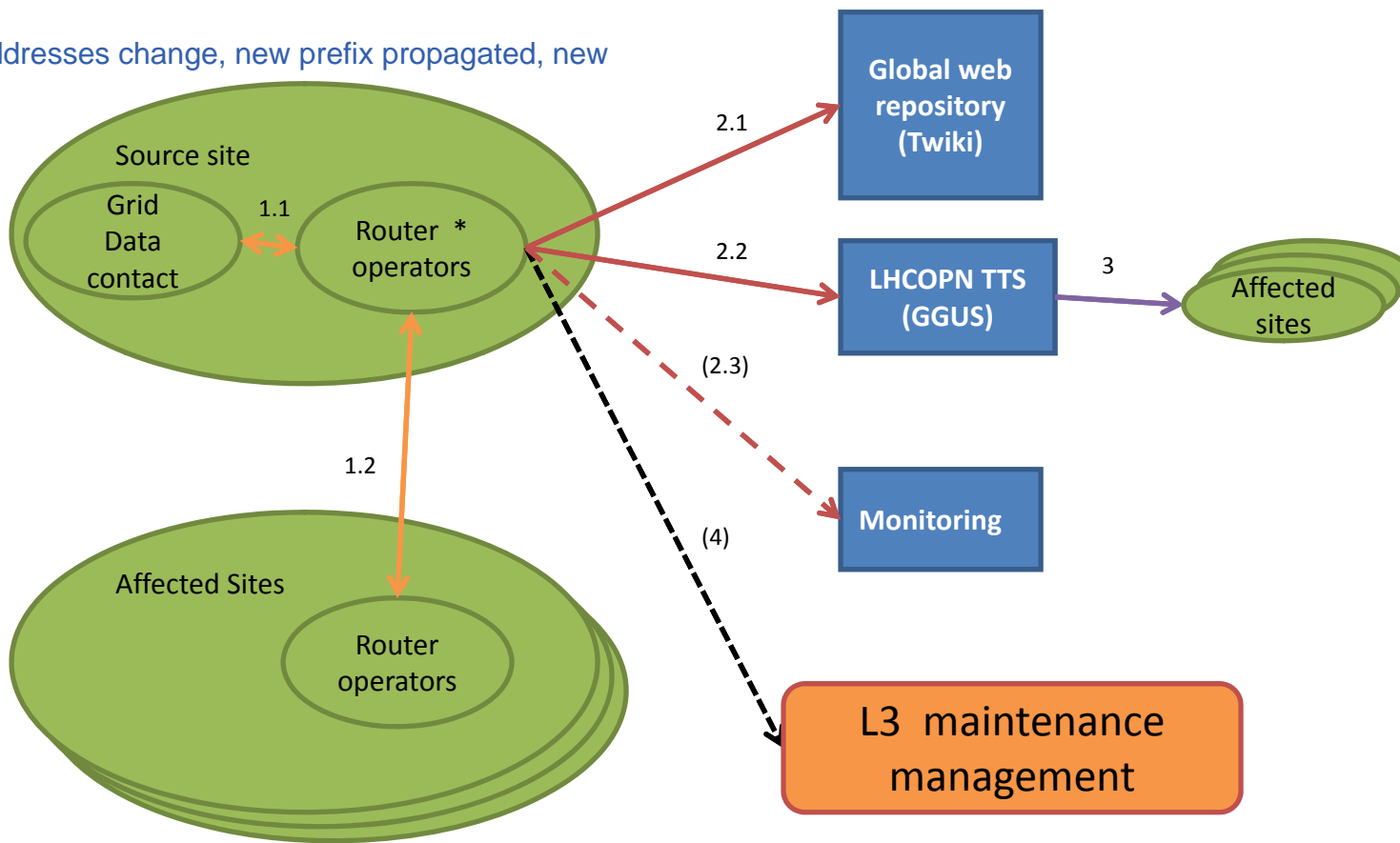
A B    A interacts with B   
 A B    A notifies B   
 A B    A reads and writes B

- **Received ticket from RENATER**
- **Link will be down 6 hours**
  - No impact on service to be confirmed with DE-KIT and CH-CERN
  - See also with Grid data contact as this may impact performance
- **Put a ticket at least 1d before the event**
  - Give reference to Grid data contact
- **Update and follow ticket**

## 1.3 Change management

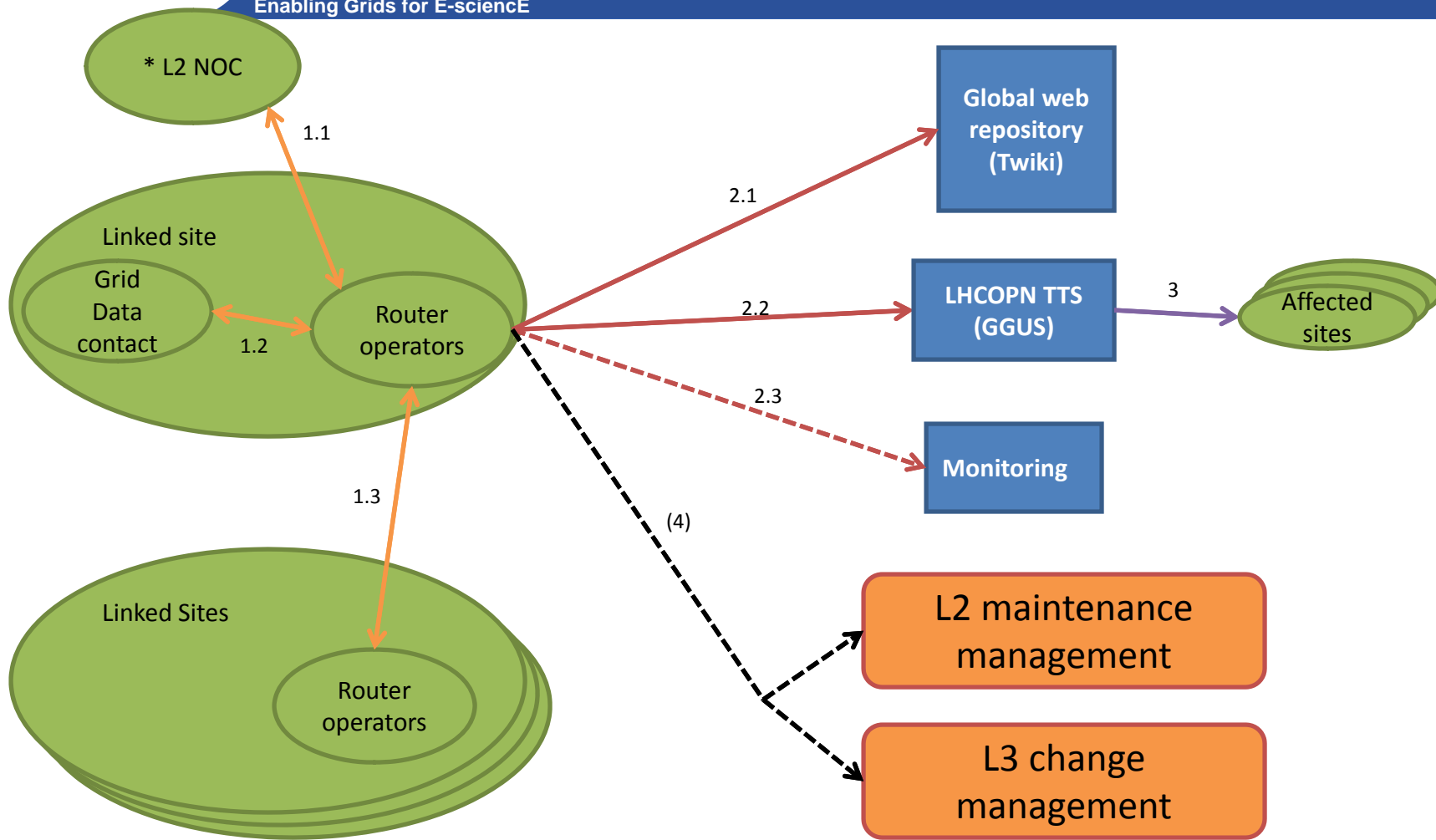


Scope: IP addresses change, new prefix propagated, new filtering



→ A interacts with B     
 → A notifies B     
 → A reads and writes B

- **No change on service delivered after**
  - Not of interest for Grid data contact
- **Discuss with CH-CERN and DE-KIT about the change**
- **Document the scheduled change on twiki and update technical informations**
  - <https://twiki.cern.ch/twiki/bin/view/LHCOPN/ChangeManagementDatabase>
  - <https://twiki.cern.ch/twiki/bin/view/LHCOPN/WebHome> part "Technical Information"
- **Put an informational ticket on the TTS about**
  - With DANTE Ops (e2emon) & ENOC in CC to have monitoring adapted — operations AT dante.org.uk;enoc.support AT cc.in2p3.fr
- **Implement (=commit) the change with a maintenance**

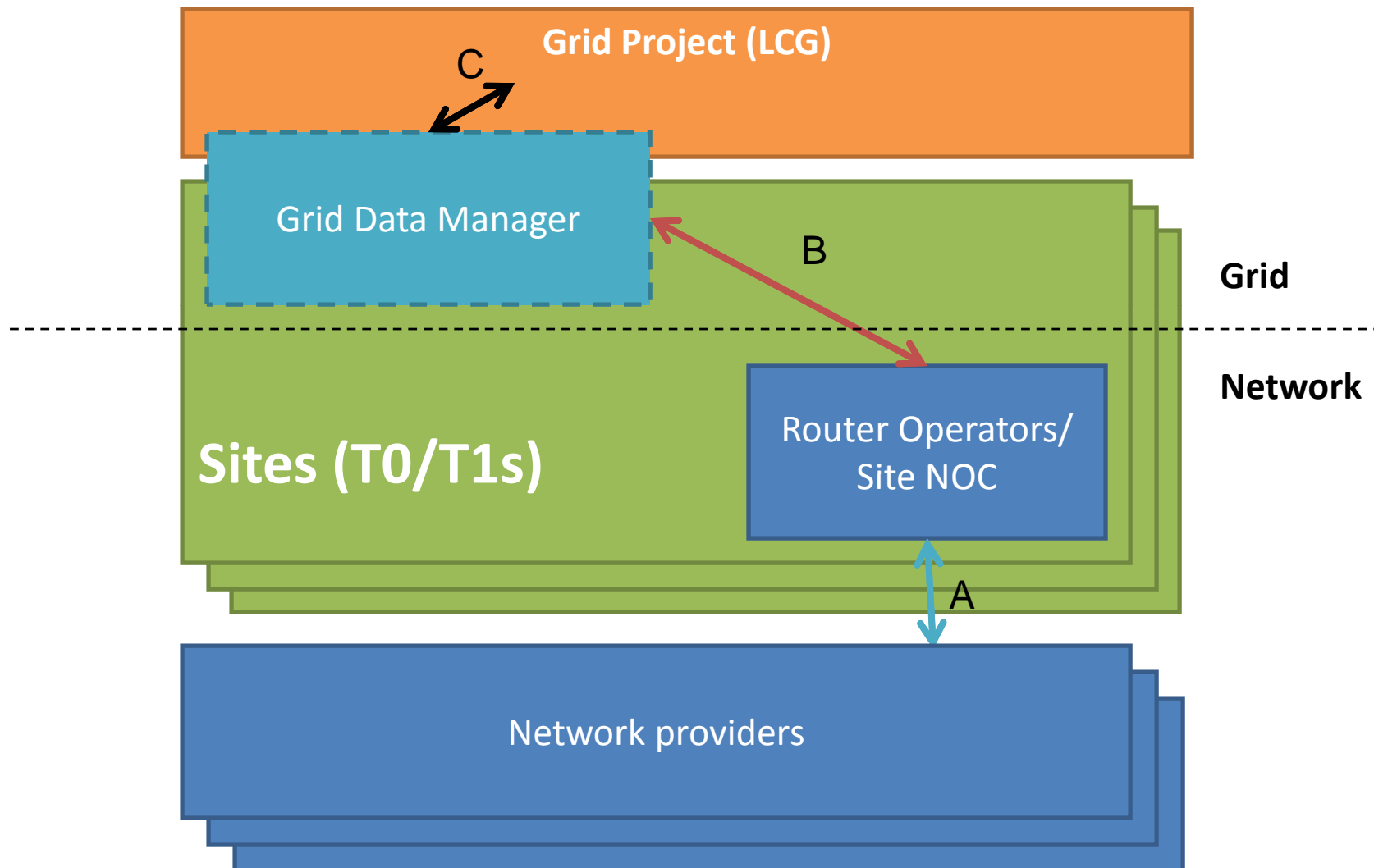


A → B A interacts with B    A → B A notifies B    A → B A reads and writes B

Scope: New LHCOPN L2 link, L2 link with new physical path, change of L2 network provider for a segment...

*Simplified*

- See with SWITCH NOC details
- See with CH-CERN, DE-KIT new p2p IPs and routing policy
- Document the scheduled change and update technical informations
  - <https://twiki.cern.ch/twiki/bin/view/LHCOPN/ChangeManagementDatabase>
  - <https://twiki.cern.ch/twiki/bin/view/LHCOPN/WebHome> part "Technical Information"
- Put an informational ticket in the TTS, warning ENOC and DANTE Ops and all sites about what is foreseen
  - Operations AT dante.org.uk;enoc.support AT cc.in2p3.fr
- **No change on infrastructure without tickets**
- **Put a L3 maintenance ticket to commit changes**
  - IP adresses, routing and testing period before production use
- Then warn Grid data contact: New bandwidth and backup possibilities for project



On going work

## A. Daily operational workflow

- Scheduled and unscheduled outages – what to practically do?
  - Try to also avoid overlap of network events & Grid events
- Each site is responsible – No central entity

## → Use simple existing things in place

- Existing tools, processes and communication channel to be used
  - EGEE broadcasting tools etc.
- Grid data contacts could also report in the daily WLCG phoneconf when needed
  - <https://twiki.cern.ch/twiki/bin/view/LCG/WLCGOperationsMeetings>
  - Can be done offline: e-mails, reading minutes etc.
    - *But phone turned on when needed*
  - Key point: VOs and experiments are reached here

## B. Upper level and long term interactions

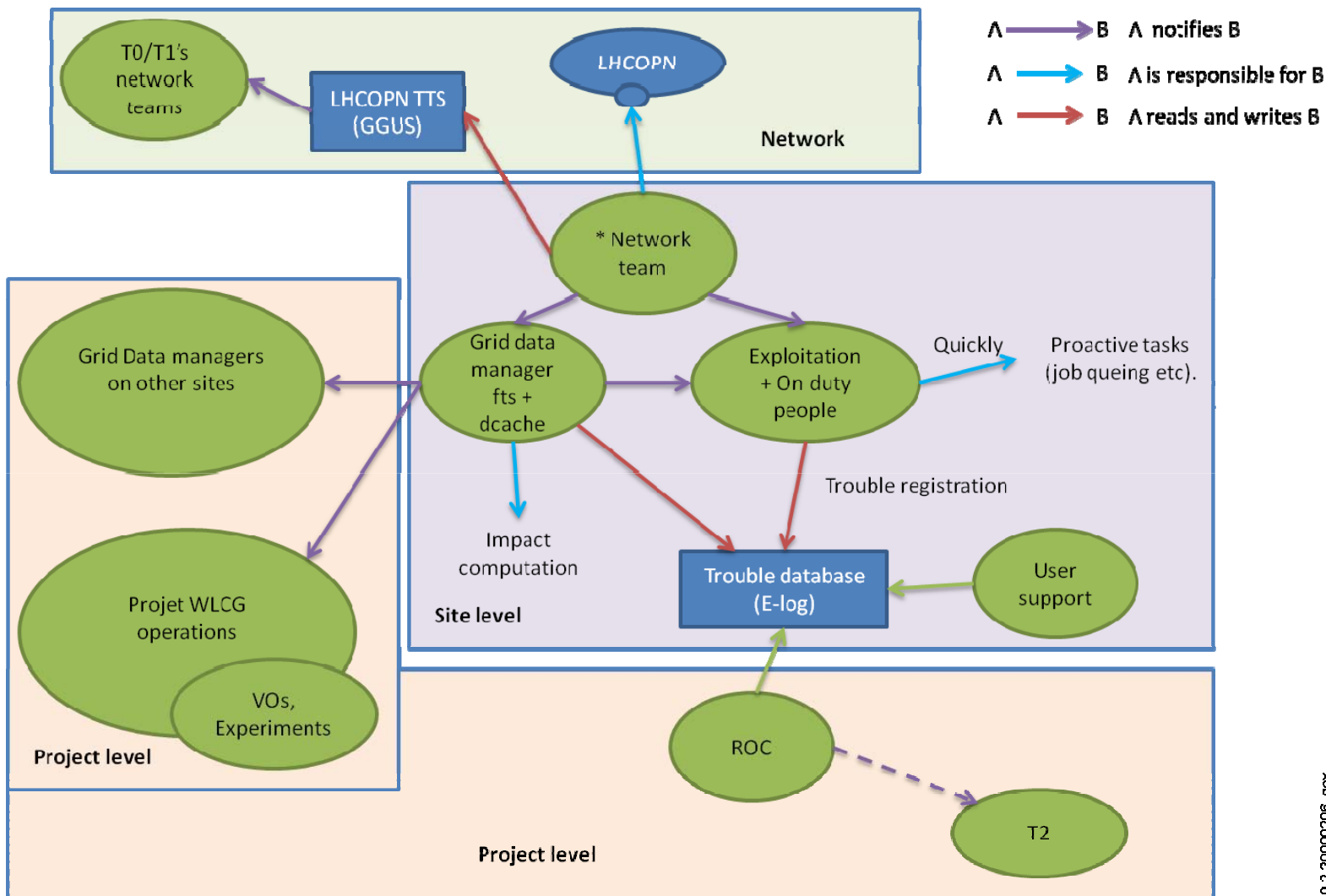
- Regular problems, improvement and change requests, global assessment of the service delivered etc.

### → A LHCOPN representative could be the exchange point between LHCOPN and Grid

- Report to Grid from quarterly LHCOPN network ops phoneconf
  - Global view of infrastructure and ops
  - Quality assessment, key incident report etc.
- Import items from Grid on the agenda
- Write conclusions into some quarterly reports

On going work

## Sample FR-CCIN2P3 implementation:



V0.2 20090206 gcx



- **Only 2 incident management processes to be fully known**
- **This is light?**
- **Model should be flexible enough for site dependant implementation**
  - From huge layered NOCs to single guy
- **Open to improvements!**