



Enforcing an IP TE policy

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- Outline:
 - Configuration and testing environment
 - Enforcing an IP TE policy: an example
 - PRC instantiation
 - COPS-PR provisioning of the configuration information
 - Reporting the actions
 - Validation aspects
 - Current restrictions
 - Preliminary performance results





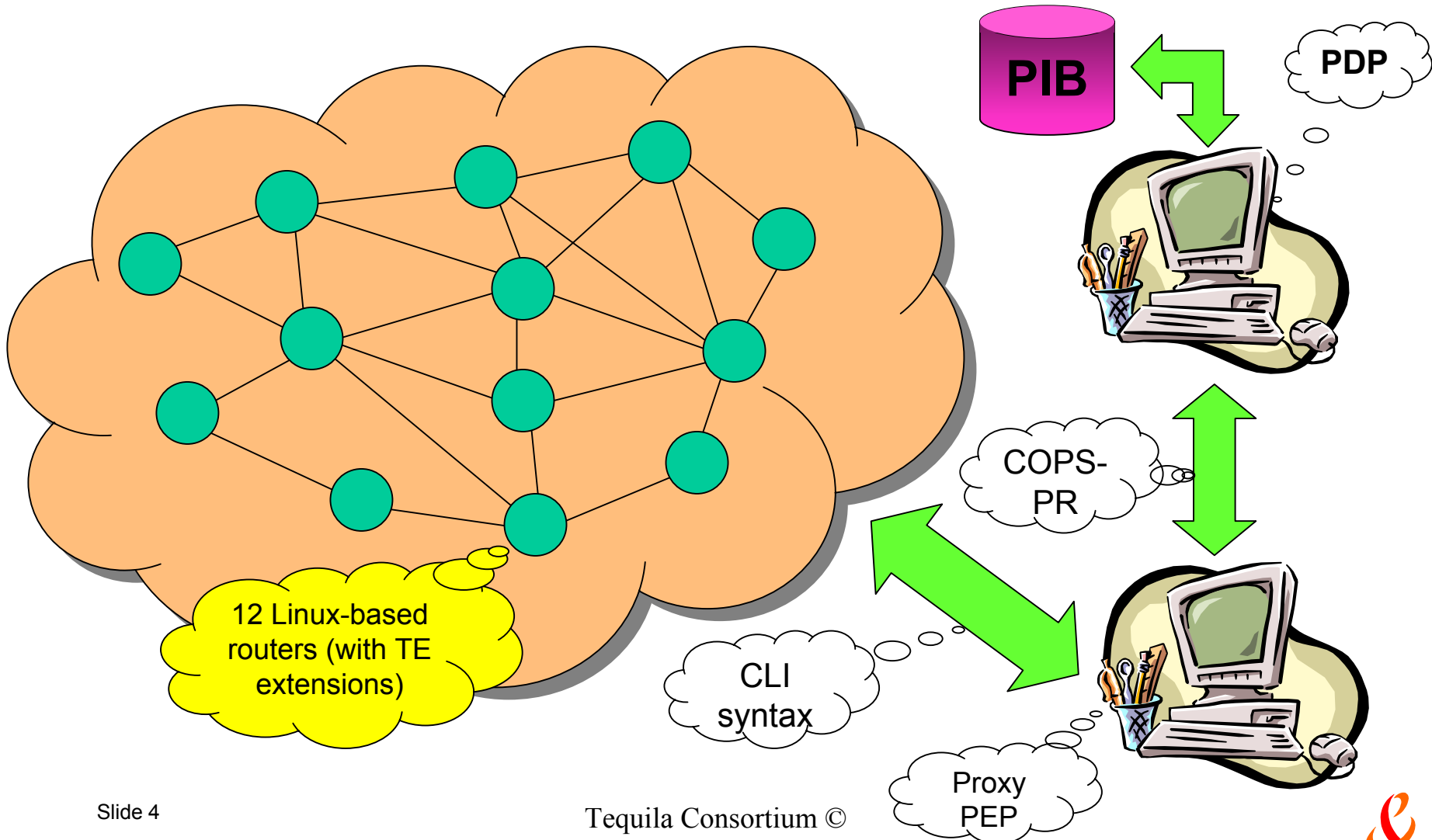
Configuration and testing environment

- Basic components:
 - An XML-based “OSS”
 - For populating the IP TE PIB, based on the manipulation of XML files
 - A PDP for making the decisions
 - *E.g.* modify a TE metric value on a given router interface
 - PEPs for applying the decisions
 - The PEP capability is currently outsourced from the routers
 - OSPF-TE-capable routers
 - Embed a CSPF computation algorithm





Development and testing resources





Access interfaces

The screenshot displays three windows from a network management interface:

- Little OSS:** Shows a list of TE (Terminal Equipment) instances (TE1 to TE12) with their addresses and installation status. Buttons for 'Install ...', 'Get state', and 'Remove' are visible.
- PDP (Policy Decision Point):** Shows configuration for TE1 and TE2. It includes a table of states and detailed configuration parameters such as bandwidths, metrics, and IP addresses for various interfaces.
- PEP Proxy (Policy Enforcement Point):** Shows configuration for TE1, TE2, TE3, and TE4. It includes a table of states and detailed configuration parameters such as bandwidths, metrics, and IP addresses for various interfaces.

At the bottom of the interface, there are buttons for 'EVENT', 'ALARM', and 'ERROR', and a footer with copyright information for the Tequila Consortium.





Instantiating a PRC

- According to the IP TE PIB structure
 - E.g. modification of the `ospfTeMetricSubTlvMaxRsvBandwidth` value

SubTlvMaxBand...	SubTlvUnrsvBan...	SubTlvMaxRsvB...	IfIndex
20000	15000	15000	2
20000	15000	15000	3
20000	15000	15000	4
15000	10000	10000	5





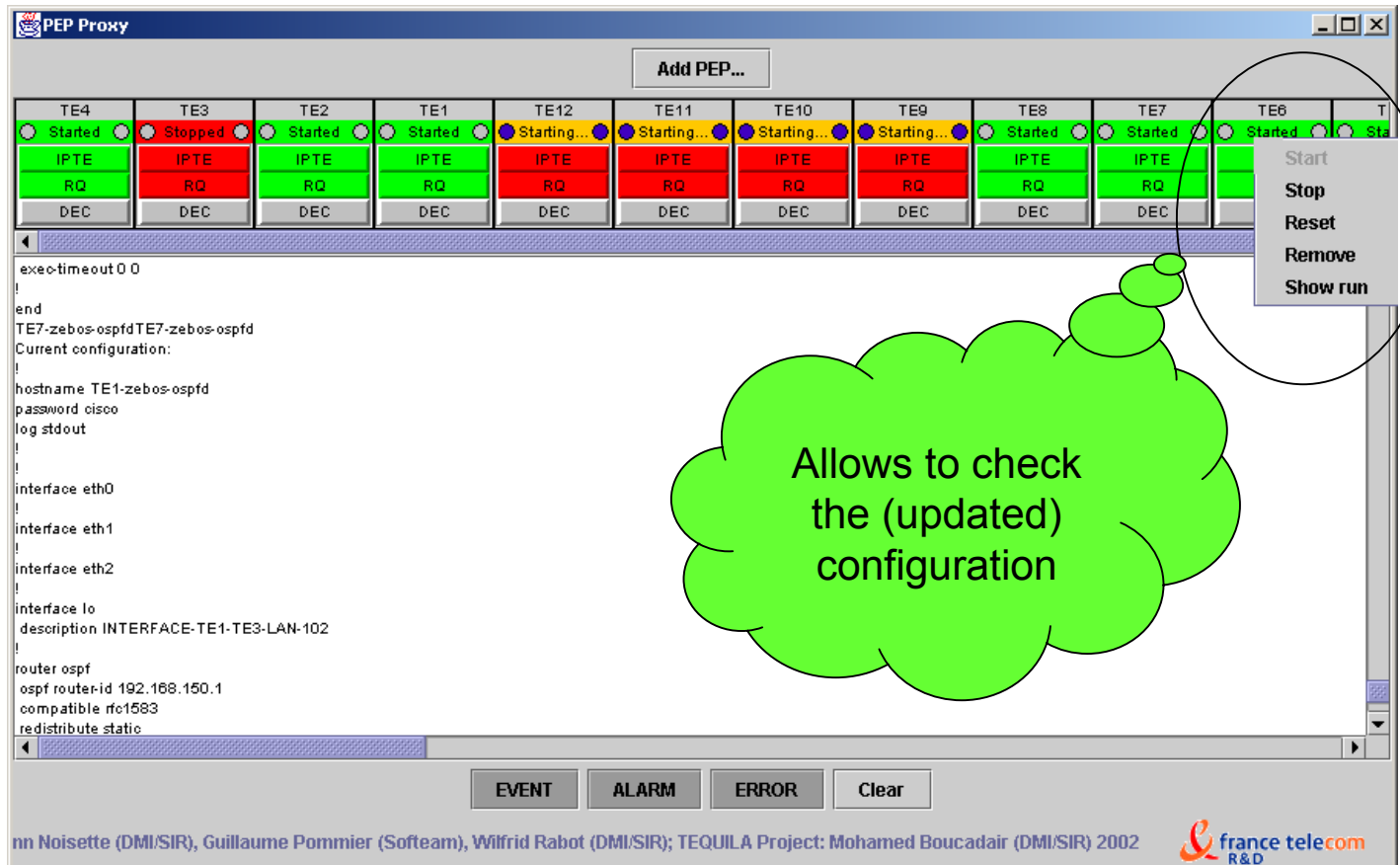
COPS-PR provisioning of the configuration information

- By sending (unsolicited) DEC messages:

The screenshot shows a software interface for PDP (Policy Decision Point) management. At the top, there is a 'Get All states' button. Below it is a grid of 12 TE (Terminal Equipment) units, labeled TE1 through TE12. Each unit has a status bar with 'D P I E' and a 'DEC' button. The status bars for TE6 and TE7 are highlighted in green, while others are red. A 'Show PIB' button is located between TE6 and TE7. Below the grid, there is a scrollable text area displaying configuration details for 'ospfTeMetrics 1.3.6.1.4.1.104.2.1.1.2 - INSTALL_NOTIFY - INSTALLED'. A callout bubble points to this text area with the text 'Views the contents of the updated PIB'. At the bottom of the interface, there are buttons for 'EVENT', 'ALARM', 'ERROR', and 'Clear'. The footer contains the text: ', Guillaume Pommier (Softeam), Wilfrid Robot (DMI/SIR); TEQUILA Project: Mohamed Boucadair (DMI/SIR) 2002' and the 'france telecc R&D' logo.



- By sending RPT messages towards the PDP:



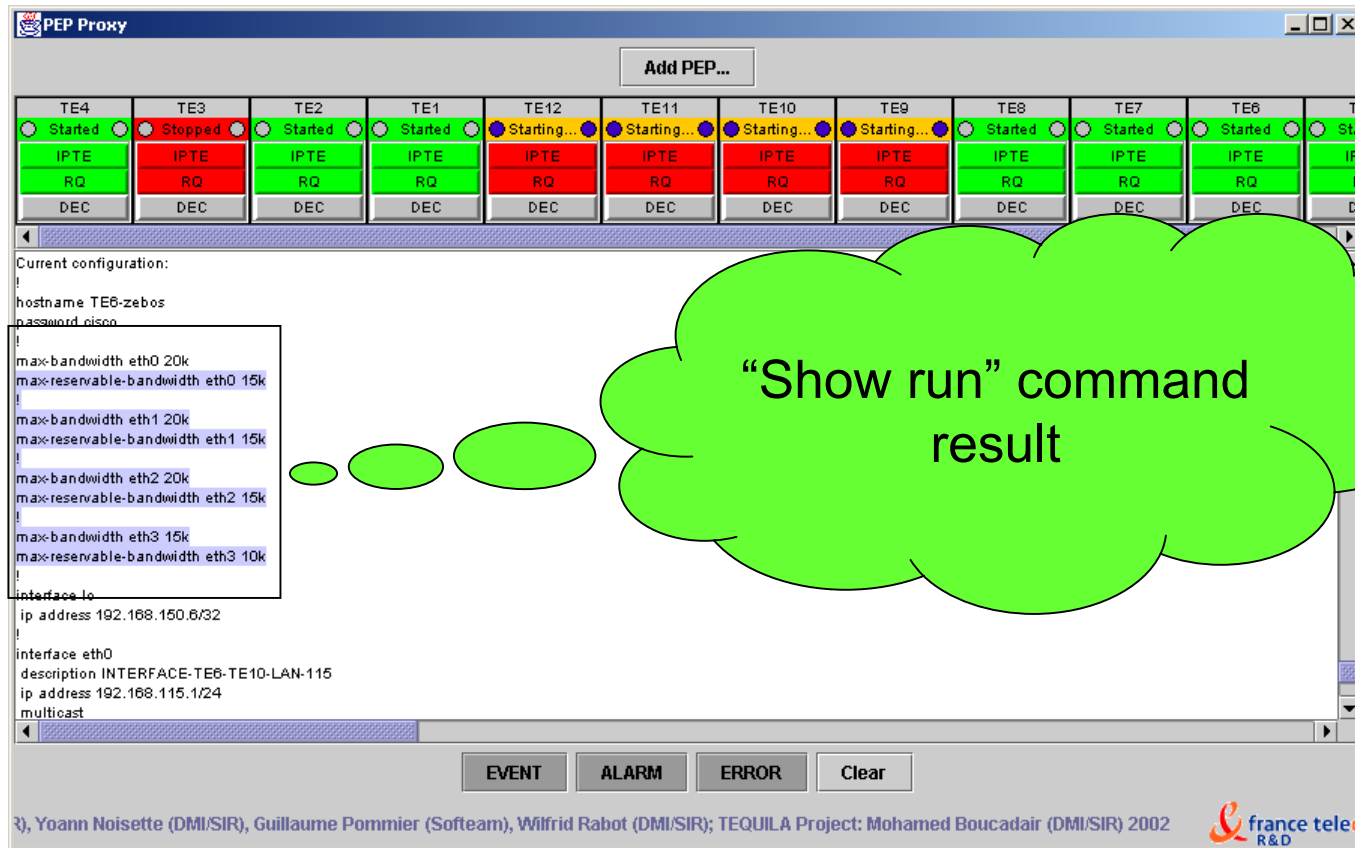
The screenshot shows the PEP Proxy interface with a table of TE nodes and their configurations. A green thought bubble highlights the configuration details for TE1.

TE4	TE3	TE2	TE1	TE12	TE11	TE10	TE9	TE8	TE7	TE6	TE5
Started	Stopped	Started	Started	Starting...	Starting...	Starting...	Starting...	Started	Started	Started	Starting...
IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE
RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ
DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC

```
exec-timeout 0 0
!
end
TE7-zebos-ospfd TE7-zebos-ospfd
Current configuration:
!
hostname TE1-zebos-ospfd
password cisco
log stdout
!
interface eth0
!
interface eth1
!
interface eth2
!
interface lo
description INTERFACE-TE1-TE3-LAN-102
!
router ospf
ospf router-id 192.168.150.1
compatible rfc1583
redistribute static
```

Allows to check the (updated) configuration

- Checking the router's configuration:



The screenshot shows the PEP Proxy interface with a table of TE nodes and their configurations. A thought bubble highlights the 'Show run' command result for TE6.

TE4	TE3	TE2	TE1	TE12	TE11	TE10	TE9	TE8	TE7	TE6	TE5
Started	Stopped	Started	Started	Starting...	Starting...	Starting...	Starting...	Started	Started	Started	Starting...
IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE	IPTE
RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ	RQ
DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC

Current configuration:

```
hostname TE6-zebos
password cisco
!
max-bandwidth eth0 20k
max-reservable-bandwidth eth0 15k
!
max-bandwidth eth1 20k
max-reservable-bandwidth eth1 15k
!
max-bandwidth eth2 20k
max-reservable-bandwidth eth2 15k
!
max-bandwidth eth3 15k
max-reservable-bandwidth eth3 10k
!
interface lo
ip address 192.168.150.6/32
!
interface eth0
description INTERFACE-TE6-TE10-LAN-115
ip address 192.168.115.1/24
multicast
```

“Show run” command result



Current restrictions

- Syntax correctness is not checked by the current PIB parser
 - Some syntax errors have been detected
- The PEP capability is external
 - Native PEP support available in June





Preliminary performance results

- On the benefits of the COPS-PR approach:
 - Manual configuration of the 12-router platform takes about 1 hour
 - COPS-PR configuration procedure takes less than 5 minutes
- On the support of the TE extensions to OSPF:
 - Negligible impact on the switching performances of the routers
 - Less than 5% on PC-based routers

