Attaching Dynamic clusters to CLUSTERIX
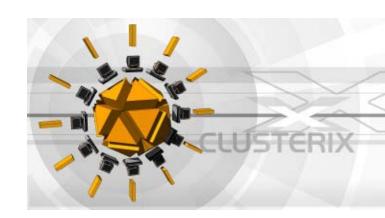
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Presentation outline

- ➢ Cumulus metacluster description
- ➢ Clusterix Grid overview
- ➢ Dynamic clusters attachment procedure
- ➢ Conclusion, future work

Work motivation

- ➢ Creation of a parallel processing environment
- ➢ Joining the Clusterix
  - Access to a nation-wide Grid environment
  - Higher computational power
  - Higher availability

Dynamic clusters

Two possibilities

➤ Clusters which are dynamically and attaching and detaching to a grid environment

➤ Clusters created from the machines operating part-time detacheted from their cluster to perform other duties

Cumulus computational environment

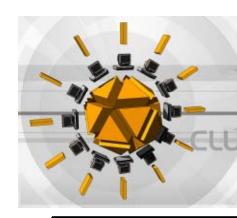Grid environment with full access to the underlying hardware and software infrastructure

Requirements:

- Cost effective – utilizes existing hardware infrastructure
- Not invasive – no large modifications to the existing infrastructure needed
- Cohabitative – no degeneration of the existing functionality
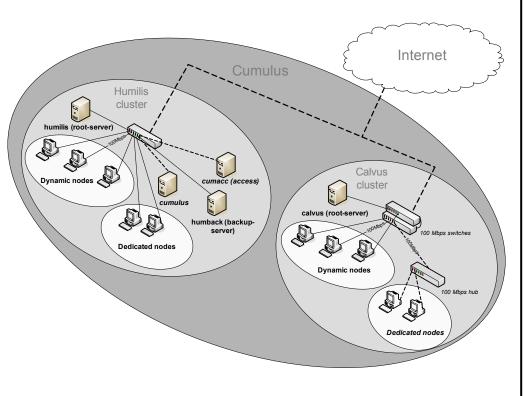- Useful – meets our scientific and educational requirements

Cumulus environment characteristics

- ➢ Fully controllable – the nodes are fully dedicated to the cluster
- ➢ Modifications only in the "cluster space"
- ➢ Operates when the machines are not utilized
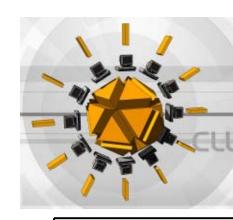- ➢ Not fully available – works only part-time

Model extensions

> Addition of dedicated nodes - full availability

> Dual mode of operations - as a local computing environment and as a part of a computational Grid

Installed software

- oneSIS single image system
- TORQUE resource manager
- Maui cluster scheduler
- Ganglia monitoring system (http://calvus.lab.wiz.pwr.wroc.pl)
- Parallel processing environments (MPICH, PVM, ...)
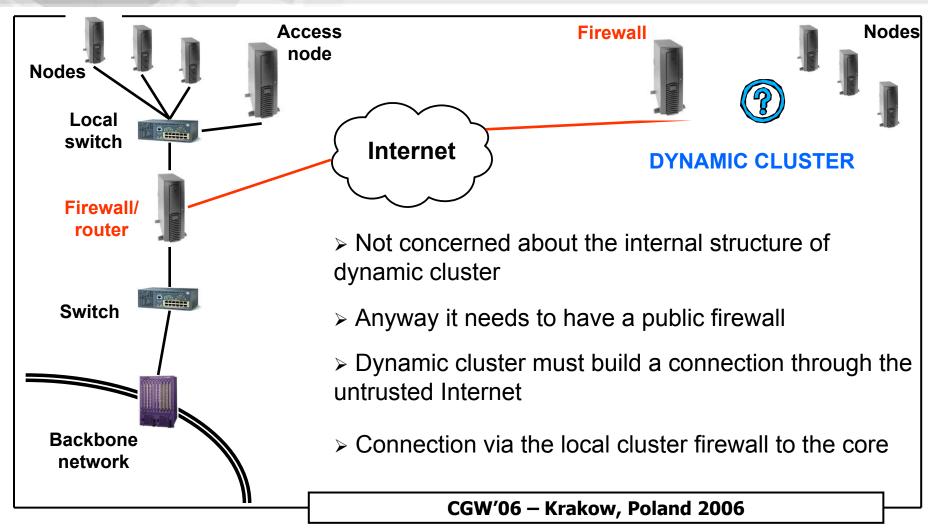- Globus Toolkit
- …

Clusterix overview

➢ The set of tools that allow the deployment of a Grid environment

➢ Basic infrastructure - local linux clusters geographically distributed, located in independent centers connected by the fast backbone provided by the Polish Optical Network PIONIER (10 Gbps)

➢ There are available static and dynamic Linux clusters connected by the basic infrastructure

Adding Dynamic Cluster

Nodes

Access node

Firewall

Nodes

Local switch

Internet

DYNAMIC CLUSTER

Firewall/ router

Switch

Backbone network

➢ Not concerned about the internal structure of dynamic cluster

➢ Anyway it needs to have a public firewall

➢ Dynamic cluster must build a connection through the untrusted Internet

➢ Connection via the local cluster firewall to the core

Clusterix Network Architecture

Clusterix Storage Element   PIONIER Core Switch

Local Cluster Switch

Access Node

1 Gbps

Backbone Traffic

Computing
Nodes

Communication &
NFS VLANs

Internet Network

Router
Firewall

Internet Network
Access

Gdańsk
Szczecin
Białystok
Poznań
Warszawa
Zielona
Góra
Łódź
Lublin
Wrocław
Częstochowa
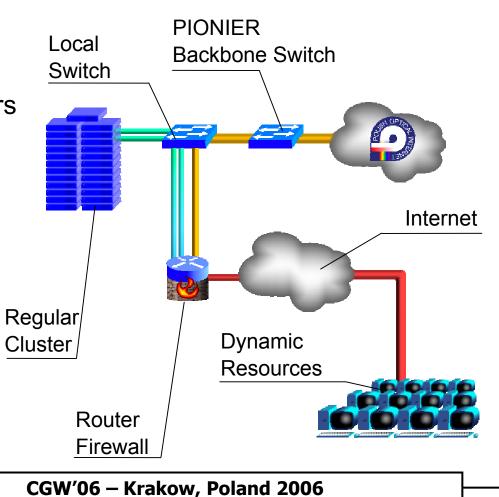Opole
Kraków

Dynamic Computing Resources - Architecture

Dynamic cluster attachment

- Requirements needs to be checked against new clusters
    - Installed software
    - X.509 certificates
- Communication through router/firewall
- New resources will be automatically discovered
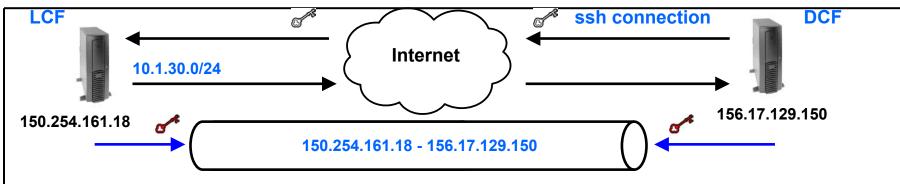- Dynamic clusters can be utilized as the regular ones

Local Switch

PIONIER Backbone Switch

Internet

Regular Cluster

Dynamic Resources

Router Firewall

Attaching Prerequisities

- Firewall in local cluster in the core (LCF):

    - dedicated user account for dynamic clusters attachement

    - *dclctl* management script installed

    - the script configured for *ip, ifconfig, iptables* commands execution

- Dynamic cluster firewall (DCF):

    - knows public IP address of the LCF

    - ssh key for communication with the LCF

    - X.509 key for IPSec tunnel creation

Attachment procedure

LCF   ssh connection   DCF

Internet

10.1.30.0/24

150.254.161.18

156.17.129.150

150.254.161.18 - 156.17.129.150

➢ **Step 1:** DCF connects to LCF through SSH and by logging to the special account invokes *dclctl* script

➢ **Step 2:** The script on LCF determines DCF IP and finds appropriate configuration settings and send the address range to DCF

➢ **Step 3:** LCF updates firewall and routing configuration, creates the tunnel from the local cluster side

➢ **Step 4:** DCF receives its address and prepares its end of the tunnel

➢ **Step 5:** Using ICF protocol and X.509 certificates DCF and LCF create IPSec tunnel

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Conclussions and future work

➢ As a result of our work we received fully satisfactory environment for parallel and distributed processing

➢The environment can be accesed locally as well as from the Clusterix National Grid

➢Currently we are evaluating the utilization of virtualisation techniques in dynamic clusters

Thank you for your attention