Inter-domain advance reservation of coordinated network and computing resources over the Pacific

A G-lambda & Enlightened collaboration



EnLIGHTened Project Overview

- Established in 2005, is a NSF seed-funded collaborative interdisciplinary research initiative that seeks to research the integration of optical control planes with Grid middleware under both highly dynamic and advanced reservation application requests. Team: MCNC, LSU, NCSU, RENCI, Cisco, AT&T, Calient
- The focuses are on research and integration of cross-layer (applications, Grid resource co-scheduling, and optical network control plane) and interactions between Management, Control plane and Grid middleware.
- The goal of the Enlightened research project is establishing dynamic, adaptive, coordinated, and optimized use of networks connecting geographically distributed high-end computing and scientific instrumentation resources for faster problem resolution.



The Enlightened Team



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CISCO SYSTEMS

EMPOWERING THE INTERNET GENERATION'







G-lambda project overview

- Joint project of KDDI R&D labs., NTT, NICT and AIST.
- G-lambda project has been started in December 2004.
- The goal of this project is to establish a standard web services interface (GNS-WSI) between Grid resource manager and network resource manager provided by network operators.





The G-lambda Team

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- "Automated" interoperability between network and computing resources in two countries' grid computing research testbeds is shown
 - The first such experiment of this scale between two countries
- Integrated computing and communication technology
 - Automated simultaneous in-advance reservation of network bandwidth between the US and Japan, and computing resources in the US and Japan
 - World's first inter-domain coordination of resource mangers for inadvance reservation
 - Resource managers have different I/F and are independently developed



US Japan EL GL FI Application Application App. Launcher wrapper EL **GNS-WSI** GL **Grid Resource Grid Resource** GL EL GL EL Coordinator Scheduler **GNS-WS CRM** wrapper wrapper HARC APAN US Acceptor KDDI ΈL NTT NRM NRM NRM CRM CRM CRM CRM CRM CRM CRM CRM Cluster Cluster Cluster Cluster Cluster Cluster Cluster Cluster

G-lambda/Enlightened middleware coordination diagram

Resource map



Demo overview

- 1. G-lambda makes a reservation. Reservation status will be shown.
- 2. Enlightened makes a reservation. Reservation status will be shown.
- 3. When the reserved time arrives, applications start running.
- 4. Activated paths and computing resources will be shown on MonALISA and RNDS.
 - Enlightened Viz client will show a blackhole.
- 5. (optional) reserve one more job from G-lambda



Enlightened: Visualization of remote data

- Data generated by remote simulation
- •Here : a black hole simulation
- •Need to explore and visualize the dataset
- Enhanced Amira
 visualization system to take
 advantage of optical
 networks



- Data available at multiple sites
- Distribution can be beneficial (parallelism, caching options, executing simple operations)
- A distributed data server (using the optical networks) can be faster than the local disk



G-lambda: QM/MD simulation

- Surveying a chemical reaction path by Nudged Elastic Band method
 - calculating system configurations during the reaction in parallel



Conclusion

"Automated" interoperability between network and computing resources in two countries' grid computing research testbeds is successfully demonstrated.

The first such experiment of this **SCale**

- Automated simultaneous in-advance reservation of network bandwidth between the US and Japan, and computing resources in the US and Japan
- World's first inter-domain coordination of resource mangers for inadvance reservation

G-lambda http://www.g-lambda.net/

Enlightened Computing http://www.enlightenedcomputing.org/