Cost Effective Testbeds and Code Parallelization Efforts

Annual Review and Planning Meeting
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Cost-effective Testbeds

- **Vision**
  - **To integrated cost-effective high-performance systems into NASA Information Power Grid (IPG) and to show the US aerospace industry the capabilities of Grid Computing.**
- **Objective**
  - **To develop in cooperation with other NASA centers a distributed computational environment capable of executing full 3-D aerospace propulsion applications.**

Cost-effective Testbeds

- This Cost-effective Testbeds task provides for the operation, maintenance, and support of the local GRC systems. It also provides initial user support. As part of providing the IPG testbed, the task provides local support for the Globus software and other grid services. A related effort is the evaluation of CORBA as the application interface to grid systems, including the provision of CORBA security services. In addition the computing testbeds are to provide a development environment for the grand challenge application.

FY02 Accomplishments

- A compressible Lattice Boltzmann (LB) model has been successfully developed for turbomachinery simulations. Successful simulation of cascades has been carried out and it is the first successful turbomachinery simulation by a LB model. The parallel performance of the simulation was also outstanding, a 400:1 speedup was archived using 500 CPUs.
- A new upgrade to the Aeroshark cluster was procured and delivered to GRC. This upgrade focuses on faster CPUs and better interprocessor communications.
- Demonstrated a 3D simulation using CORBA over the Information Power Grid. VULCAN (Viscous Upwind ALgorithm for Complex Flow ANalysis) Code was used for this simulation.

FY02 Accomplishments

- **The IPG tem at GRC had a major contribution to the completion of a PCA milestone for CICT/CNIS project. The team worked for months with ARC researchers to get their applications running on our clusters.**

Milestones

- **FY03**
  - **Test and document the use of high performance interconnects on Commodity Based Cluster (4th Qt.).**
  - **Demonstrate coupling of high fidelity aerospace propulsion codes using CORBA on the Information Power Grid. (4th Qt.)**
- **FY04**
  - **Demonstrate and document the use of alternative schedulers capable of integrating seamless into the grid. (2nd Qt.)**
  - **Demonstrate a cost performance ratio of at least 15:1 on commodity based cluster vs. traditional UNIX clusters using an aerospace propulsion application. (3rd Qt.)**
- **FY05**
  - **Demonstrate hybrid network communication tool for applications utilizing the mobile and terrestrial grid (2nd Qt.)**
  - **Provide Seamless and Autonomous Information Power Grid Support to CORBA-Enabled Applications (2nd Qt.)**
  - **Upgrade commodity based cluster to 512 64bits CPUs (3rd Qt.) (Over guideline funds required for this milestone)**

Technical talks

- **Aeroshark Cluster Upgrade**
- **CORBA highlights**
- **A LATTICE BOLTZMANN METHOD FOR TURBOMACHINERY SIMULATIONS**

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Commodity Based Cluster “Aeroshark”

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Why Commodity Based Clusters?

- **Provide a cost-effective platform for running aerospace application.**
- **Introduce a heterogeneous component to NASA Power Grid**

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CBC upgrade
Why it was needed?

- **In order to better impact more advanced simulations**
- **To make available a larger number of processors to a single simulation**
  - **Faster interconnects**
- **To bring cluster technology to current state of the art**

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CBC upgrade

Old cluster numbers:

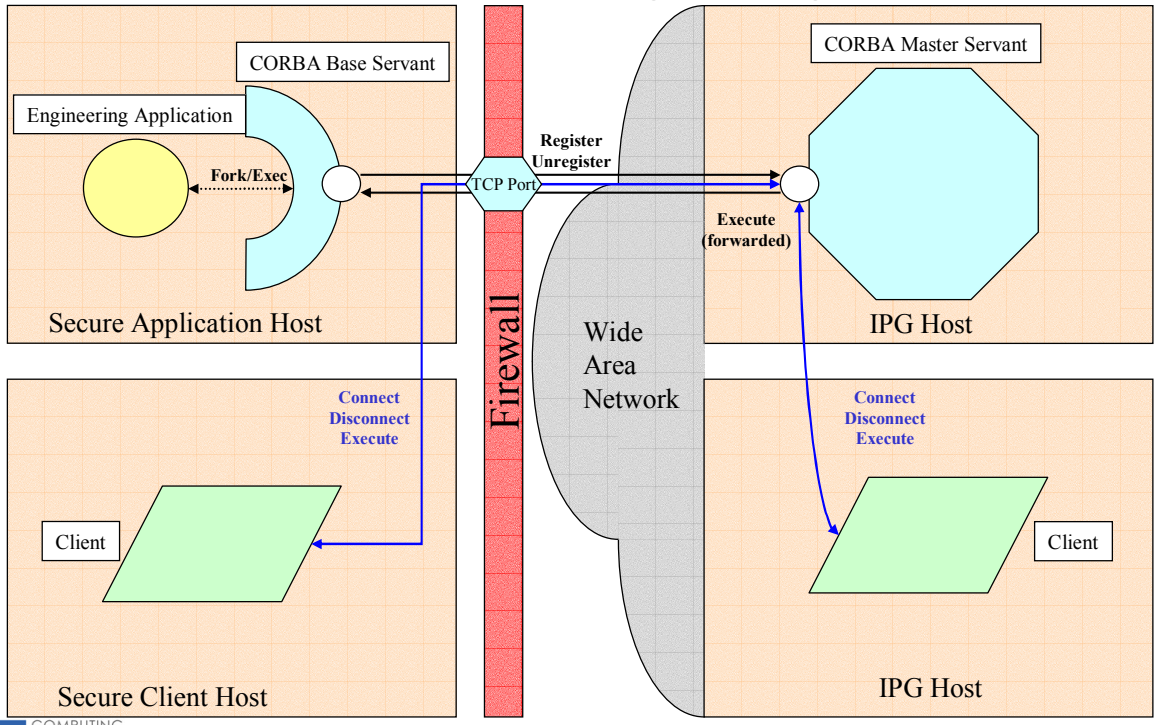
- Processor speed: 600 MHz
- Memory speed: 100 MHz
- Memory/node: 512 MB
- Memory total: 32 GB
- Network bandwidth: 100 Mbps
- Network latency: 0.1 ms (1 x 10^-4 s)
- PCI bus peak performance: 132 MByte/s

New cluster numbers:

- Processor speed: 1667 MHz
- Memory speed: 266 MHz
- Memory/node: 1024 MB
- Memory total: 64 GB
- Network bandwidth: 2,000 Mbps
- Network latency: 7 ns (7 x 10^-9 s)
- PCI bus peak performance: 528 MByte/s

CORBA Highlights

Bi-Directional IIOP Enables Cross-Firewall Interactions for Secure, Grid-Enabled Engineering Applications



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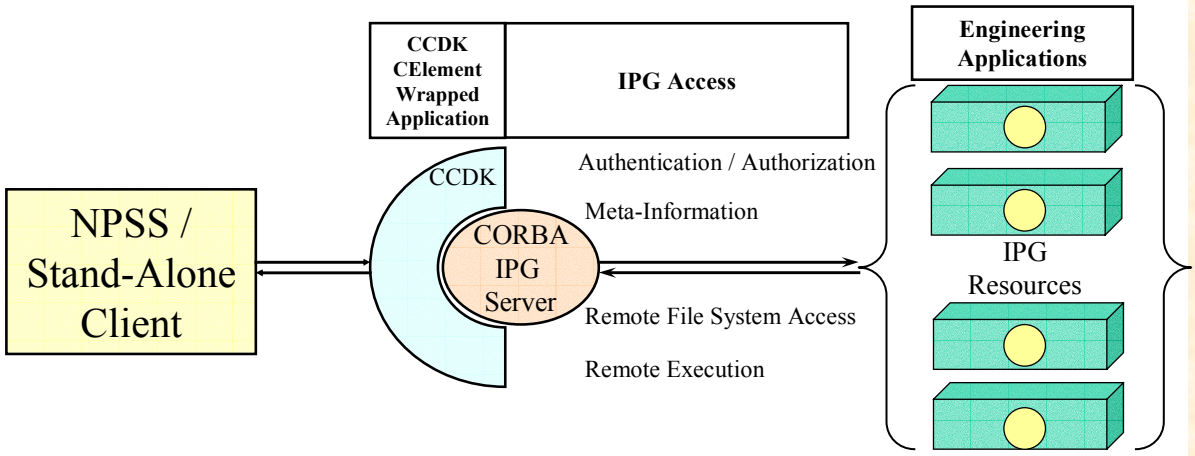
Integration of IPG with the NPSS CORBA Component Developers Kit



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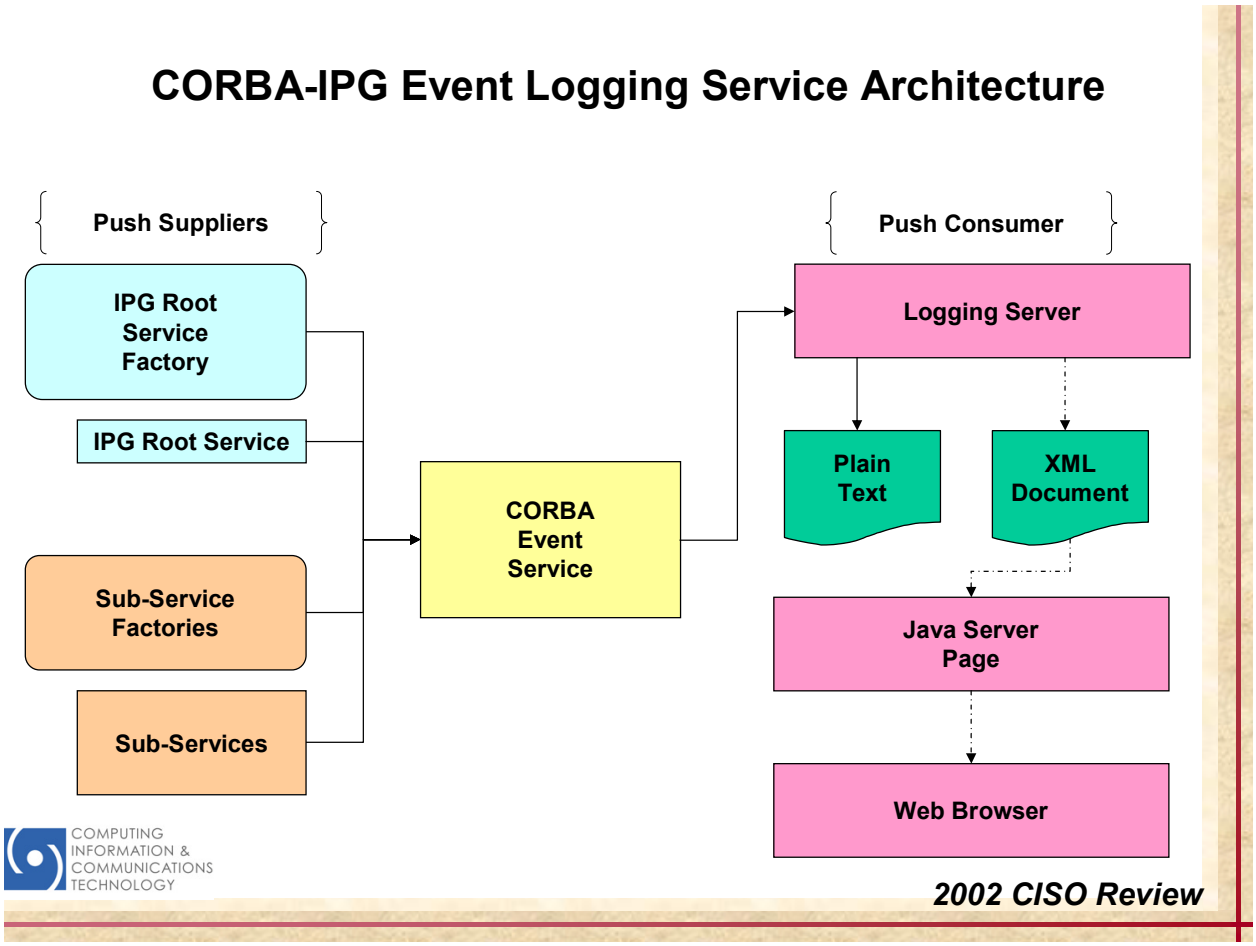
CORBA-IPG Event Logging Service Architecture
Push Suppliers
Push Consumer
IPG Root Service Factory
IPG Root Service
Sub-Service Factories
Sub-Services
CORBA Event Service
Logging Server
Plain Text
XML Document
Java Server Page
Web Browser
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