# Paradyn and Globus: Instrumentation for High-Performance Network Applications

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## Networked Applications

- Couple multiple computers to solve very large problems
- Interactive use of remote computation
- Enable collaboration within shared virtual environment
- Mine information at multiple sites
- Scientific instruments enhanced with computation

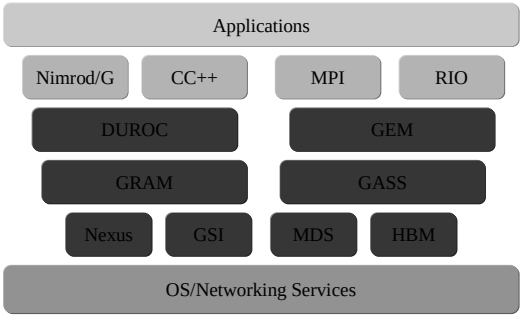
## Goals

- Explain performance of network applications
- Detect system components that do not meet performance contracts
- Support for adaptivity in tools and applications

## Globus Toolkit (Argonne/USC-ISI)

- A set of components providing core services required for networked applications
  - Information, resource management, security, communication, fault detection, data access, etc.
- Used to implement higher-level tools (e.g., MPI, CC++, CAVERN) and applications
- Deployed on international testbed including 20 sites in U.S. and Europe

## Globus




## Issues

- Many types of components: computers, networks, protocols, system software, etc.
- Large numbers of components
- Sharing and lack of global control, hence dynamic behaviors
- Wide range of performance characteristics
- Incomplete knowledge of system structure
- High data rates

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## Why Are We Interested In Paradyn?

- High data rates
  - 100s of nodes, Gb/s networks, etc.
  - ⇒ Post-mortem diagnosis infeasible
- Need to instrument multiple components
  - Application, tool, protocols, local OS
  - ⇒ Can't rely on availability of source code
- Hence adaptive placement of instrumentation seems promising

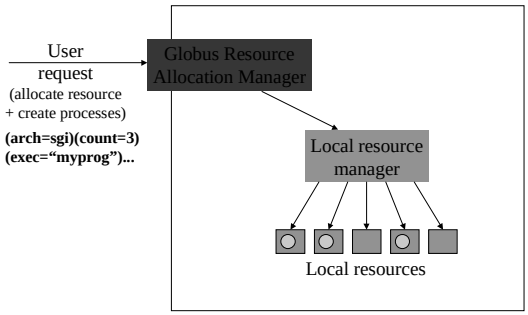
## Alternative Approach

- WHERE (LBNL)
- KQML agents downloaded to network components
- Local resource management API allows access to locally collected data, also control
- Used for system management, instrumentation, etc.
- Clearly less flexible, but perhaps flexible enough?

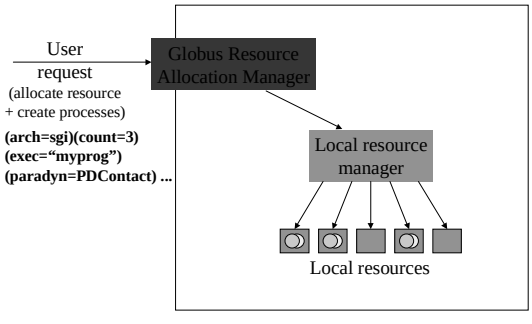
## Initial Steps

- Integrate Paradyn with Globus resource and process management mechanisms
  - Hence allow "seamless" startup of instrumented applications
- Develop instrumentation for Globus communication library (Nexus)
  - Bandwidth, loss rates, jitter, etc.
- Experiment with use in applications

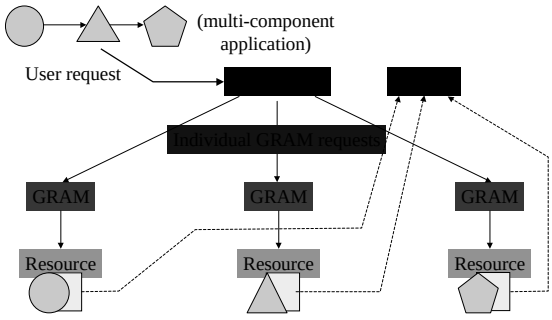
## Globus Resource Management




## Paradyn Integration




## Paradyn Integration (cont.)

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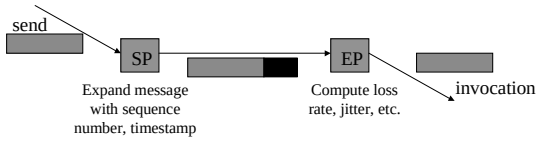
## Nexus Instrumentation

- Communication link: startpoints→endpoints
- Comm methods selected on per-CL basis
- User-managed transforms for encryption, compression … and instrumentation




- Dynamic insertion of transforms?

## Challenges

- Synchronized insertion of instrumentation (e.g., addition of sequence numbers to messages)
- Collection, analysis, and display techniques to deal with heterogeneous applications
- Hierarchical processing and analysis of data
- Instrumentation of Globus components
- Lack of SGI version of Paradyn

## Summary

- Network computing introduces new performance challenges
  - explaining performance & diagnosing problems
  - adaptivity to provide performance guarantees
- Dynamic instrumentation seems promising due to high data rates & lack of control
- Paradyn + Globus integration & application experiments are just starting

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