

The QoS Challenge

- ❑ The Internet provides the opportunity to conduct business at vastly **increased scales** using a **shared-cost infrastructure**
- ❑ However, to take advantage of this opportunity, companies are “increasingly dependent on large-scale distributed systems that operate in **unbounded network environments**” (IEEE *Internet Computing* 11/99)

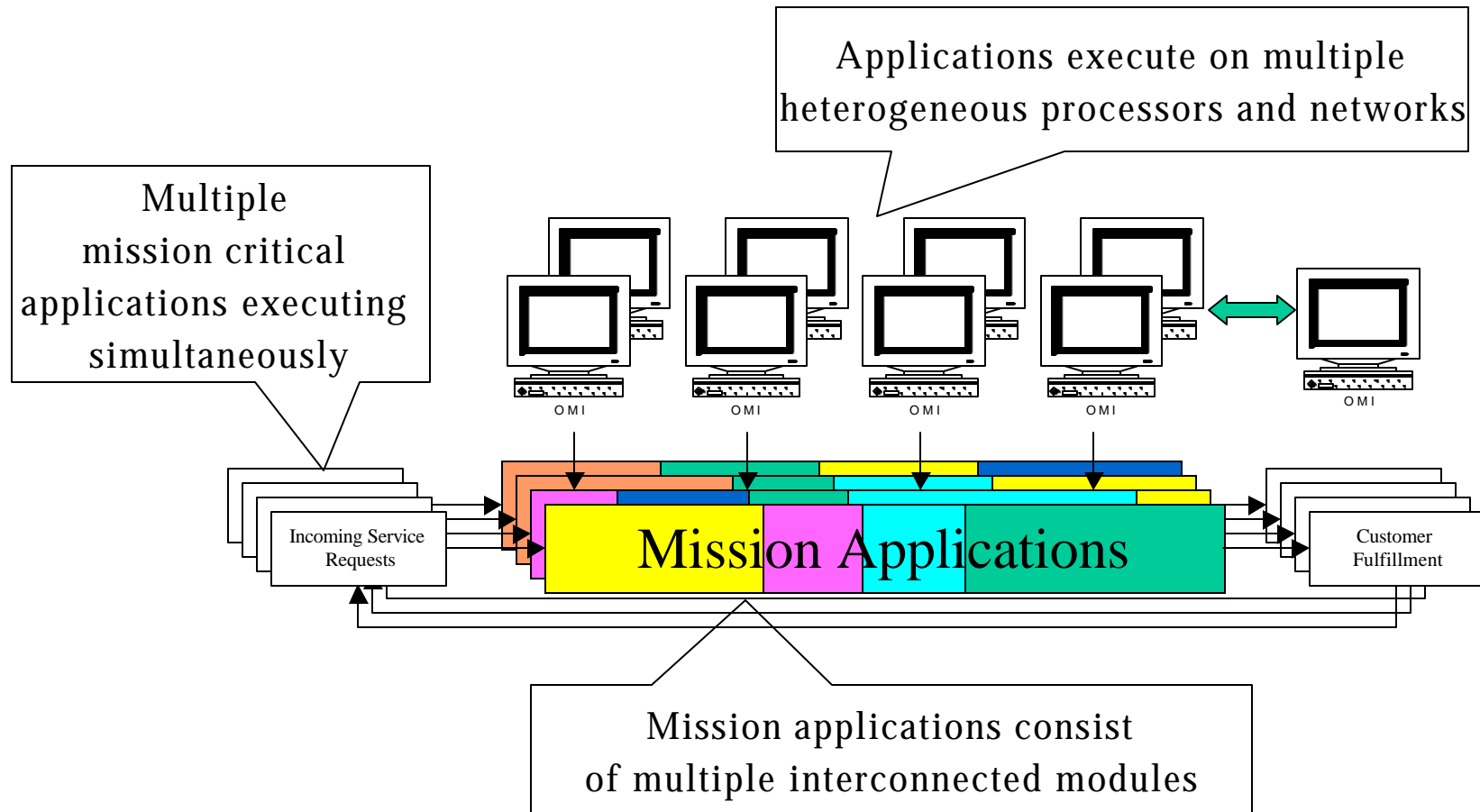
QoS Opportunity

- ❑ As value of transactions on unbounded networks grow, companies will seek guarantees of dependability, performance, and efficiency for distributed applications and networks.
- ❑ To provide adequate levels of service to customers, companies need same level of assured operation as they got from the mainframe “Glass House”
 - End-to-end performance
 - Availability and Fault Resilience
 - Adaptivity to changing load and network conditions

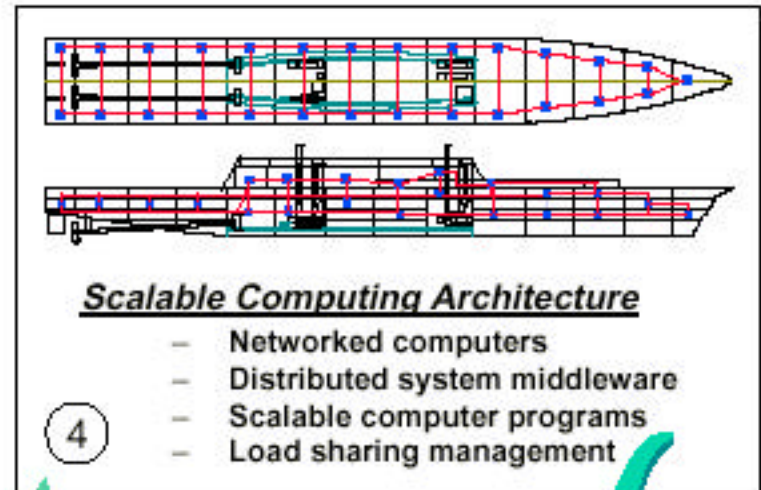
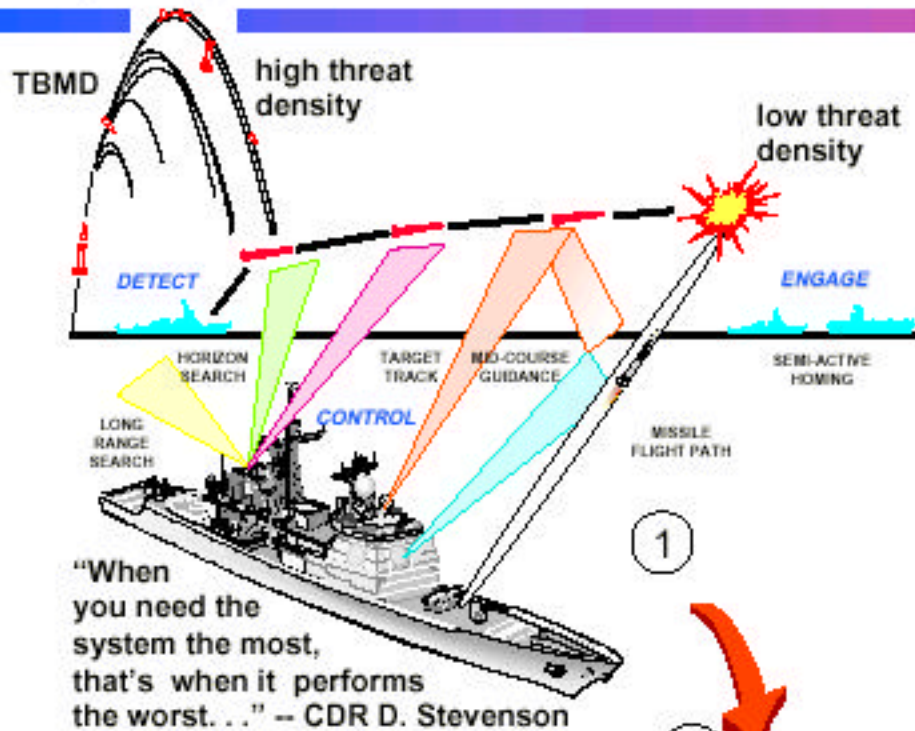
Basis for End to End QoS Solutions

- ❑ Government research is developing a wide set of techniques for providing end-to-end service guarantees in distributed LAN and WAN computing and communications environments
- ❑ Internet equipment vendors (e.g. Cisco) are starting to deploy the building blocks of QoS for the internet
 - Differentiated Services support in routers
- ❑ Combinations of government and emerging commercial QoS technologies can provide the guarantees that mission critical military and e-commerce systems will need for their critical end to end transactions

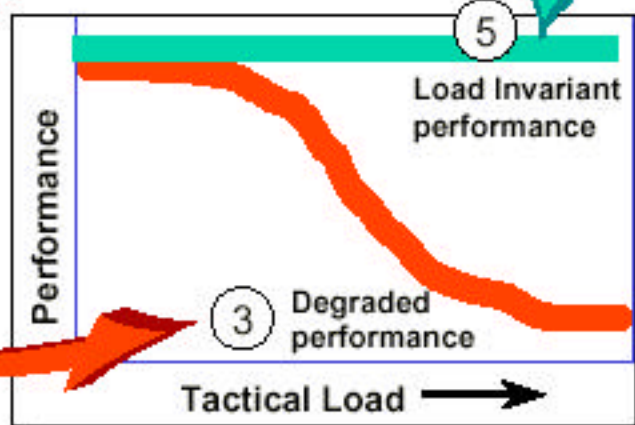
The Managed QoS Environment



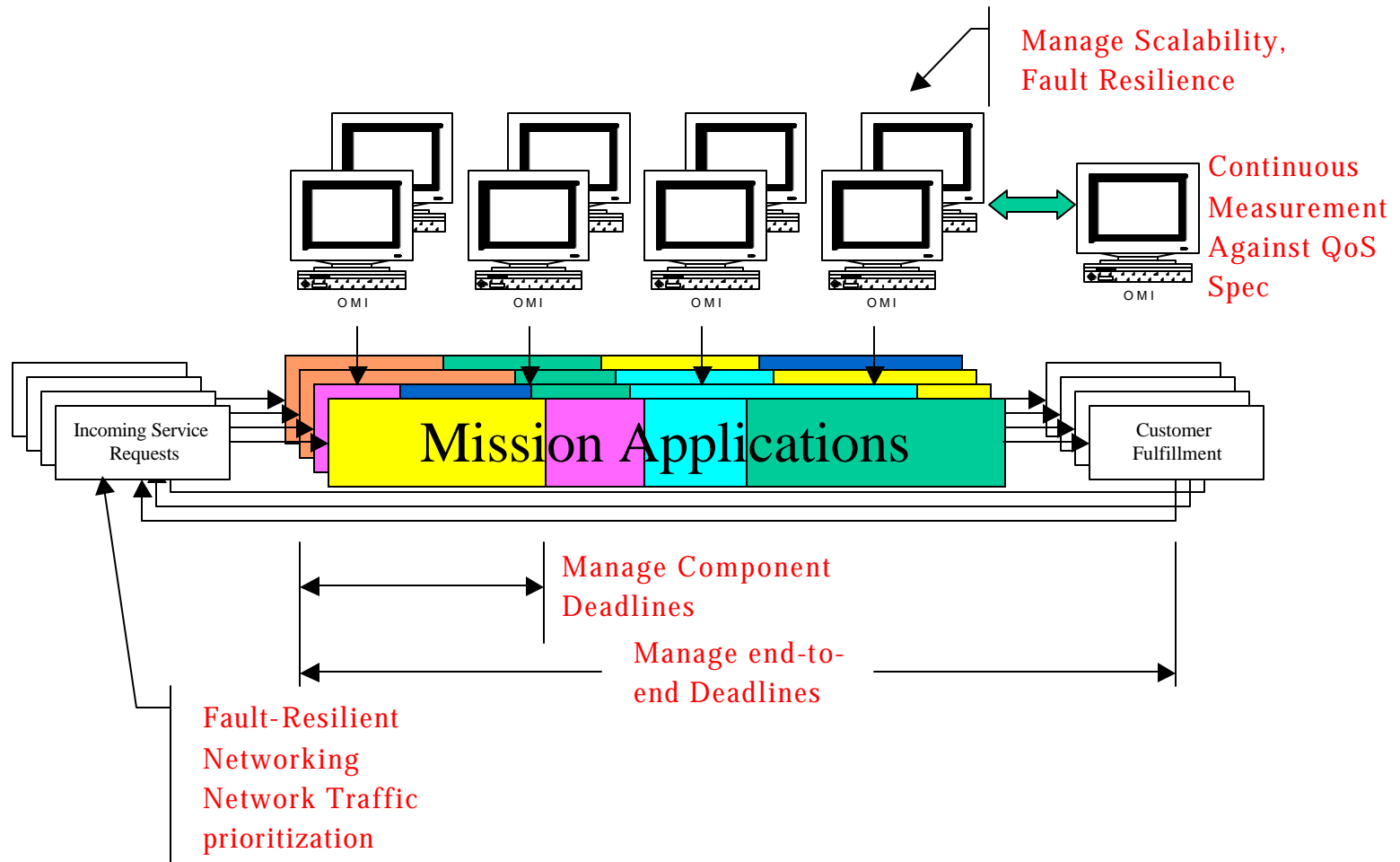
SCALABLE PERFORMANCE



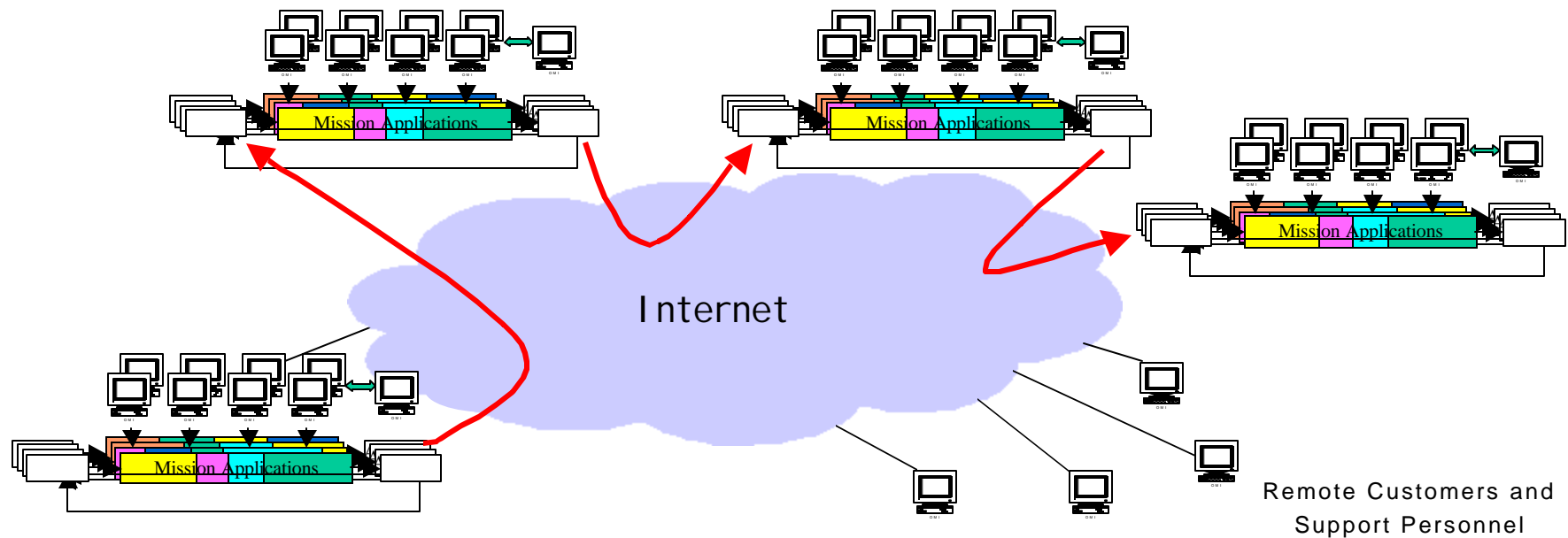
- Today's systems often exhibit degraded performance as tactical load increases
- Systems may be over-designed for worst case; this increases complexity & cost
- Scalability provides constant performance despite load & allows sharing of resources



Managed QoS Technology Impacts

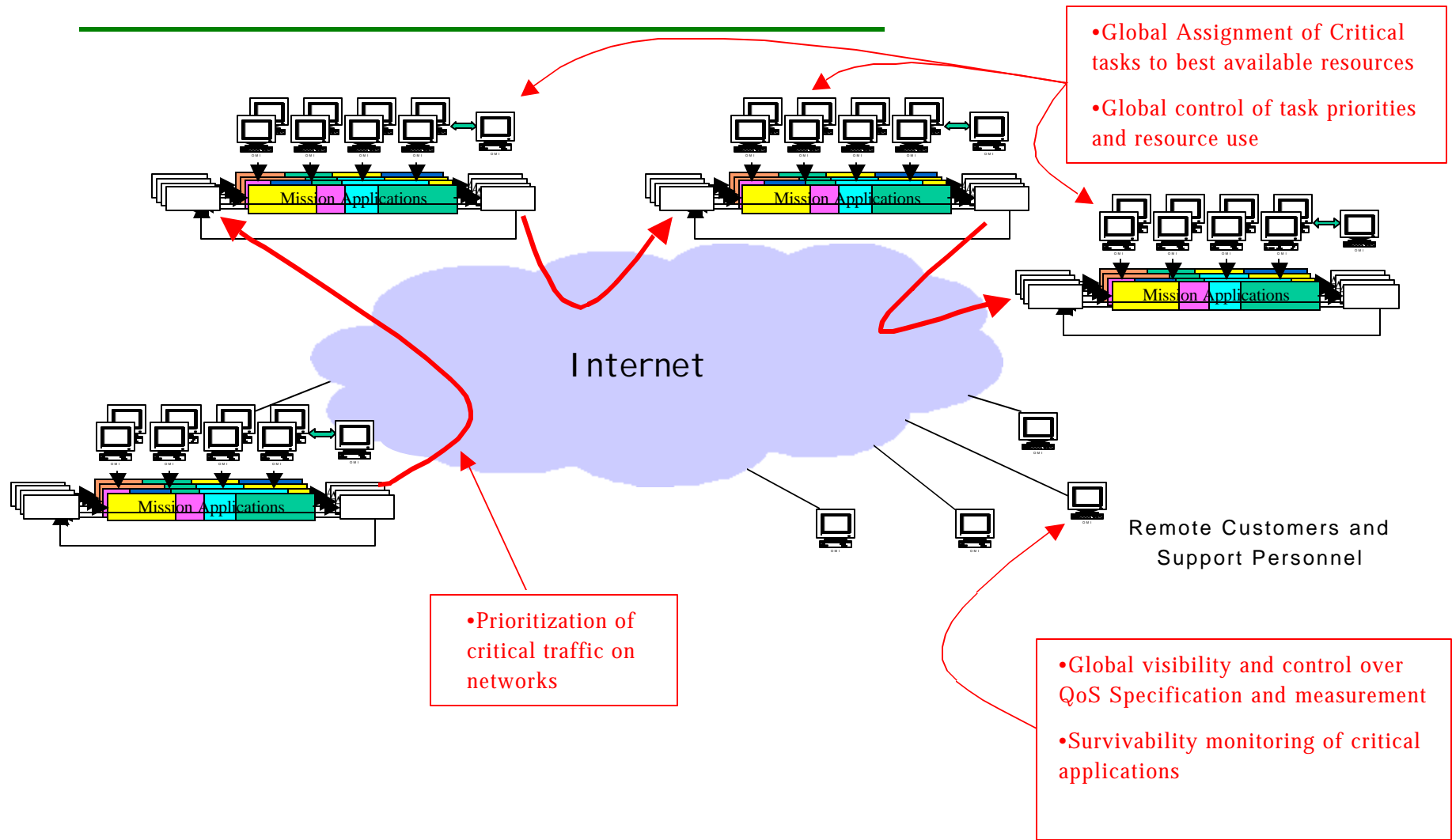


Wide-Area Managed QoS



- ❑ **Dependence on *Multiple Linked Services*:** Critical services depend on Quality of Service (QoS) from multiple sites, as well as from Remote Personnel Support Sites
- ❑ **Lack of QoS *Visibility & Control*:** IT personnel can not specify, measure or control the QoS of the linked services that business depends on.
 - Services received on “best efforts” basis
 - Cannot set priorities
 - Results in intermittent critical end to end System QoS failures.

Wide-Area Managed QoS Technology Impacts



QUITE

- ❑ Integration of 40+ QoS research projects sponsored under DARPA Quorum program
- ❑ Quorum program goal: develop innovative software-based approaches to end-to-end QoS
- ❑ QUITE provides testbed, characterizes and combines promising research results, transfers technology to government and commercial markets

QUITE Capabilities

- ❑ QoS Specification And measurement
- ❑ Layered Resource Management
- ❑ Fault Tolerance/Resilience

QUITE Capabilities

- ❑ **QoS Specification:** Tools to specify the expected performance and availability of critical computing and network service links.
- ❑ **QoS Measurement:** - QoS Metrics Services (*QMS*). A mechanism for measuring and reporting on actual QoS being delivered

QUITE Capabilities

- ❑ **Resource Management:** Software that compares specified to delivered QoS and allocates computing resources to maintain specified service levels
 - *DeSiDeRaTa* - middleware that schedules pieces of applications on multiple computers so that components of an end-to-end path **meet fixed processing deadlines** regardless of load.
 - *Globus* - software to assign computing tasks to groups of processors based on **matching available resources to task needs**.

QUITE Capabilities (3)

- ❑ **Fault Tolerance:** Software which maintains service during system or network failures
 - *AQuA* - extensions to CORBA services such that **CORBA objects can be transparently fault-tolerant.**
 - *DeSiDeRaTa* - Maintains specified number of redundant copies
- ❑ **CPU Control:** *Quasar* - operating system extensions that can guarantee that critical processes get a fixed percentage of computer resources.

QUITE Capabilities

- ❑ **Bandwidth Management:** *HPF* - network software which can denote one flow of network traffic and deliver it reliably in the face of competing, lower-priority traffic.
- ❑ **QoS tools:** *QuO* - a way of adding QoS capabilities to CORBA objects. Already integrated with fault tolerance and bandwidth management.

CORDS and GIPC

- ❑ **CORDS**: A framework for constructing high-performance, real-time communication protocols
- ❑ **GIPC**: A protocol (built using CORDS) which offers **real-time group communication** services
 - All members of group are **guaranteed to receive messages in identical order**
 - Rapid recovery from failure of group member