Roadmap for Research Programs to Support the National Information Infrastructure

	Algorithms	Architectures	Tools	Networks	Languages	Applicatio
ollaborative odeling day's Grand Challenges	• physical models • matrix methods • spectral methods • reactive flows • molecular models • electronic structure • structural mechanics • n-body methods • optimization	• workstations • clusters • single MPP • vector computers • simple distributed sys • largely single domain • strong on Flops • weak on I/O • small data systems	• compilers • debuggers • auto parallel pre-X • event tracing • visualization • algorithm prototyping • libraries (MPI, p4) • "tool kits" • templates	• ethernet (LANs) • FDDI (LANs) • HIPPI (sub-LANS) • FCS (not yet) • ATM (not yet) • fiber infrastructure • long haul T1/T3 • experimental OC-48 • workstation peers	• Fortran 77 • C • C++ • HPF (not yet) • Fortran 90 (not yet) • Fortran M (not yet) • PCN • Linda • extensions vs new	• extensions of vec codes • physical models • few non-science • few engineering • mostly modeling design • little linkage to ex • batch still prime r
llaborative alysis and sign uted shared resources	• caching, browsing • MDA, MDO • statistics • comparative analysis • interactions • CAD linkage to models • database linkage • compression • automatic filters • neural networks	• workstation aggregates • MPP aggregates • heterogeneous nodes • cooperative systems • mobile nodes • database linkages • multimedia support • archival storage • data systems • I/O intensive	• multiuser AVS • multiuser MMA • hetero MATLAB • linkage CAD/MMA • linkage CAD/MPP • linkage CAD/DB • linkage CAD/MDA • multisite above • penbased interfaces	• gigabits to the desk • national filesystem • ATM combo • nonmetered • bandwidth on demand • high peak / low mean • aggregate for blasting • standard HW/SW • blasting protocol	• integrated analysis and CAD languages • MDO extensions • hetero parallel • fast MATLAB • AVS like extensions • OBJECT support • implicit I/O support • DB integration • analysis objects	• manufacturing of complex systems • analysis of 3ary science problems • rigorous analysis computational exp • simulation intens engineering
tual Reality and ltimedia iviewer interactive ibuted deployment	• projective geometry • rendering • kinematics • linkage to physics • new paradigms for visualization of data • interactions • compression • indexing • data movement	• CAVE^n • CAVE++ • HD-CAVE • HD-Goggles • body suit I/O • retinal imagers • 3-D projection • holographic display • holographic input • mobile links	• 3-D AVS • 3-D highend MMA • multisite CAVE env • 3-D tcl scripting • CAVE/ MOSAIC • Goggleland • connections • linkages • pad based kibitzing • scalability	• CAVE-to-CAVE • low latency sync lines • scaling up/down • 10's Gb each site • fanin/fanout problem • GB to each user • mobile head to head • LAN-MAN-WAN	• 3-D and VR extension • VR objects • parallel objects • parallel interacting agents • coupling to world DBs • visual programming • visual tuning • pen based sketches • 3-D story boards/lang	• medical imaging • remote explorati • database mining • education • telecollaboration • 3-D data immers • micro manufactu • entertainment • travel reduction
elepresence ote manipulation monitoring ote "participation"	• autonomous systems • solids models • planning, interactions • navigation • multimedia fusion • sensor fusion • human/computer int • compression • geometry reasoning • vision and images	• gigabits network • hetero drivers • MPP • workstation • realtime links • multi-sensor • robotic support • manipulators • nanobots • mobile support	• protocols • sockets for multisense • SVP simple video pro • roboKIT interfaces • stationary video interf • voice/vid/window • manipulator KIT • multiview protocol • DB interfaces • agent interfaces	• gigabits/human-rin • short range radio • transparent LB/radio • digital video • low latency ATM • radio ATM interfaces • multimedia mix • multisense mix • network compression	• scripting for RINs • manipulationscripts • programming by example • multisense objects • multisense extensions • linkage to multisense • databases • autologing of events • autolog I/O library	• monitoring r activ • r manufacturing • r assembly • r exploration • r experiment ma • r inspections • semi auto develo • r piloting • toys

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