Impact of Internet on e-Cad: A field Survey

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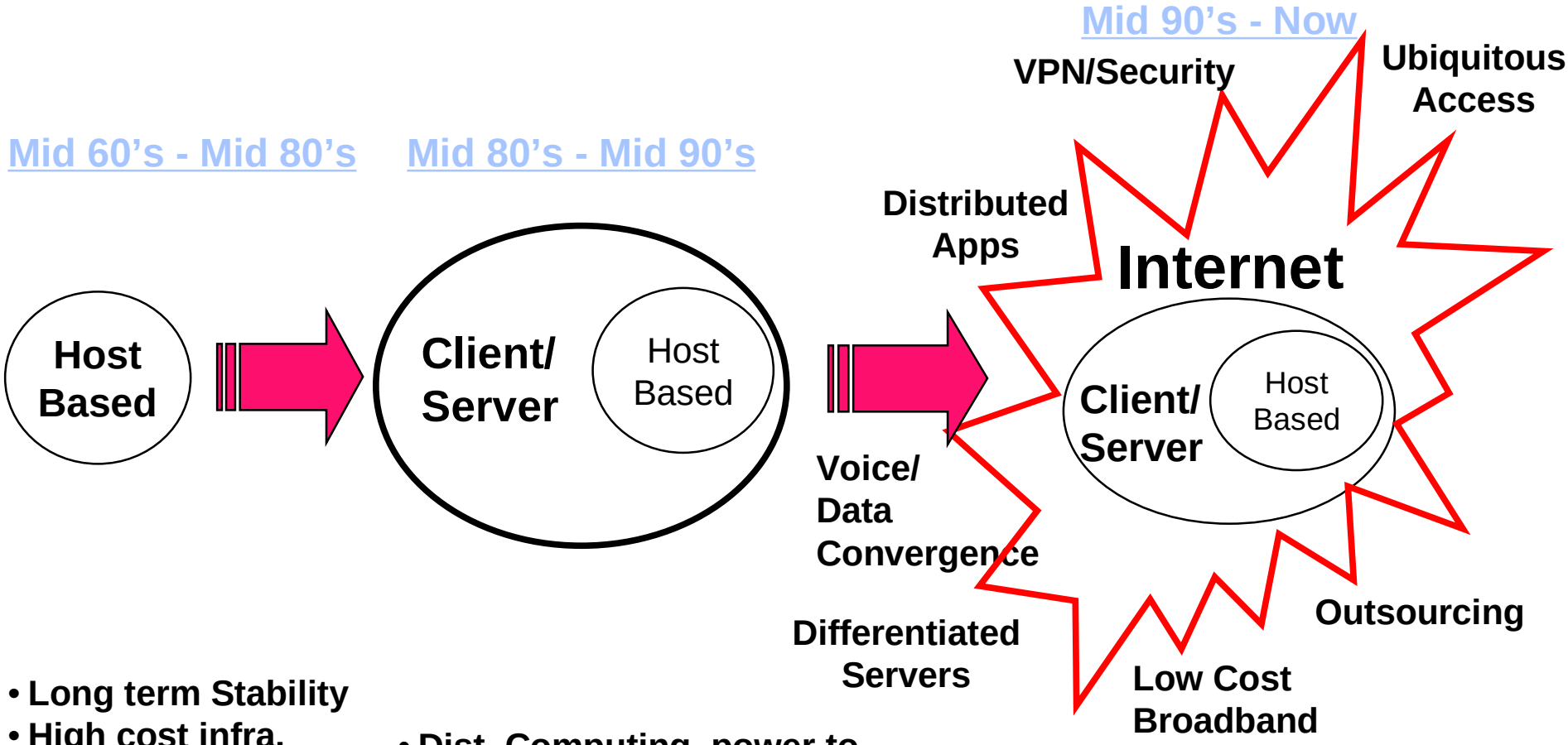
- Internet Background
- e-Commerce business models
  - c2c, b2c, c2c
- Emerging internet software models
- e-CAD business models
  - t2t: Tools2Tools
  - t2d: Tools2Designers
  - d2d: Designers2Designers
- A web enabled tool example - SAGA
- Future opportunities and directions

Internet Changes the Computing Model



- Long term Stability
- High cost infra, limited access
- High transaction costs

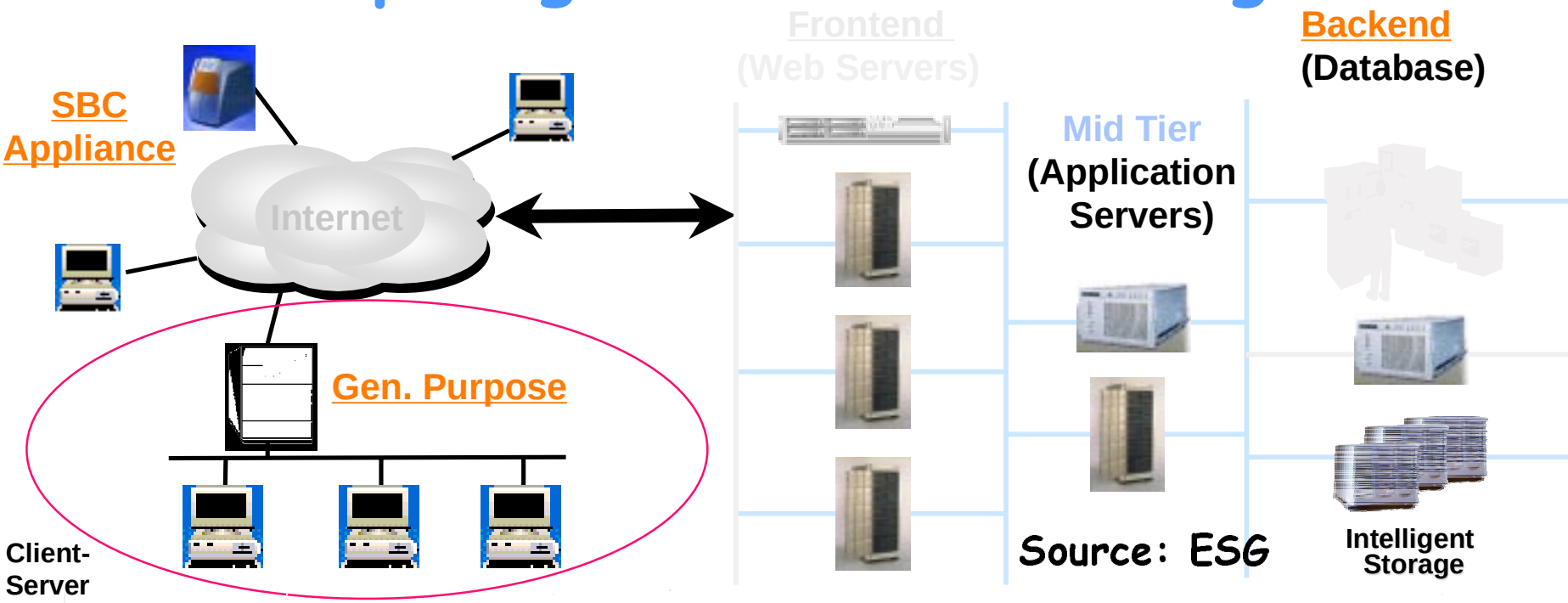
- Dist. Computing, power to the masses
- Lower cost of entry, but still barriers to small biz

- Low cost entry, open access
- Enables new compute & business models
- Low transaction costs
- Lots of enabling technology

Move to Distributed Model

Source: ESG

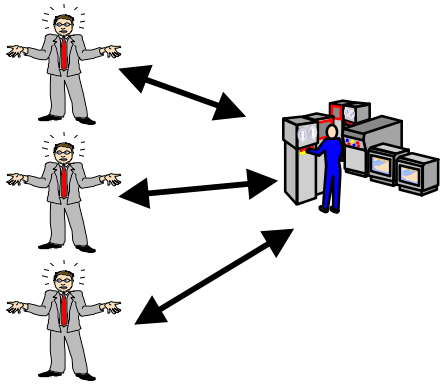
New Computing and business categories



- C2C: Consumer-to-Consumer, e.g., Chat rooms in AOL
- B2C: Business-to-Consumer, e.g., uBID
  - very competitive, battle for eyeballs, est. $25 B ($5.3B in Q4'99 according to 03/03/2000 SJ Merc report)
- B2B: Business-to-Business, e.g., Toyota
  - est. size $200B, grows to $2 Tril. By 2003 (Gartner group)
- Infrastructure:
  - External, e.g., Oracle, and Internal, e.g., IT dept of Boeing

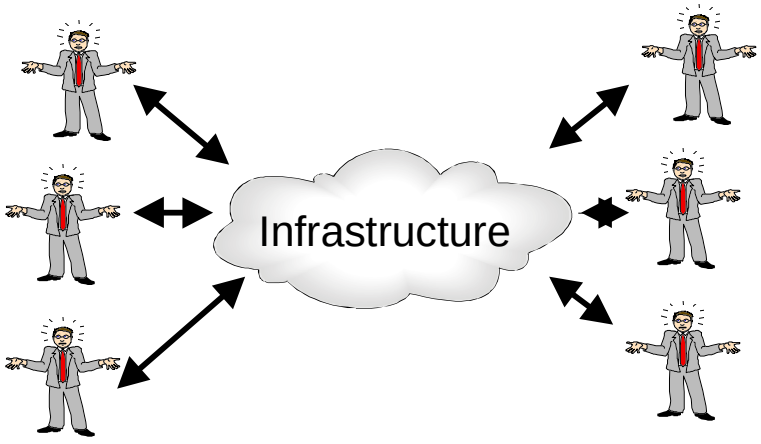
E-Commerce Portal Models

- Sell-side storefront
  - B2C scenario: single seller, typically a store-front to sell to many customers
  - Buyer has to do comparisons

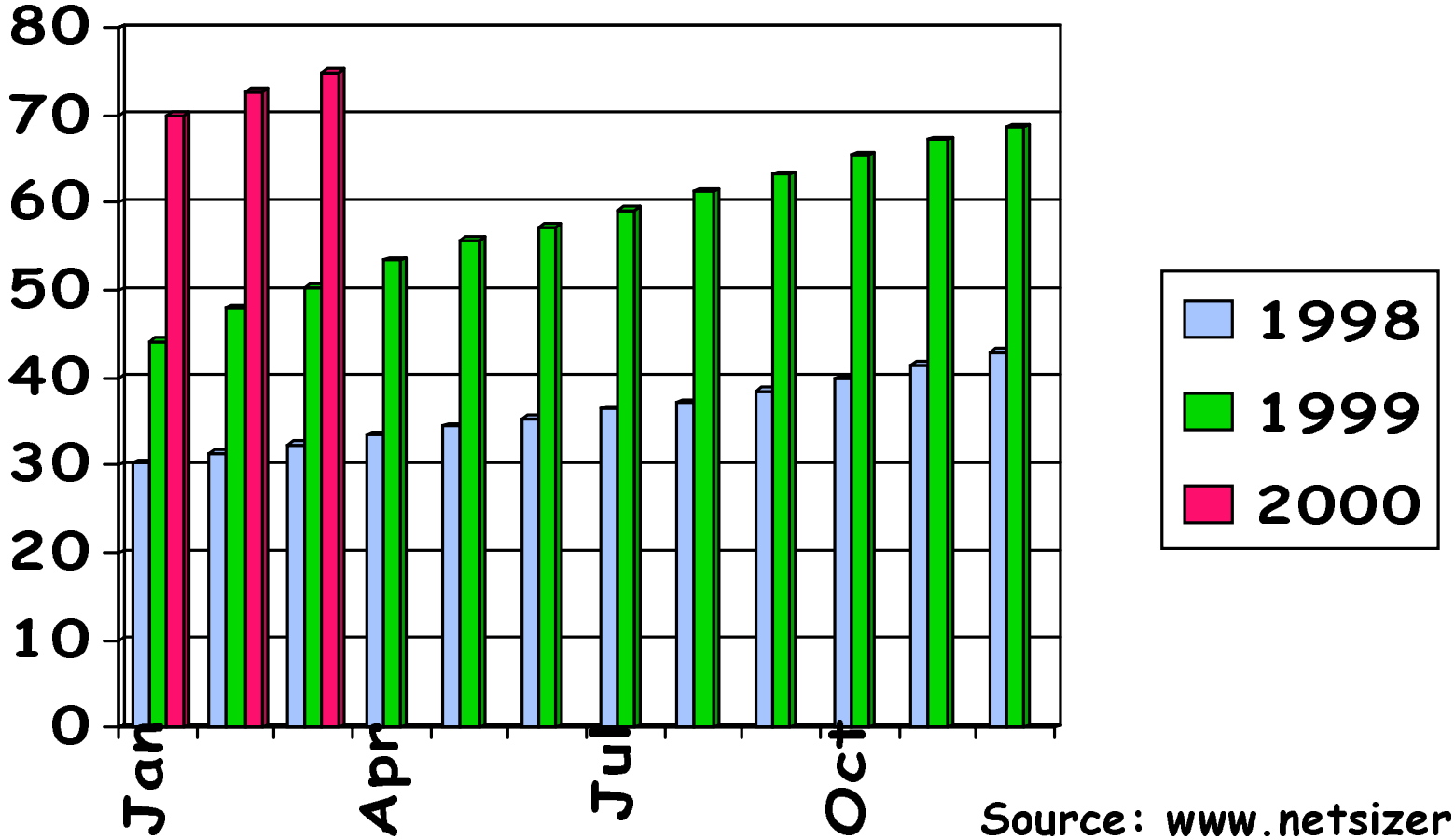


- Buy-side e-procurement
  - Aggregates many supplier catalogs for corporate purchases
  - Reduced transaction costs, but not lower purchase prices

- B2B marketplace
  - many-to-many relationships between buyers and suppliers
  - Leverage economies of scale in a liquid marketplace
  - Dynamic pricing models, such as auctions and exchanges, improve the economic efficiency of the market



Internet Server Growth: Monthly hosts in Millions



Source: www.netsizer.com

- Already 77.784 Mil. Servers till Tuesday April 18, 2000

Emerging Internet software models

- Move away from point-based computing to distributed models
  - lower initial customer costs
  - pay as you go, per invocation
- Architecture independent software
  - portability ensure larger customer base
  - Java and EJB
    - reality1: code once and debug everywhere
    - reality2: JVM issues with MT and MP
    - reality3: Java performance generally inferior to C/C++ based solutions
  - future releases may improve the situation
- New emerging class of ASPs (Application Service Providers)
  - software is stored on remote computers
    - accessed over internet (public or dedicated wires)
  - customers rent the computers, space and connectivity
    - on data centers
      issues with bandwidth and access delays
    - move to edge networks and cached servers
      minimize the # of hops
  - expected to be $11.3 Billion by 2003
    - e.g., tax filing through Intuit or Fidelity web sites
- Some of the unresolved issues with ASP model
  - security, bandwidth bottlenecks, ultimate cost models

Other benefits of Internet

(source: Popular Science,March 2000)

- Saving the planet
  - 1.5 Bil. Sq ft retail floor saved by e-commerce
  - 2 Bil. Sq ft office space, eq to 450 sears towers
  - 53 Bil. k-wt hrs energy saved, eq to 21 power plants
  - 35 Mil. Metric tons greenhouse gases not released
- How Big is big?
  - 800 Mil. Est web pages on internet
  - 200 Mil. Large index of web pages in the world
  - 38 web pages created/second
  - 19 avg. clicks between two randomly selected web pages
  - 7 avg. links/web site to other sites

INTERNET is the BIGGEST technological change since Industrialization and Transportation

So, what does this mean for e-Cad?

- Inevitable move to internet based cad: e-Cad
- Potential benefits for customers (e.g., designers)
  - ability to get newer version/patches of tools over the web
  - pay as you go
    - in a design flow, a tool is needed only in a particular step, e.g., layout extraction, so the ownership of a license can be shared
  - new collaboration opportunities with other designers
    - enable interaction with other design phases
    - one designer does not need to be all the way "tall and thin"
- Potential benefits for tool vendors
  - development and financial efficiency
    - move away from file based designs
    - lower prices and higher volume (invocation vs. seat based)
  - be the ASP of your own tools, fixed user environment

T2T: How do two tools in a flow interact?

- **T2T Interaction: better interoperability**
  - Old fashioned
    - tool license invocation linked to IP address of a m/c
    - file based data transfer between tools
  - Opportunity for further improvements with
    - Shared databases between different tools, even when invoked from different servers. Database may be on the local client or a 3rd server
    - Fast access with in-memory database. Take advantage of new DB technologies, e.g., TimesTen. Persistence may be an issue
    - Tools to leverage MP systems. Some problems more natural than others, e.g., extraction Tools
    - Tools to leverage MT systems. Shared memory between different threads, e.g., simulation
  - Example:
    - Enable better interaction between tools across design phases, e.g., between logic and layout synthesis

D2T: Designers using a Tool?

- T2D: How does a designer views a tool?
  - Web enabled flow manager
    - run any-tool from any-where, any-time
    - Actual tools and data may be residing on different network clients
    - Benefit from distributed computing, scalability and availability
  - An example:
    - Combination of optimization techniques
      Simulated Annealing (SA) and Genetic Algorithms (GA)
    - Heuristics to solve NP complete problems
    - Careful parameterization needed
    - Large problem can be partitioned
    - Multiple threads/jobs can be spawned on different network m/cs
  - Such a system has been developed by Prof. Jose Lima
    - UMLe-Anneal is a modular solution with client-server architecture
    - Detailed example at the end

D2D: How do two designers interact?

- D2D: Designers to communicate using web
  - Across geographical and time boundaries
  - whiteboard based interactions at the same time
    - A designer can draw figures, highlight parts of the design
    - Communicate in conjunction with POTS
    - In future, upgrade to audio/video streaming data
  - Enable data/constraints/info hand-over
    - overlays of electronic post-it notes
    - Instant Messaging based alarm invocations
  - Maintain and search repositories of FAQ
- Most pieces of enabling technology exists today
  - no major CAD tools known to be using it
  - Need to train designers to accept electronic water-coolers
- Some issues with electronic info tracking

Umle-Anneal: Internet based SAGA System

Using GAs to determine good SA parameters for a TWPP.

Prof. Jose A. Lima,

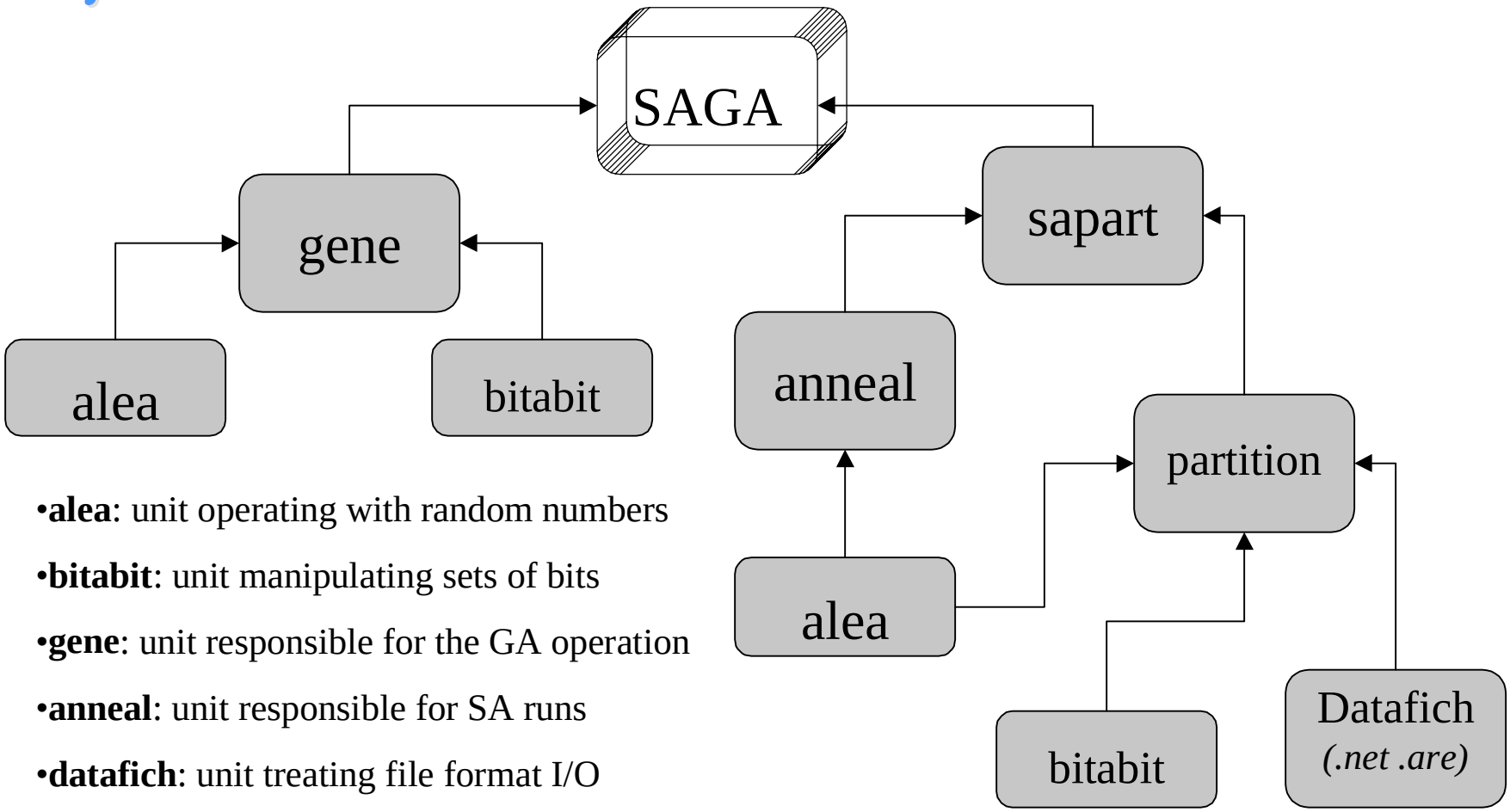
University De Minho, Portugal

email: **jal@di.uminho.pt**

SAGA: a case study around the TWPP

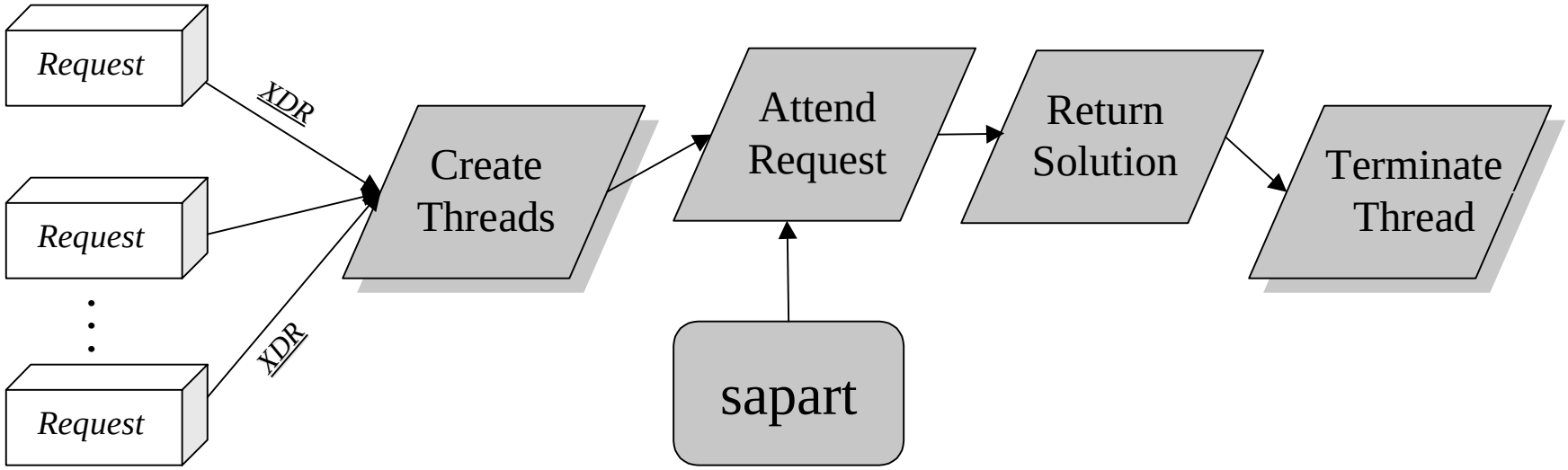
- **Methodology**
  - Adopt a systematic, and effective, method for SA problem instance parameterization.
  - Use a GA pre-processing phase whose objective is solely that of finding adequate parameters for an ensuing SA based problem solution.
  - UMLe-Anneal implements a case study approach: SAGA applies the GA+SA method to the well known two-way partition problem (TWPP).
  - SAGA is not problem dependent. It uses a modular set of units. They can be re-used for other kinds of SA problems, in order to obtain good initial estimations and schedules of SA parameter values.

Using GA to determine SA parameters



- **alea**: unit operating with random numbers
- **bitabit**: unit manipulating sets of bits
- **gene**: unit responsible for the GA operation
- **anneal**: unit responsible for SA runs
- **datafich**: unit treating file format I/O
- **partition**: unit with partition problem description
- **sapart**: unit responsible for SA solution of partition

UMLe-Anneal: Client-Server structure



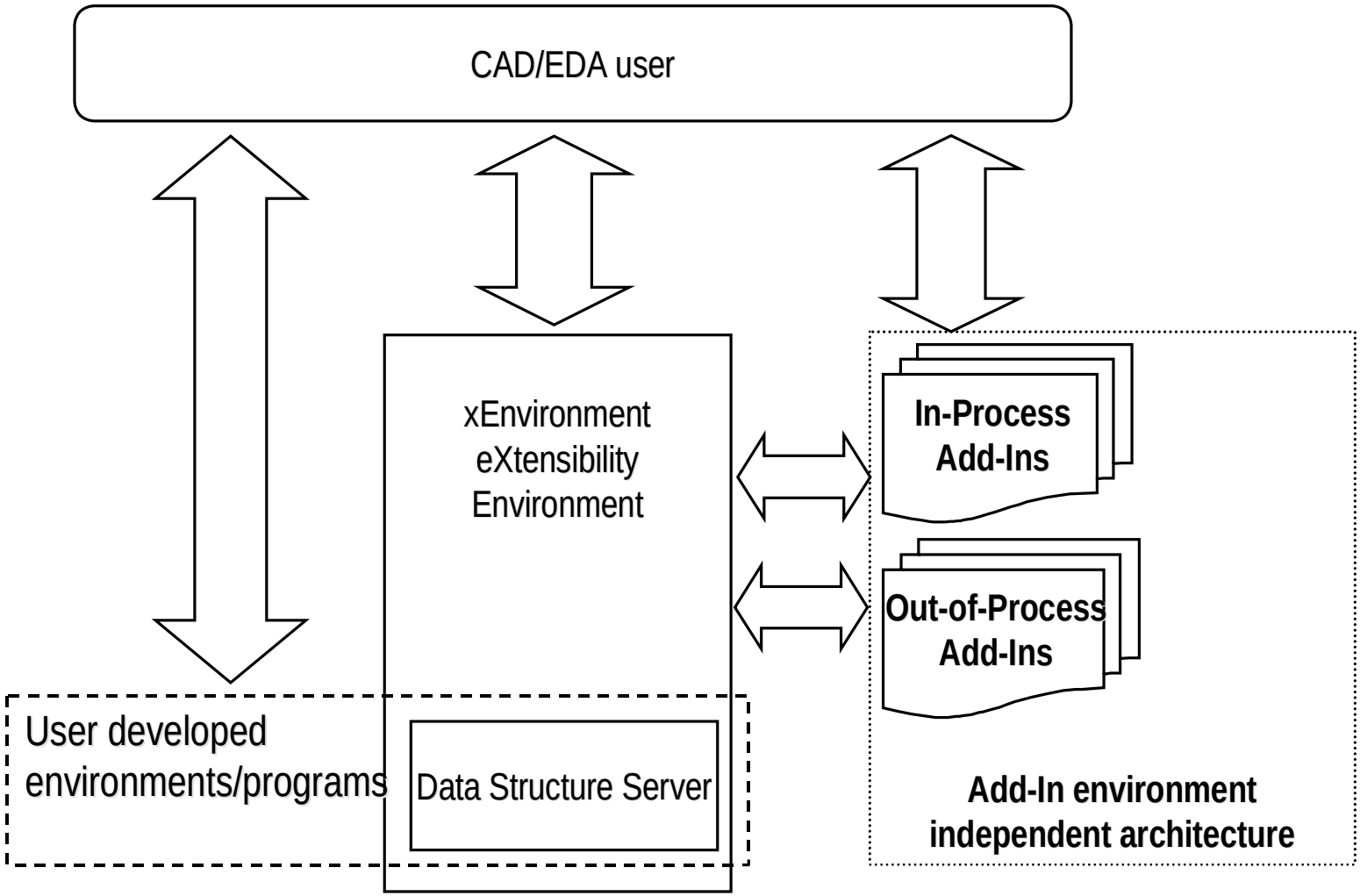
- *UMLe-Anneal Partition Server:*
  - multi-threaded service
  - accepts data from internet clients - in XDR *(eXternal Data Representation)* format - creating a thread for each new client submission.
  - data submitted only describes the specific partition problem.

Internet Submission

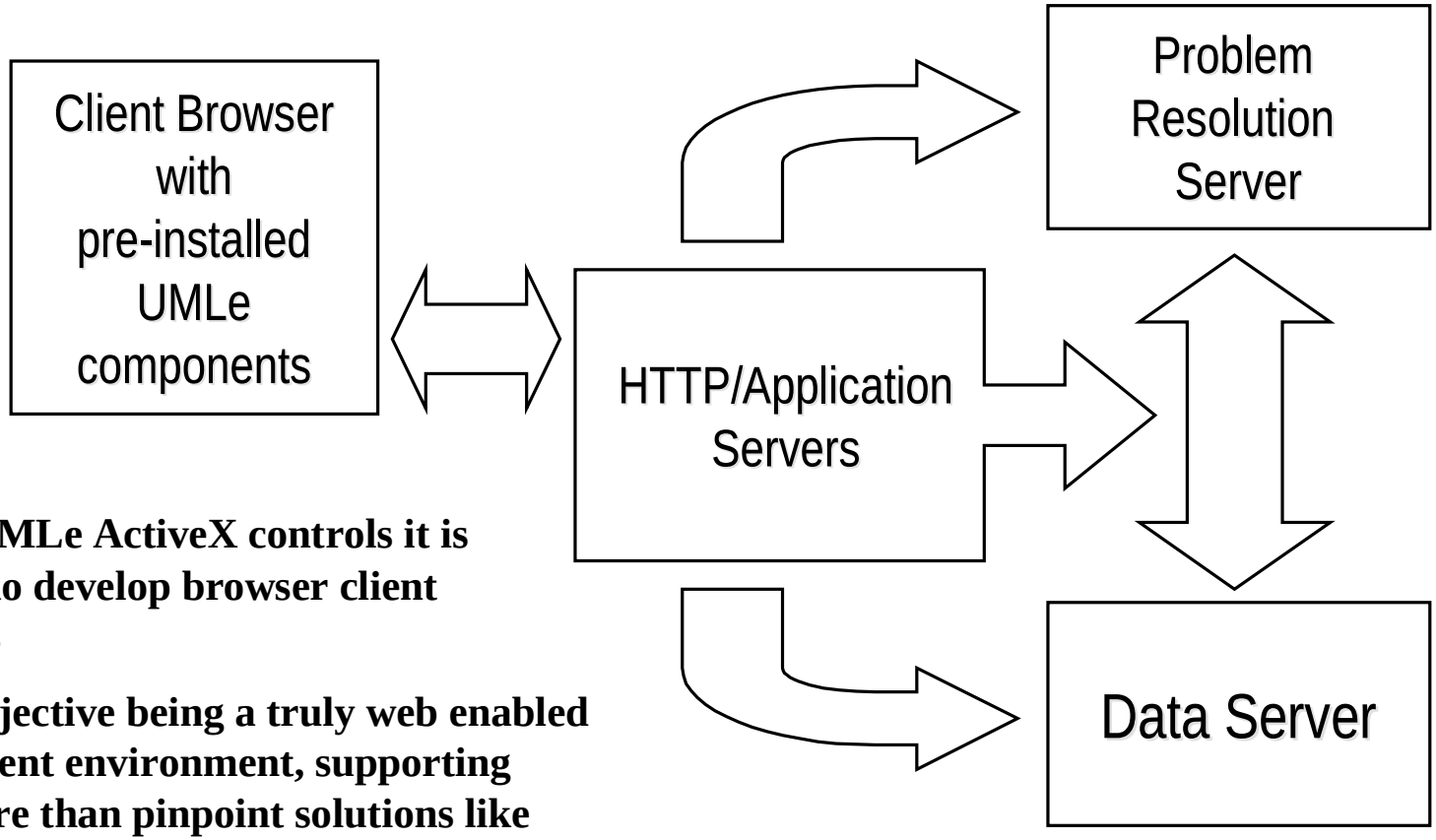
- To submit Annealing related partition problems to the UMLe-Anneal server (at the University of Minho) a client must use an appropriate program to contact the server.
- Access a web page, where from a RedHat Linux pre-compiled GLIBC 2 version of the *submit* can be downloaded
- Alternatively the *submit* source code can also be downloaded.
- Problem submission is very simple:
  provide files .net and .are having the problem description
- invoke the submission application as follows:
  submit file.net file.are galeao.di.uminho.pt 17837
- the server uses SAGA determined parameters to obtain a better SA solution.
- Problem solutions are obtained using a system similar to sapart.

Current UMLe Extensibility Model

http://gioconda.di.uminho.pt/UMLe



Evolution of UMLe-Anneal,
using a Web capable environment



- **Using UMLe ActiveX controls it is possible do develop browser client interfaces**
- **Final objective being a truly web enabled development environment, supporting much more than pinpoint solutions like SAGA**
- **Technologies like dhtml will allow rapid interface building, and customizing**
- **DA problem specific server proliferation**

Web Revolutionizing the VLSI-Design and management processes

- Knowledge base with Archiving
  - Living documents: not set in concrete
  - Infinite memory: distributed storage and search
- Enable hierarchical thinking
  - Knowledge mapping, with abstraction
  - Hide complexity - zoom in and zoom out
  - Show detail as appropriate
- Need this for management
  - open, global information sharing work environment
  - real time indicators and information flow - intranet
- Organizational impediments - net changes everything
  - Watch out for old style, access controls - institutional resistance
  - New organization dynamics - information flowing crossways
    - need to evolve continuously, as opposed to re-create every time

It seems that Web was designed for a better VLSI CAD methodology - Dennis Lucey

BACKUPS

The SA parameters considered

- Each individual of the AG population encodes a different SA parameter, namely:
  - *maxIter*: max. number of iterations;
  - *maxNulos*: max. number of consecutive Metropolis iterations without change
  - *alfa*: cooling schedule constant
  - *beta*: constant determining the *RunLimit* (max number of consecutive Metropolis iterations) schedule
  - *gama*: determines the scheduling variation of the *sucLimit* (upper-bound on the number of Metropolis solution perturbations)
  - *factTemp*: initial temperature adjustment factor
  - *factRunLimit*: initial RunLimit adjustment factor *(RunLimit= factRunLimit*numElem)*
  - *factSucLimit*: initial SucLimit adjustment factor *(RunLimit= factSucLimit*numElem)*
  - *numPerturb*: number of perturbations in the current solution

The SA parameters *(continued)*

- The fitness of an individual is determined by the results of the SA using that value, the following expression is used *adequacy = α*quality + β*run-time (we used α=0.999; β=0.001).*
- *n* different partition problems (i.e. *n* different test cases).
- *m* is the number of SA runs for each case. To use a value of *m>1* (incurring in a much greater processing time) one establishes a confidence level (e.g. 95%) and using normal distribution determines if the interval $\mu_1 - \mu_4$ is positive (*m=1* vs *m=4*).
- adequacy´s geometric mean: $\sqrt[n]{\Pi_{i=1}^{n}(c_i/m)}$.
- adequacy´s arithmetic mean of each test case $c_i=\Sigma_{j=1}^{m}$ *α*quality + β*run-time*

UMLe-Anneal Partition:
A few preliminary results

Parameters	Good averaged values
maxIter	250
maxNulos	2
alfa	0.45
beta	0.82
gama	0.85
factTemp	500
factRunLimit	160
factSucLimit	5
numPerturb	2