Distributed stochastic analysis using remote service providers

Presentation

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Demonstration

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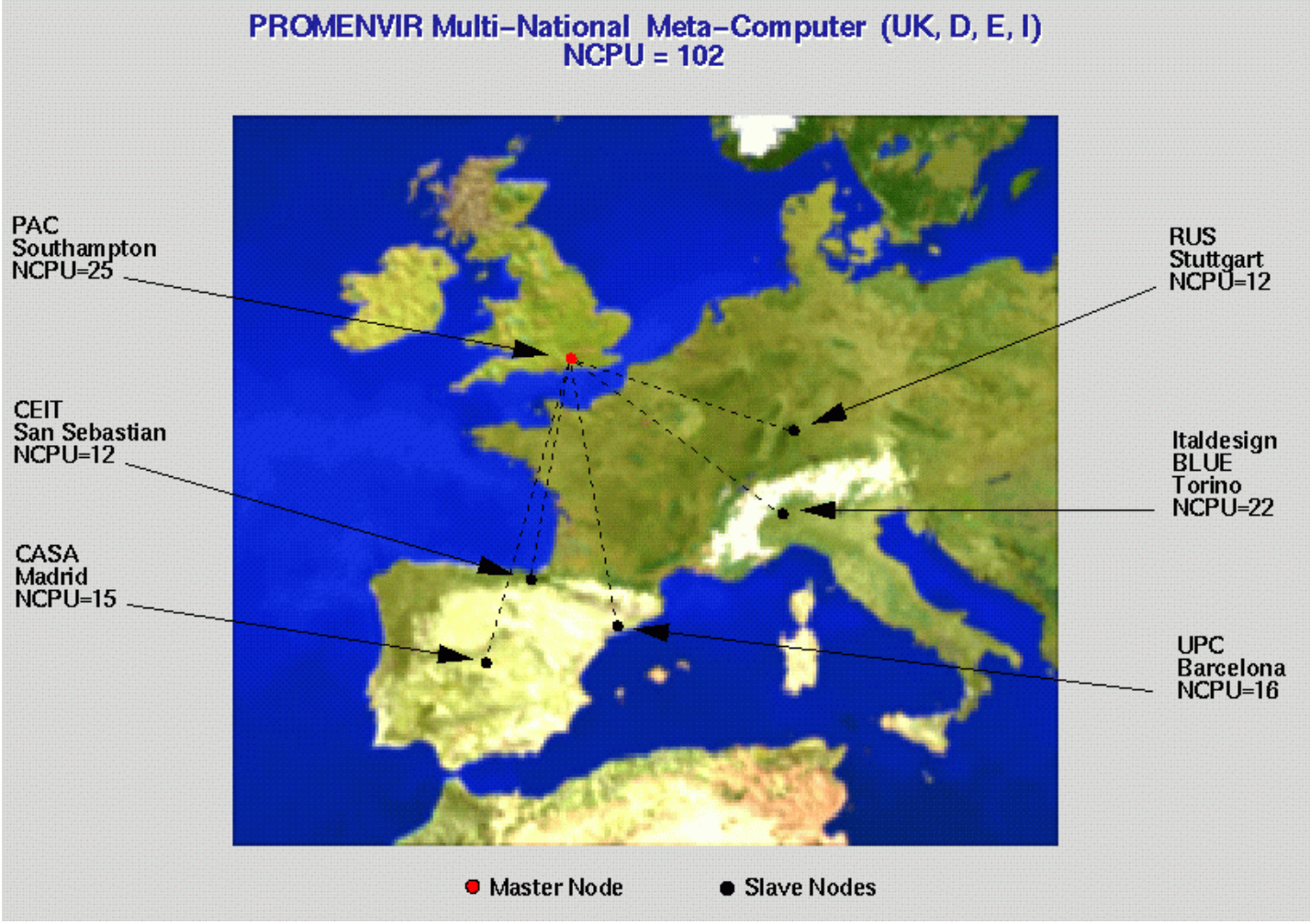
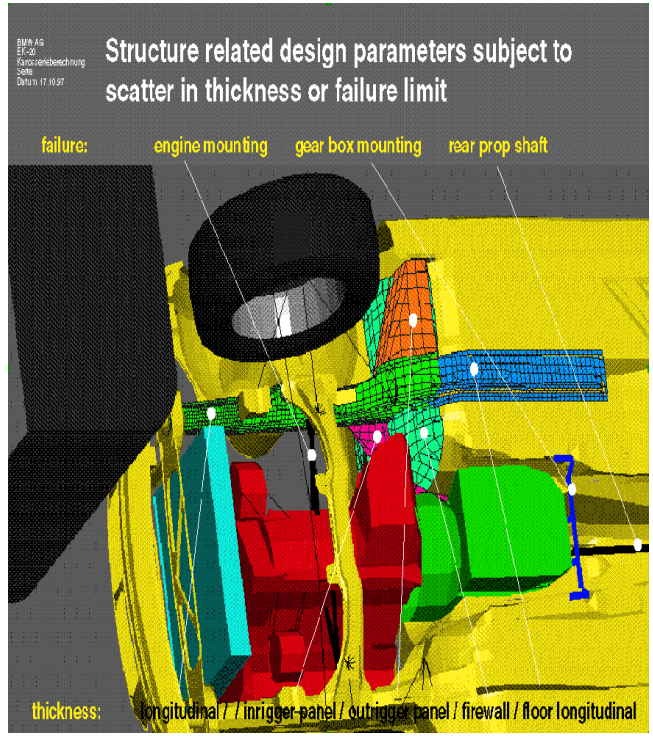
In 1997 PROMENVIR demonstrated distributed meta computing over the Internet



Distributed stochastic analysis using PROMENVIR was very promising …

- Off-set car-crash Simulation
  - Stochastic uncertainties of typical dimensions and constraints
  - 128 PAM-Crash simulations 8000 CPU Hours in 3 days
  - Calculated distribution of deformations and stresses, accelerations and energy

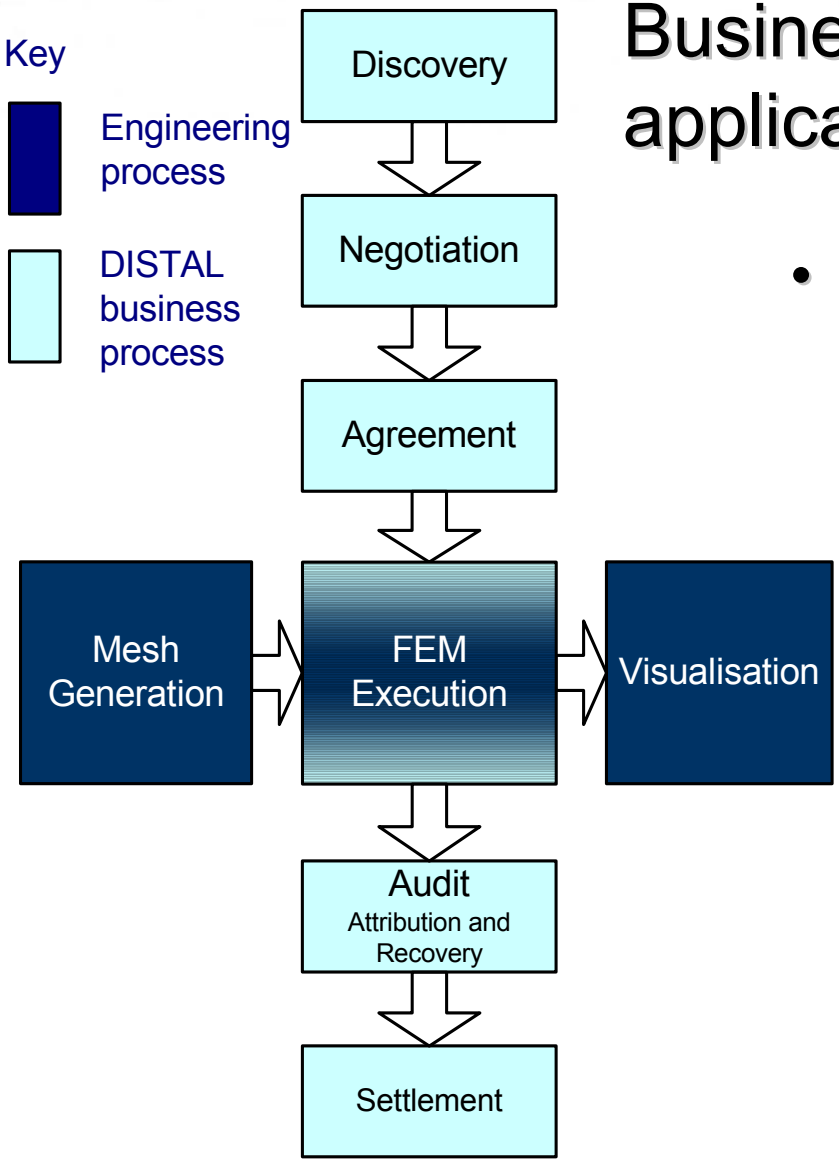


- Significant advantage for the design engineer
  - Optimisation of the design in reasonable engineering time
  - Reduction of the design cycles, reduction of cost

… but distributed stochastic analysis wasn't exactly easy to arrange or execute

- Manual coordination via e-mail, fax and telephone
  - Agreement for use of remote facilities
  - Scheduling of machines
  - Lowering of security barriers
- Remote access to hardware wasn't enough
  - No information on software installations, versions or licenses
- One site controlled all the others as slaves
  - Not suitable for discovery, access and use of third-party resources on a licensed commercial basis
- Conclusion: develop new technology to support required business processes

Business process of remote application execution



- For each compute task
  - Find resources
  - Estimate costs
  - Negotiate terms
  - Agree access
  - License application
  - Transfer data
  - Execute task
  - Retrieve results
  - Audit what happened
  - Settle bills and disputes

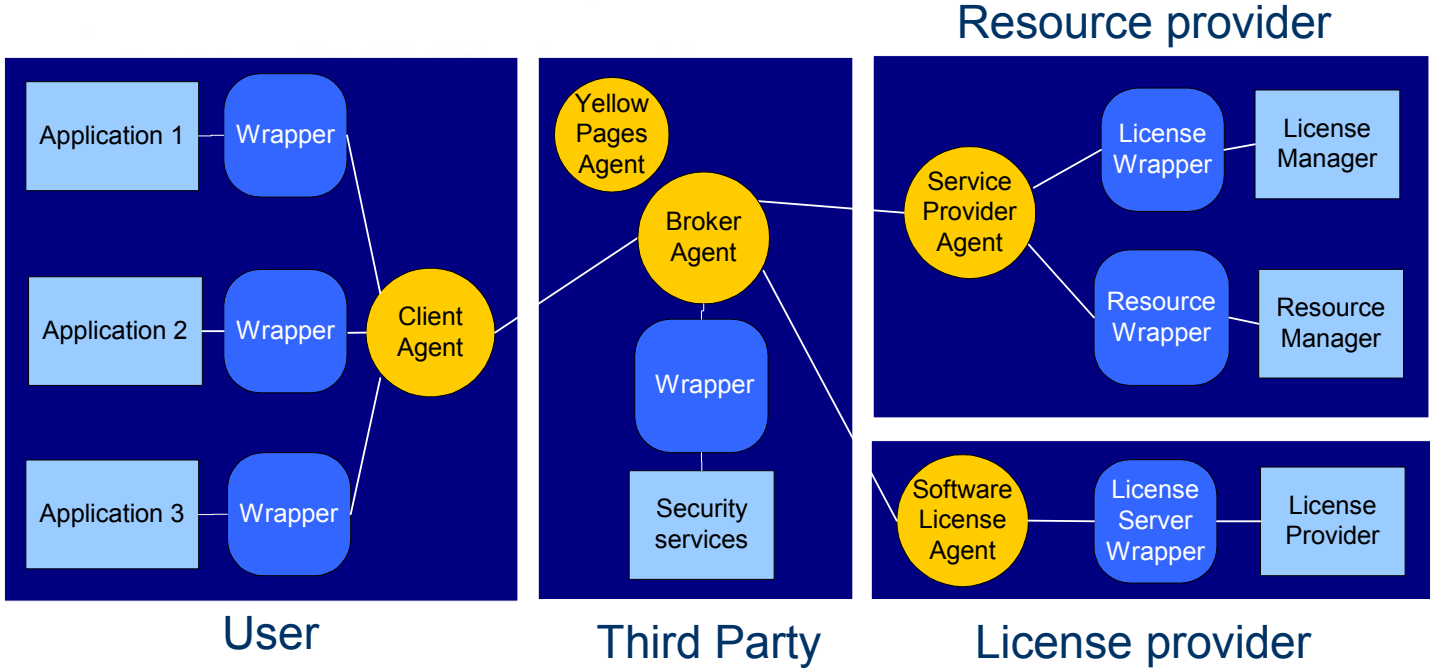
DISTAL

DISTributed Software Access for Large-Scale Engineering Applications
Esprit 26386 (1999-2001)

- MannesmanSachs
  - Sharing of compute resources across the company LAN and WAN
- CASA
  - Provide access to in-house resources for subcontractors
- ESIL
  - Remote compute resources at times of peak load
- Technical Partners
  - IT Innovation, ATOS, MSC, Baltimore

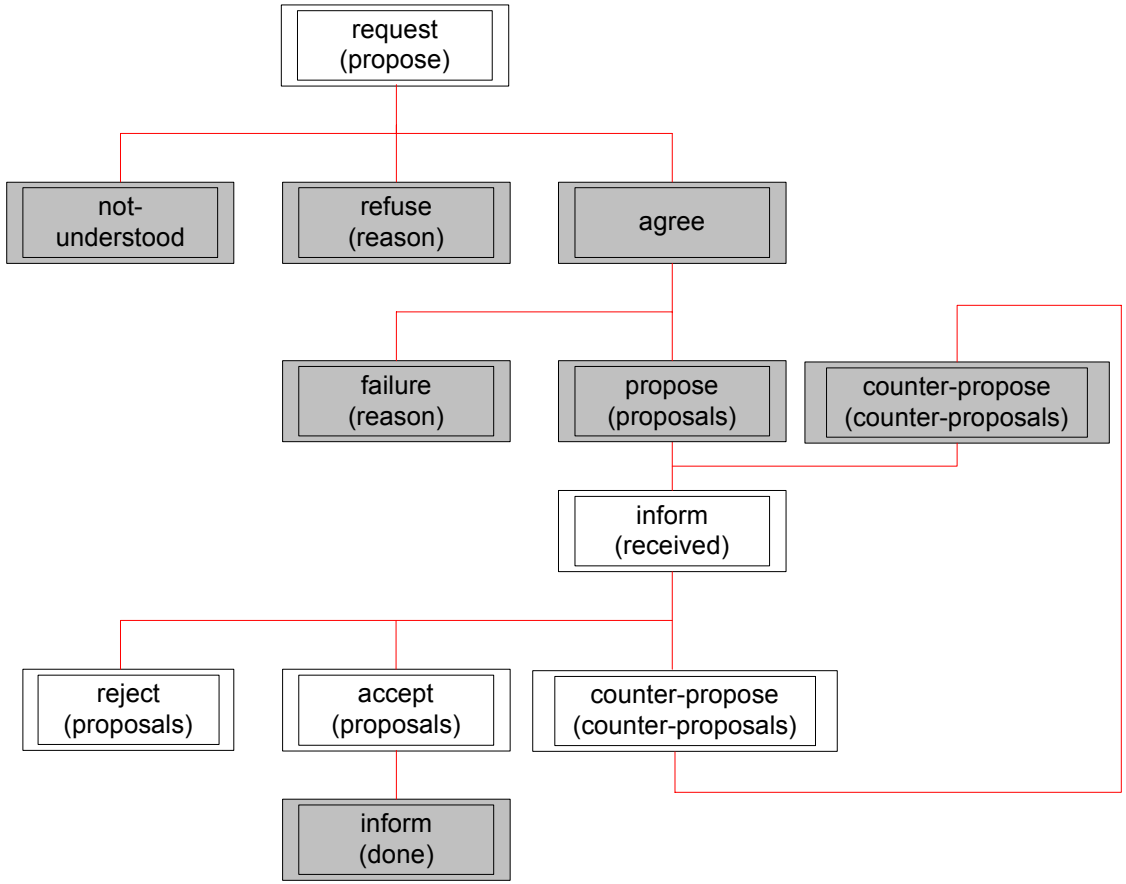
- Software and hardware on-demand over the Internet
- Corporate, collaborative, and third-party scenarios
- Investigate business models

DISTAL was very promising…

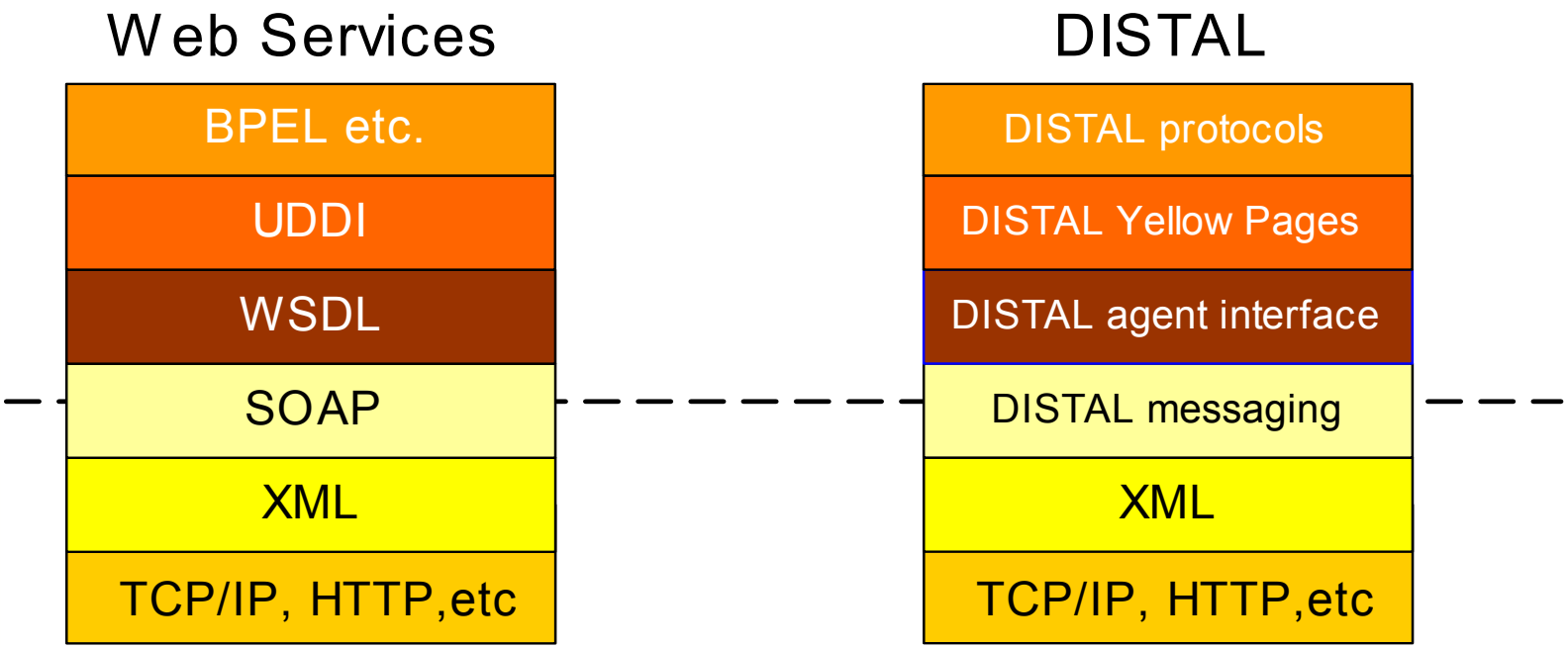


- End-to-end business process
  - Respect for ownership of resources and data
  - Flexible and automated interactions
  - Trusted Third Party and PKI
  - Supports a range of business models
- Not only suitable for engineering applications

DISTAL business processes are implemented using agent communication model



DISTAL technology stack is very similar to Web Services

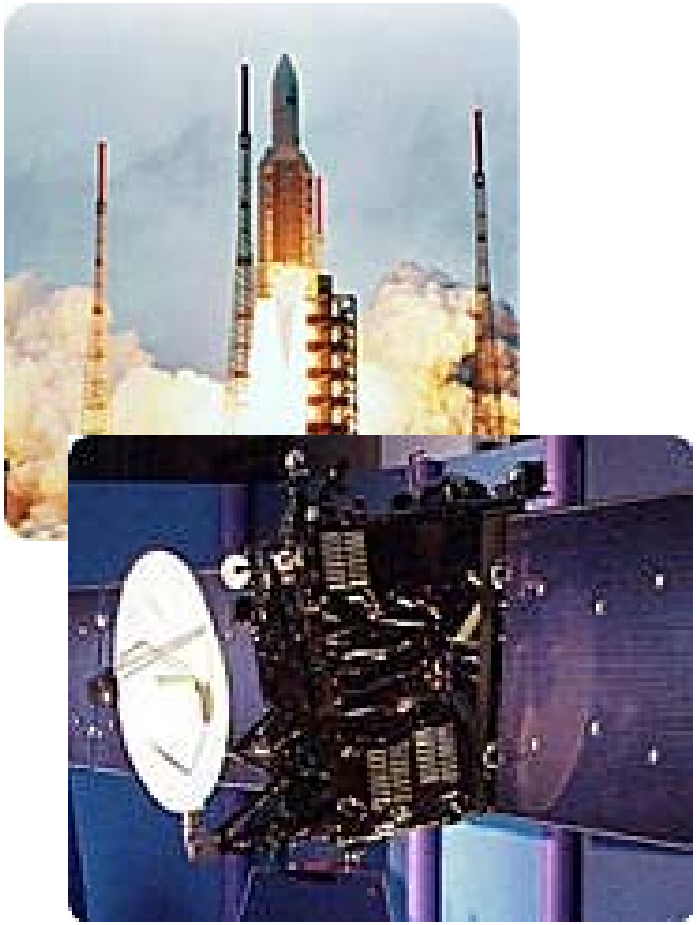


… but DISTAL didn't prove the business case

- Business case couldn't be proven for software and hardware on demand
  - Too many technical challenges
  - Too early for end users
  - DISTAL 'only' mediates a business process
    - Discovery→Agreement → Execution → Settlement
  - Community need to defines the business model
    - Pay-as-you-go, fixed-cost, leasing
    - DISTAL facilitates process and witnesses agreements
- Software not ready for industrial scale testing
  - Proof-of-concept R&D project
  - Prototype standard software
- Conclusion: quantify business models based on industrial testing and software customisation

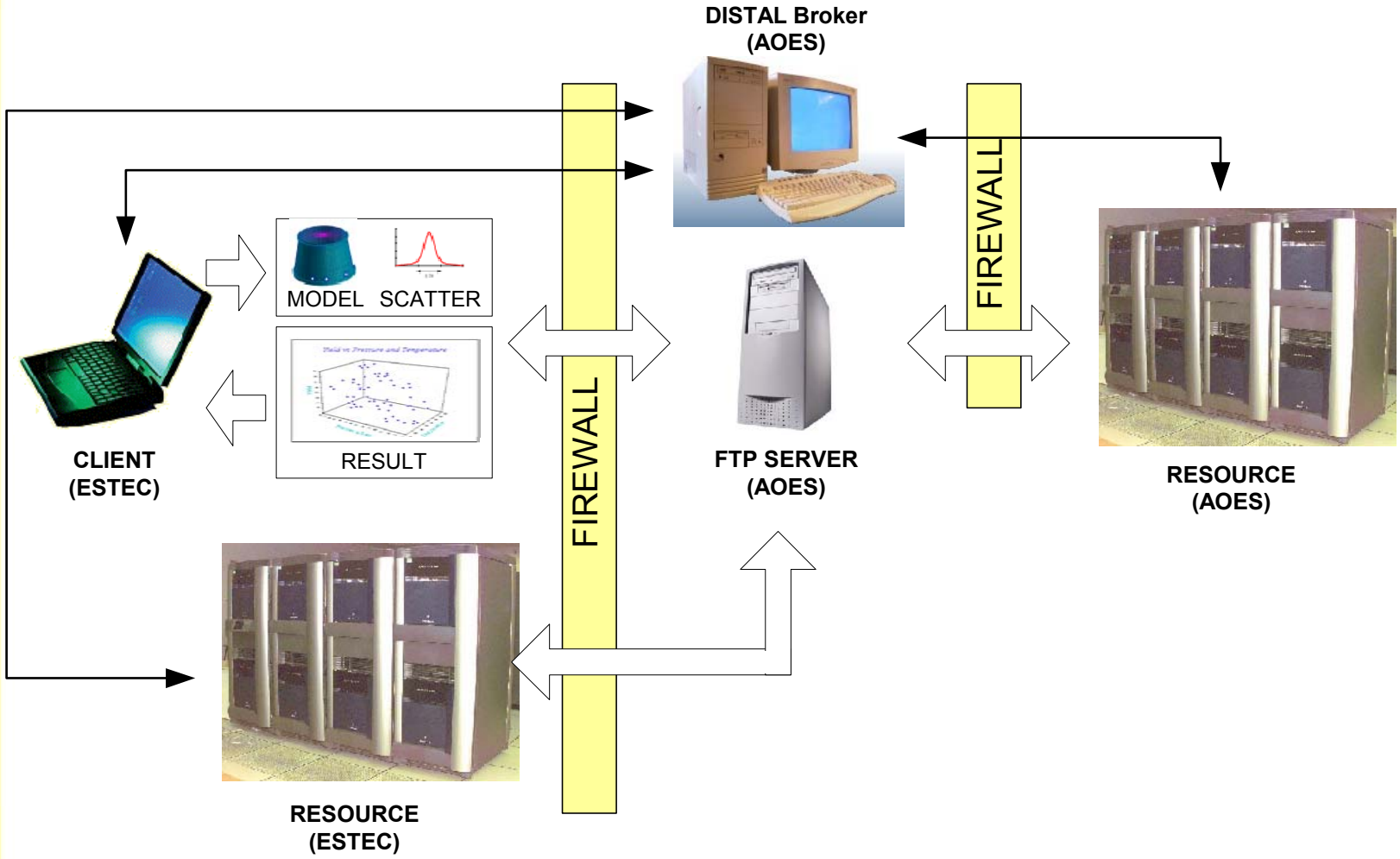
DISTAL Take-Up is completing the circle

IST-2000-28221 (Jan 2002 – Sept 2003)

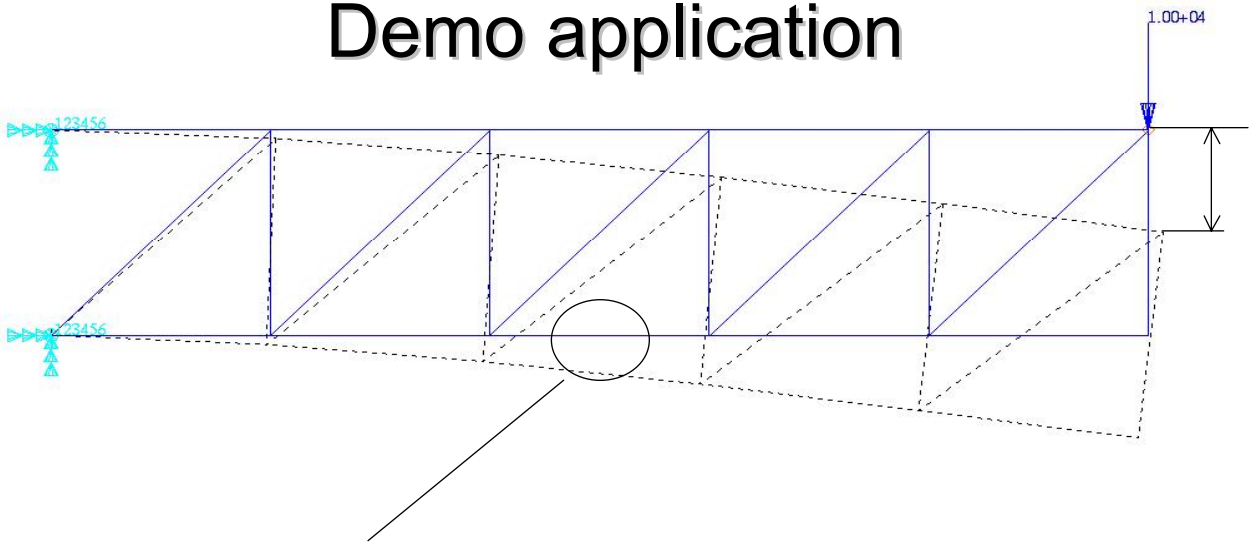


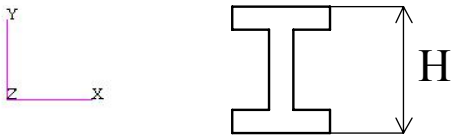
- Quantitative business models
  - Based on Industrial testing by ESTEC and AOES
- Business plans for suppliers and users
- Business impact report
- Improving the DISTAL software for use in industrial scenarios
  - IT Innovation

DISTAL demonstration



Demo application





Cross sections :

$H = H_o + \Delta H$

Material :

$E = E_o + \Delta E$

- ST-ORM stochastic analysis
  - 50 shots
  - 4 random variables
- MSC.Nastran model
  - 50 degrees of freedom

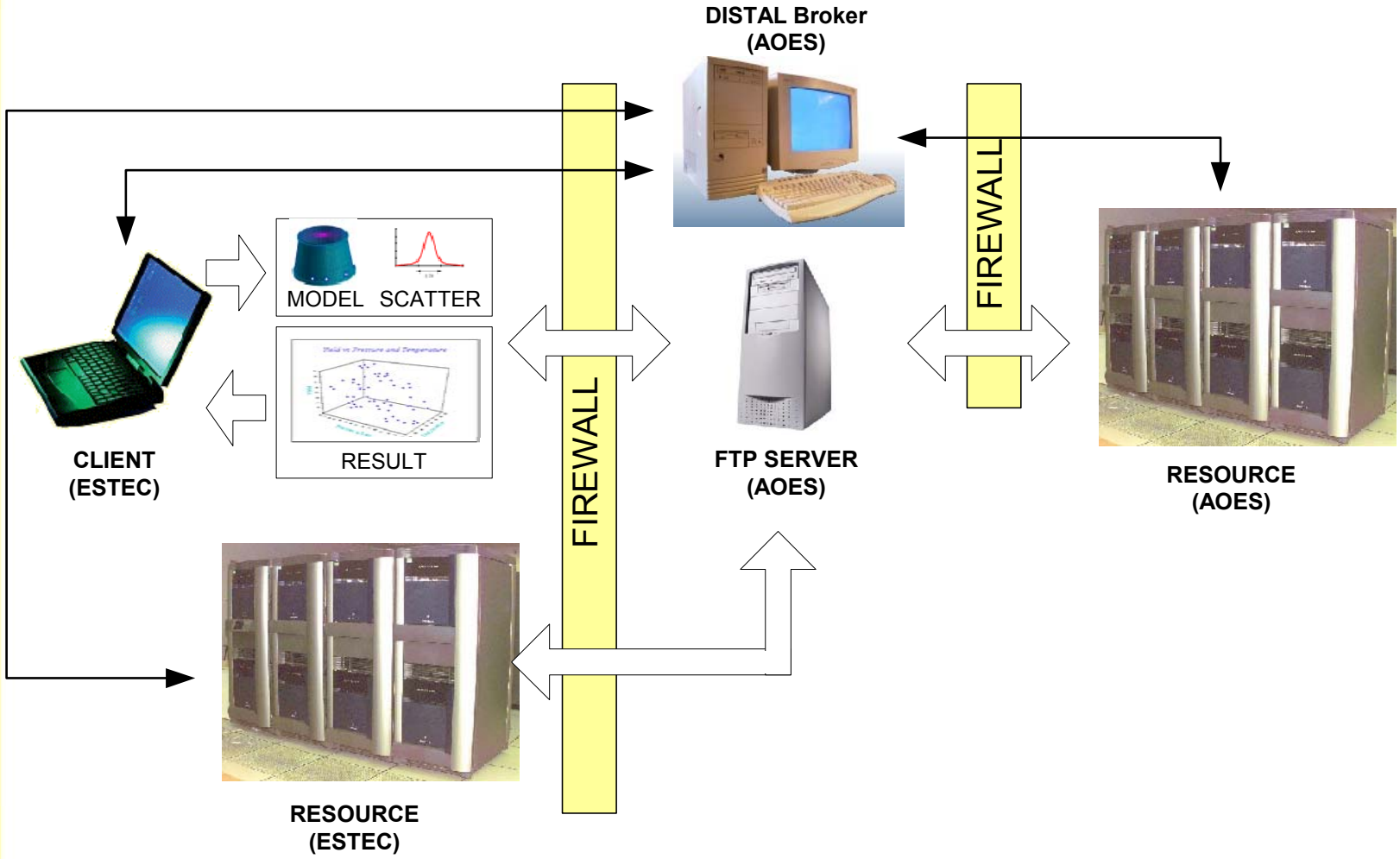
Business case for stochastic analysis at ESTEC

- In-house use of stochastic analysis (ST-ORM) usage is limited
  - Limited number of (expensive) application licenses and machines means it simply takes too long
  - Set-up and maintenance costs
  - Contention for resources (people, software, hardware)
- More stochastic analyses will be done if time can be reduced
  - EITHER … new investment in additional hardware
    - Hardware and software have to be able to handle the peak-load of largest job possible, but most of the jobs require much less power
  - OR … Use DISTAL for large jobs and meta-computing
    - Keep the current hardware for small and medium size jobs.
    - Additional cost for using external services and resources

Service provision by AtosOrigin

- Creating strategic alliances and development partnerships with all software providers
  - Applications, Meta-applications, Security, DISTAL
- Negotiating special license agreements for first two years of DISTAL service provision
  - Targeting key accounts & their suppliers (aerospace and automotive industry)
- Forming Application Service Provider consortium
  - IT Innovation, Baltimore Technologies, Oracle and IBM
  - Application software providers (MSC.Nastran, CFDRC, …)
  - H/W providers (HPC portals, University computing centres)
  - H/W and S/W providers of targeted key accounts
- Commercialisation under standard licensing terms & conditions subject to market acceptance

Back to the DISTAL demonstration



Current status

- DISTAL customisation has enabled distributed stochastic analysis using industrial tools and applications
- Large scale industrial testing is underway
  - DISTAL only marginally increases analysis time for a large number of shots when compared to using the same resources in-house
  - High reliability is possible, but the extra software, hardware and network components do result in occasional failed shots. This can be managed as part of stochastic analysis
- Licensing and service provision models are being developed in conjunction with all necessary players

Acknowledgements and Further information

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- Further Information

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