The Landscape of Enterprise Applications - a personal view

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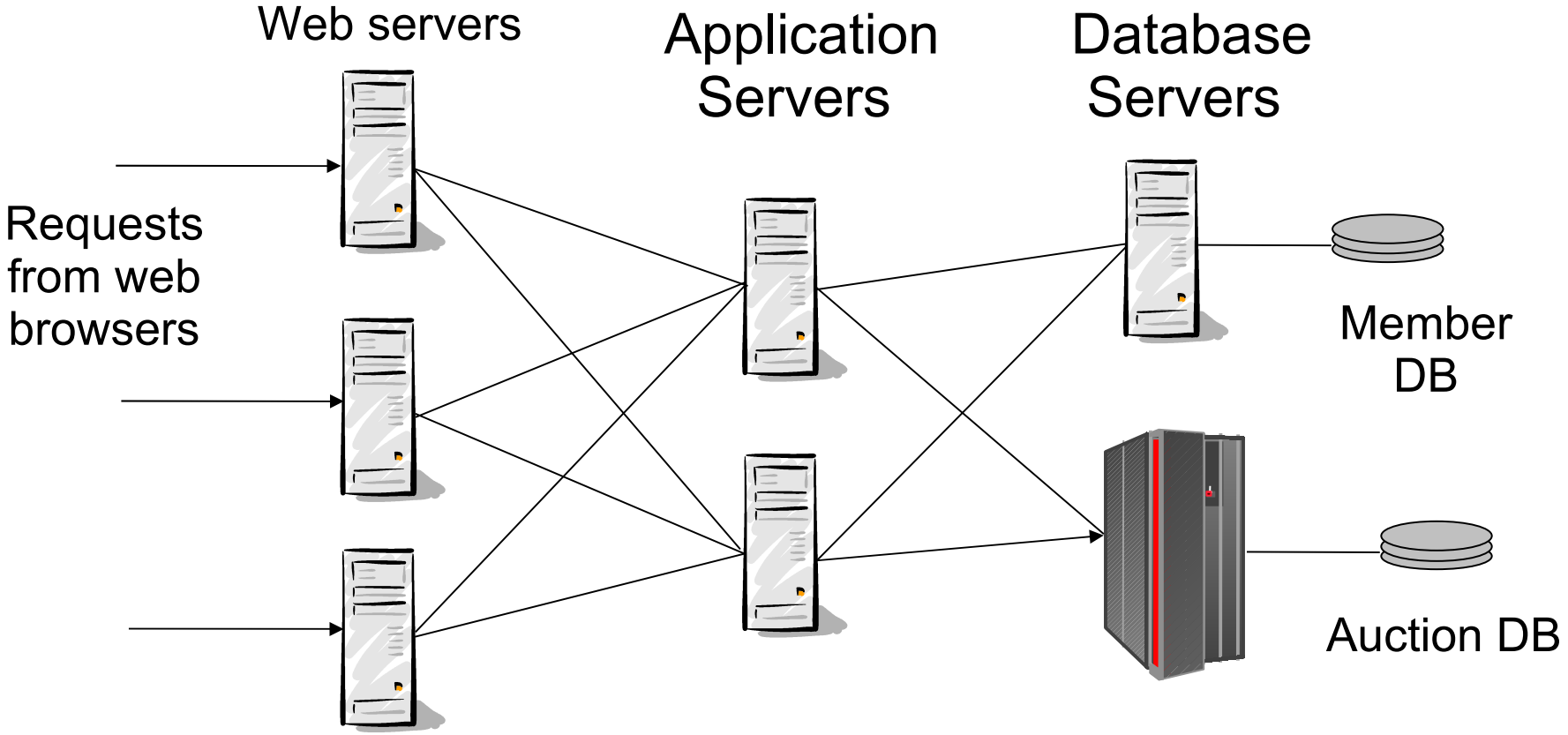
Typical Web Application?



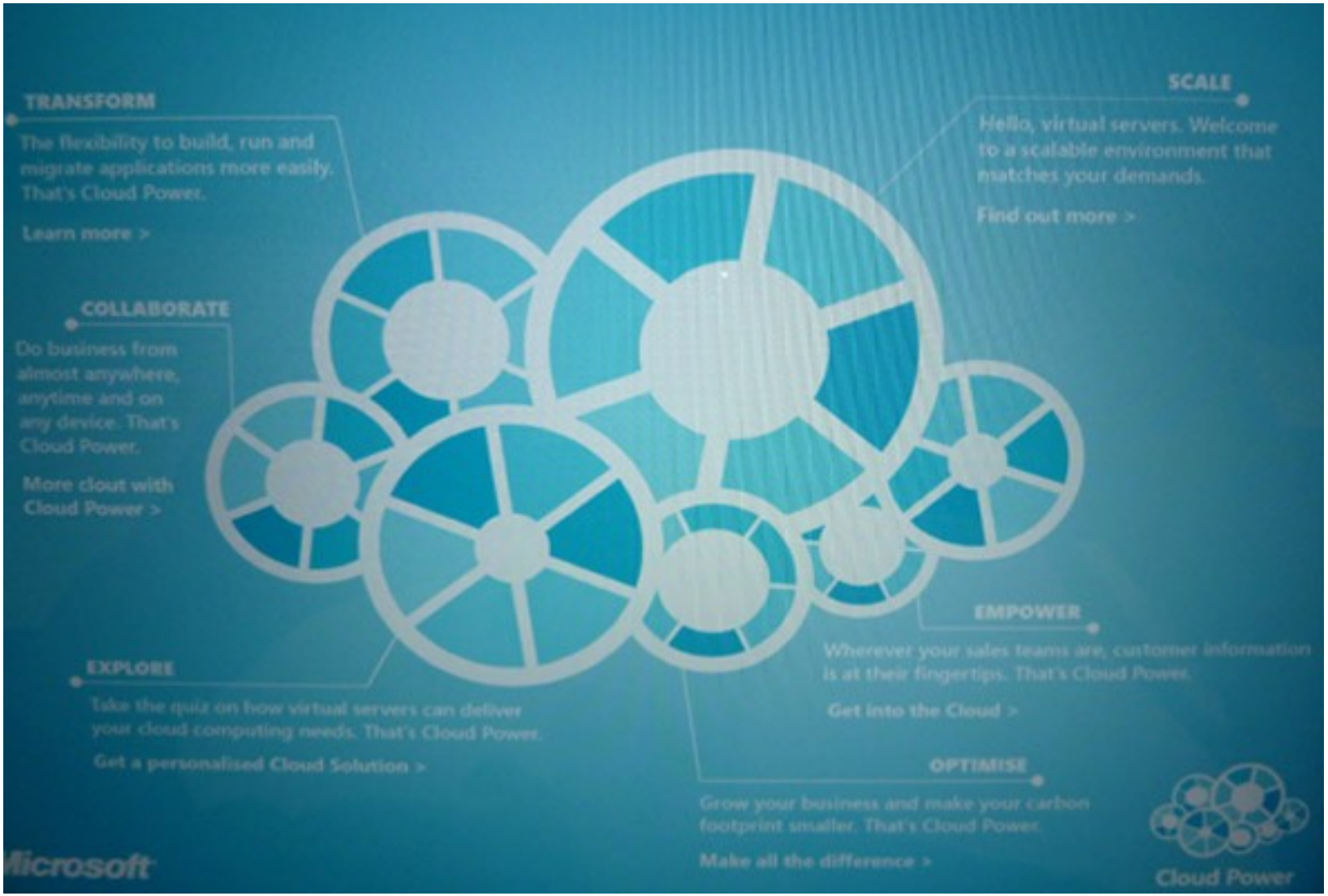
- *Static pages served from web server/content management system*
- *Dynamic pages assembled by applications on application servers*

Did you do any of these today?

- *Buy something in a supermarket?*
- *Buy a ticket for travel or entertainment?*
- *Make a telephone call (mobile or fixed)?*
- *Use a cash machine or debit card?*
- *Pay for something with a credit card?*
- *Use electricity, gas or water?*

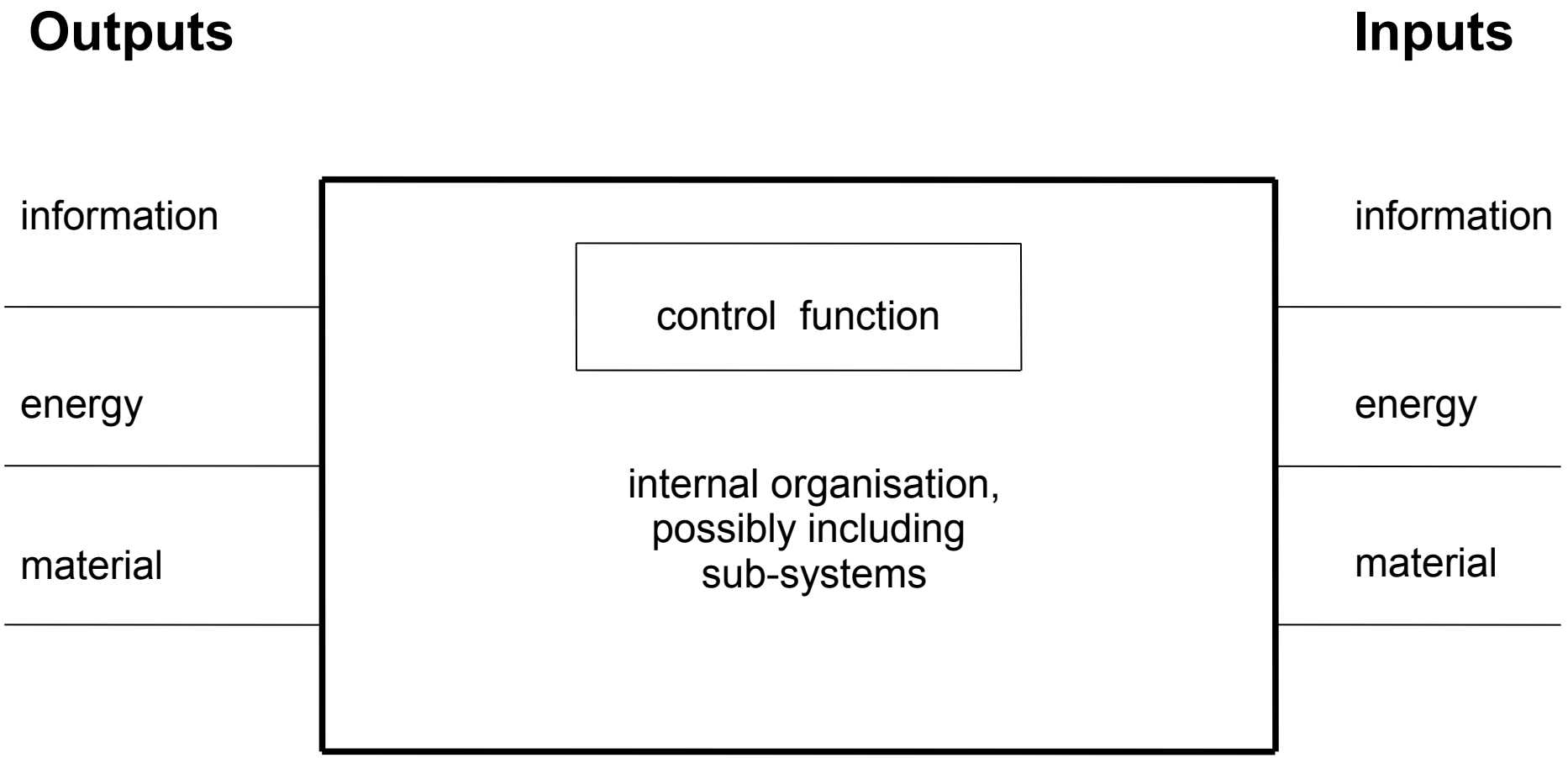
The chances are you used a traditional online transaction system (running on a mainframe?)

That's Cloud Power?



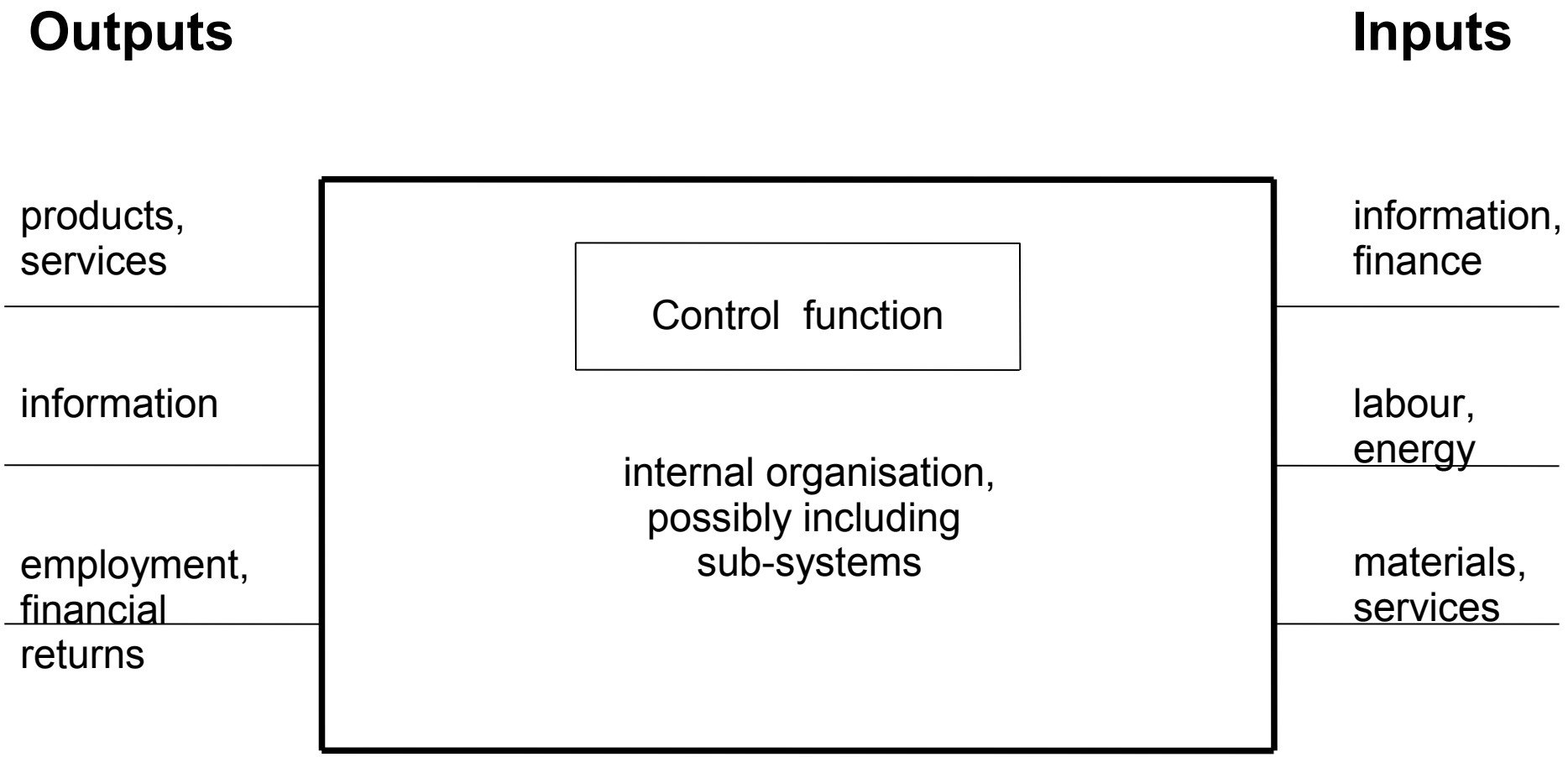
What's an Enterprise, or an Enterprise System?

What is a System?



Physical, chemical, biological, social systems - real-time dynamic behaviour

An Enterprise is a System
for delivering economic & social outputs



Related pairs of inputs & outputs are often referred to as **transactions**

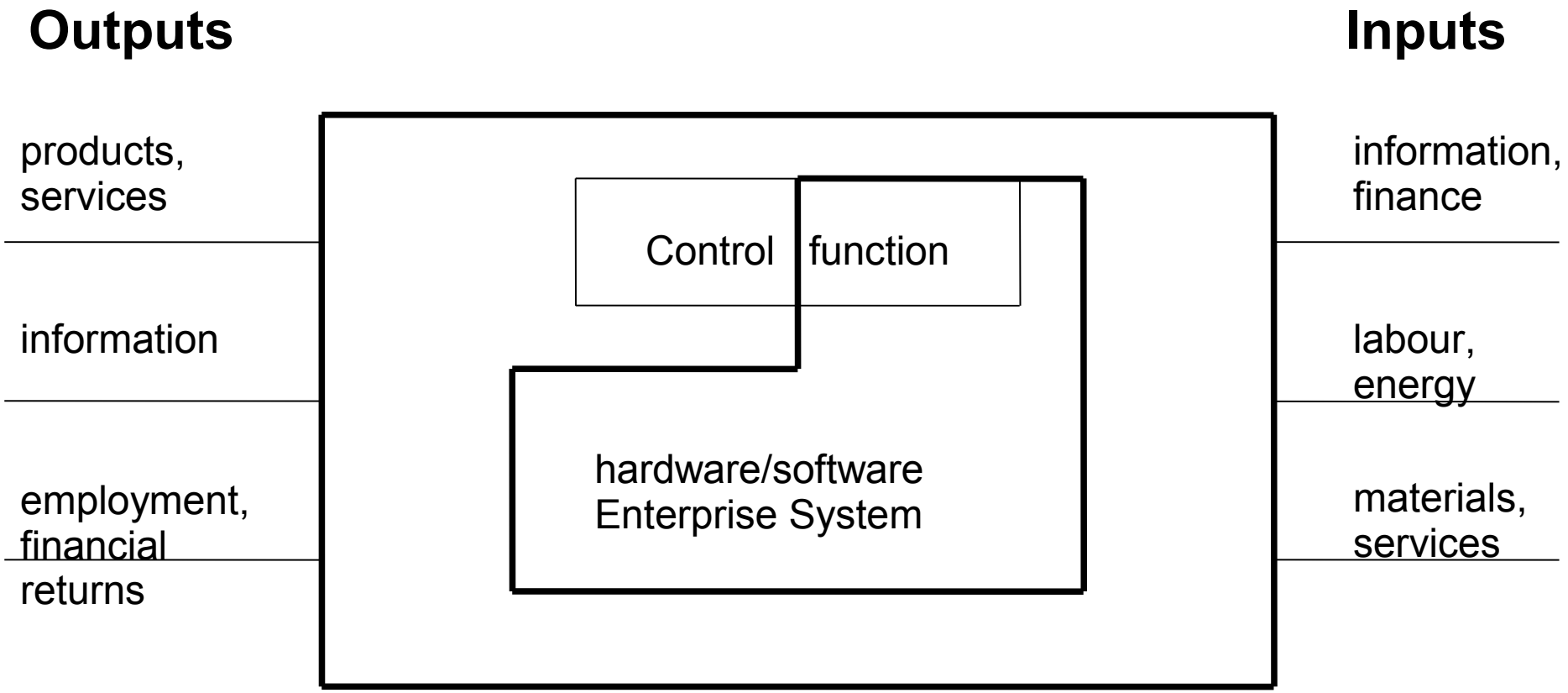
Interesting What's an Enterprise?

- Large numbers of customers
- Large numbers of transactions
- Large financial throughputs
- Complex behaviour/operations
- Sustainable operation

→ ***High scale for an extended period***

An Enterprise System

is the automated part of an enterprise
= a real-time <u>model</u> of the enterprise



Where would you find an ES?

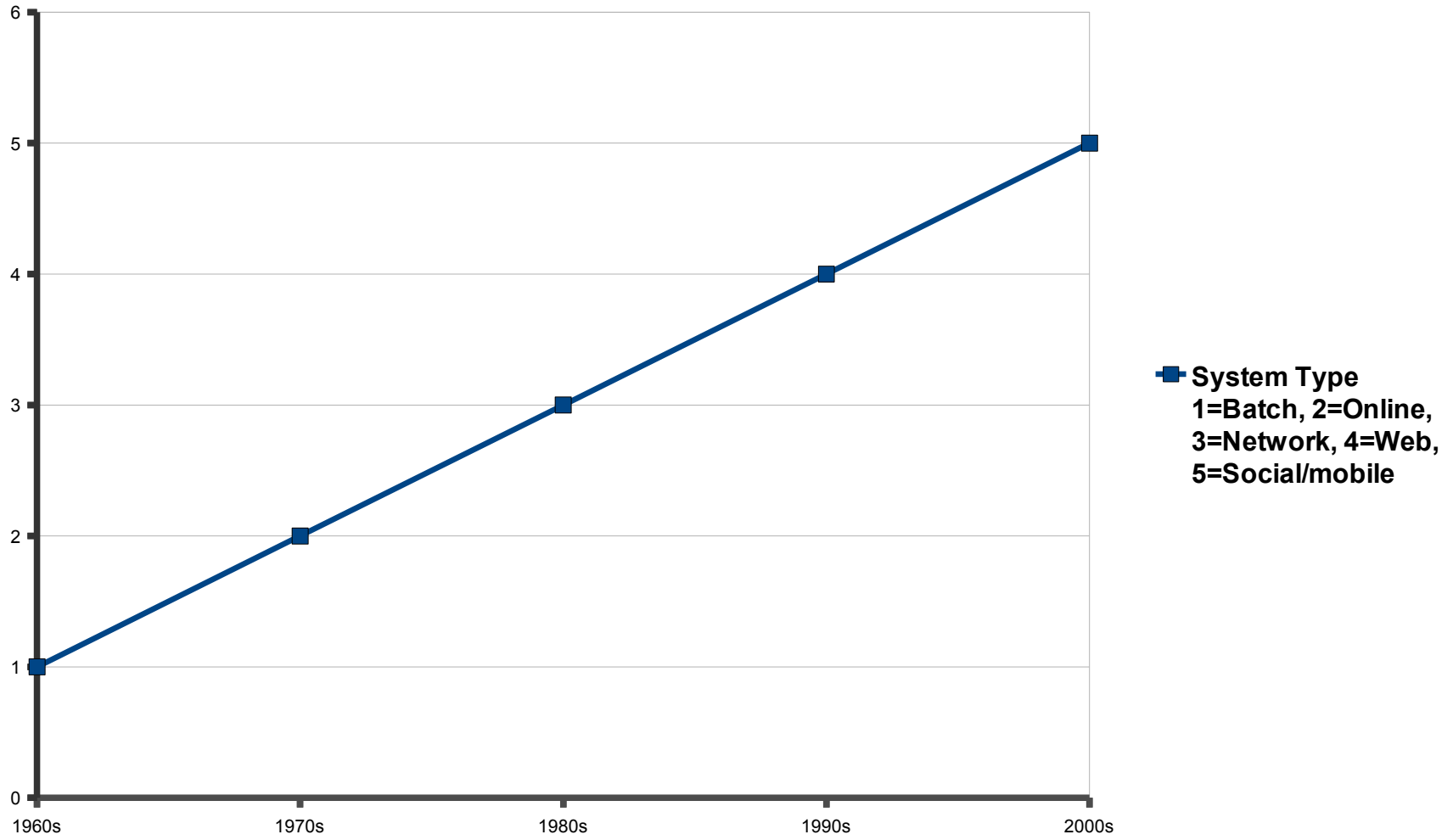
- *Probably not here:* *(primary industry, 5% of economy)*
  - *Agriculture, fisheries, forestry, water extraction*
  - *Mining, oil & gas extraction*
- *Possibly here:* *(secondary industry, 40% of economy)*
  - *Construction, utilities*
  - *Transport, distribution, communications*
  - *Manufacturing (discrete & continuous)*
- *Probably here:* *(tertiary industry, 55% of the economy)*
  - *Financial & business services, media, retail*
  - *Education, healthcare, tourism, entertainment*
  - *Public admin*

Brief History of Enterprise Systems

Pioneers of Enterprise Systems

- 1952 – Joe Lyons & Co. Leo system
  - batch accounting & payroll operations
- 1965 – American Airlines Sabre system
  - online flight reservations & check in
- 1993 – Amazon.com
  - direct customer service, just-in-time delivery
- 2001 – Google.com
  - customised search using large amounts of data
- 2008 – Apple iPhone
  - mobile applications

Getting Closer to the Customer



What were the Key Innovations?

- 1950s – main storage (delay lines, ferrite cores), secondary storage (magnetic tape), batch job scheduler
- 1960s – operating system, direct access storage, database management, time sharing terminals
- 1970s – TP monitor, relational database
- 1980s – personal computer, networking
- 1990s – World Wide Web
- 2000s – search engine, social networking, mobile

Programming Paradigms

Time Sharing/Conversational

- At logon time, operating system allocates:
  - Memory address space for application
  - Operating system process
  - Files, communications channels, etc.
  - These remain dedicated to user until logoff
- Paradigm is widely used, but:
  - No sharing of resources
  - Not scalable beyond few hundred users

TP Monitor PseudoConversations

- TP Monitor acquires & retains shared resources
  - Applications, memory, processes, threads, files, databases, communication channels, etc.
  - On receipt of user transaction request, provides ***concurrent*** access to resources for application
  - Frees resources as soon as output message sent
- Highly scalable to 10s of thousands of users
  - Requires stateless application programming
  - Conversation state held in “scratchpad” files

Representational State Transfer

- Underlying paradigm for Web hypertext transfers
  - Commonly abbreviated as REST
  - Web servers manage network & provide ***concurrent*** access
  - Defines stateless clients for rendering data
  - Highly scalable to 10s of thousands of users
- Does not define how to build update applications on the Web
  - Disallows “cookies” - no scratchpad
  - Does not define server application model

Google Applications

- Underlying paradigm for Google search and other applications
    - Uses GAE (Google App engine)
    - Requires stateless clients
    - Concurrent access to “scratchpad” storage via GFS/BigTable
    - Highly scalable to 10s of thousands of users
- Especially suitable for applications using read-only data, e.g. search data, maps, etc.

Why do these Paradigms Work?

- All these paradigms embody the ***many-to-one relationship*** between customers and the enterprise

- The TP, Restful, & Google paradigms provide scalable concurrency & enable the enterprise to exploit ***economies of scale***

- None of them is a ***complete description*** of what modern enterprise systems need

What Paradigm is Needed?

- Stateless applications provide the highest scalability and work well for read only requests

- ***But*** commercial applications, e.g. web shopping, need conversation state & concurrent update
  - Use HTTP because it supports any-client-to-any server, unlike object-based protocols
  - Hold state on client or replicated server file system
  - Collect updates that form part of a transaction
  - Permanently save data at end of conversation

Current Enterprise System Challenges

Enterprise Business Challenges

Enterprise business people care about two primary objectives:

- ***Reducing costs:***
  - automating/eliminating internal processes
  - reducing operating costs for enterprise systems
  - reducing ownership costs for enterprise systems
- ***Increasing revenue:***
  - Winning new customers
  - Retaining existing customers
  - Getting more business from existing customers

Enterprise System Challenges

1) ***Multi-channel applications***
   - acting consistently to the customer

2) ***Multi-business service***
   - providing multiple offers consistently

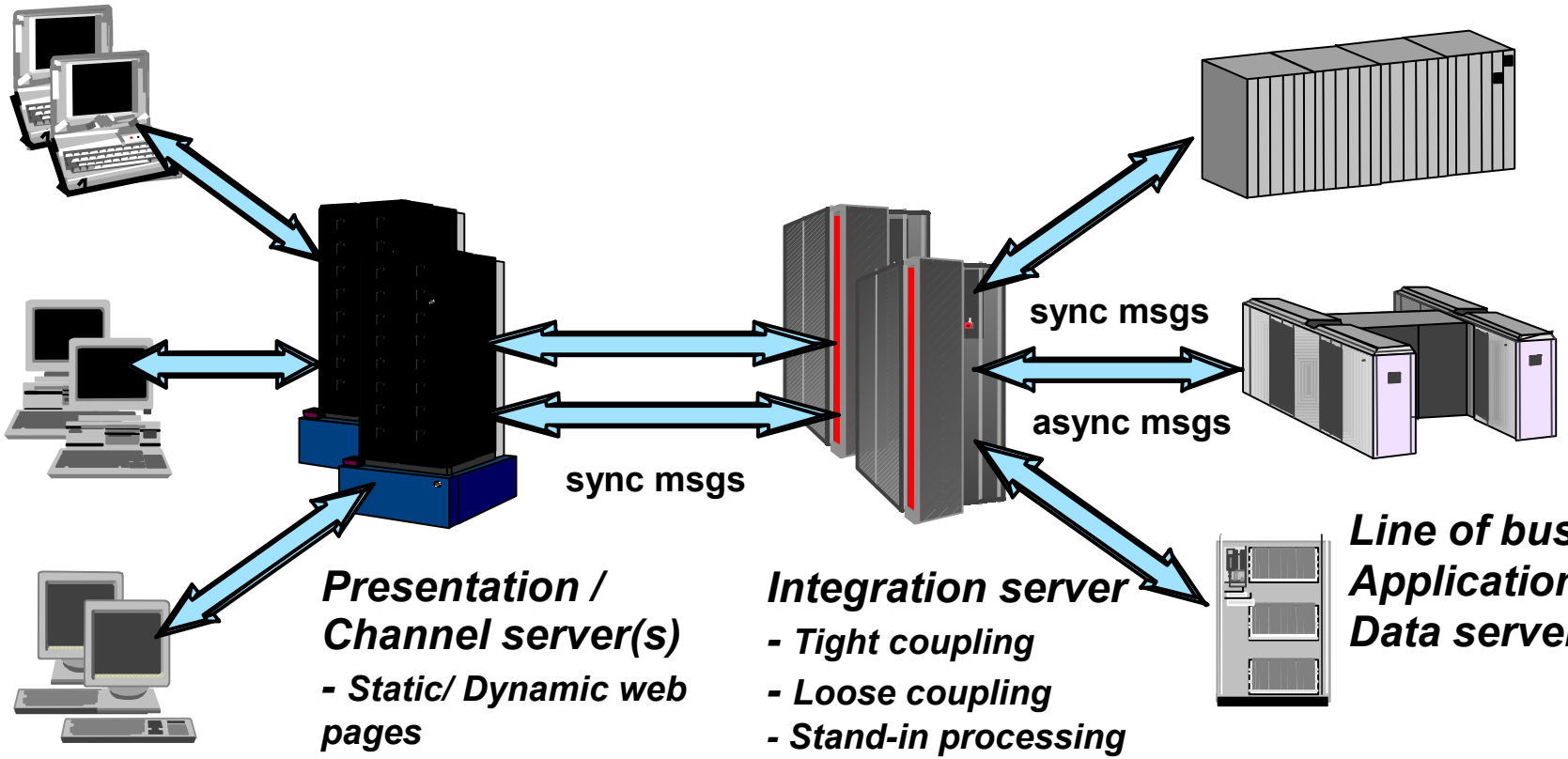
3) Effective customer knowledge
   - acting more intelligently to the customer

4) ***Effective market knowledge***
   - foreseeing what customers will want next

Multi-Channel Applications

- Many enterprise systems are designed to support particular sales channels, eg.:
  - Store checkout systems
  - Kiosk/ticketing systems
  - Call centre systems
  - Web based systems
  - Mobile systems
- Business offer may depend on channel, but
- Applications should ***treat the customer consistently***, whichever channel he/she uses

Typical M² Architecture



Presentation / Channel server(s)

- *Static/ Dynamic web pages*
- *Portals*
- *Channel specific*

Integration server

- *Tight coupling*
- *Loose coupling*
- *Stand-in processing*
- *Flow ctrl/compensation*

Line of business Application and Data server(s)

M^2 = Multi-Channel, Multi-Business

Customer Knowledge

- Many web systems allow customer to explore options before & after a transaction:
  - high “browse to buy” ratio in web shopping
  - evaluations of product, service, etc.
- If we identify the customer, we can study:
  - search patterns
  - history of actual transactions
  - customer likes & dislikes
- May enable ***better offers*** to the customer
  - need more data & may require real time ***parallel*** computation

Market Knowledge

- Many enterprise systems collect data about a mass of customer transactions:
  - Collected/refined in data warehouse
  - Linked with tools for analytics / Bus Intelligence
  - Used to produce periodic reports & analyses
- This process may be ineffective:
  - Too slow/costly for business needs
  - Only structured data – much unstructured data
  - New methods use very large data sets
- Best practice uses ***highly parallel*** processing

"Highly Parallel" Processing

- Google is the best known exponent
  - Many processes crawling the Web in parallel
  - Combine results using MapReduce technique
  - Store results in Google File System
  - Effectively substitutes concurrency for parallelism
- Also widely used in scientific applications:
  - e.g. SETI @Home used subscriber PCs
- IBM "Blue Gene" protein modelling project
  - 4K processors generated 10 μsec simulation
  - Uses hardware cluster plus GPRS

Summary

- When building an Enterprise System, we are building a model of (part of) the enterprise:
  - Model must be real time and scalable
  - Customer can use anywhere, anytime, any device
  - Access any business offering consistently
  - Know and respond *intelligently* to each customer
- Meta-Enterprise System should analyse system & aggregate behaviour of customers
  - Detect trends and respond to them