The Objects of E-Commerce

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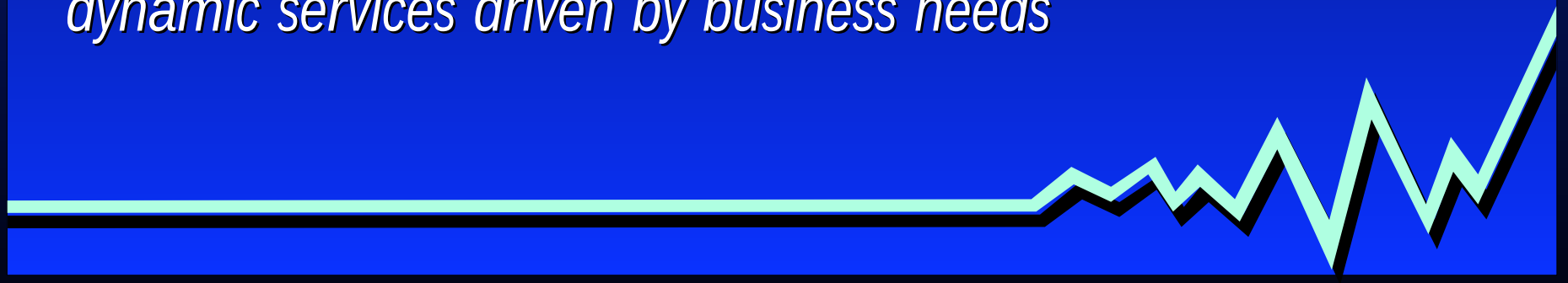
Outline

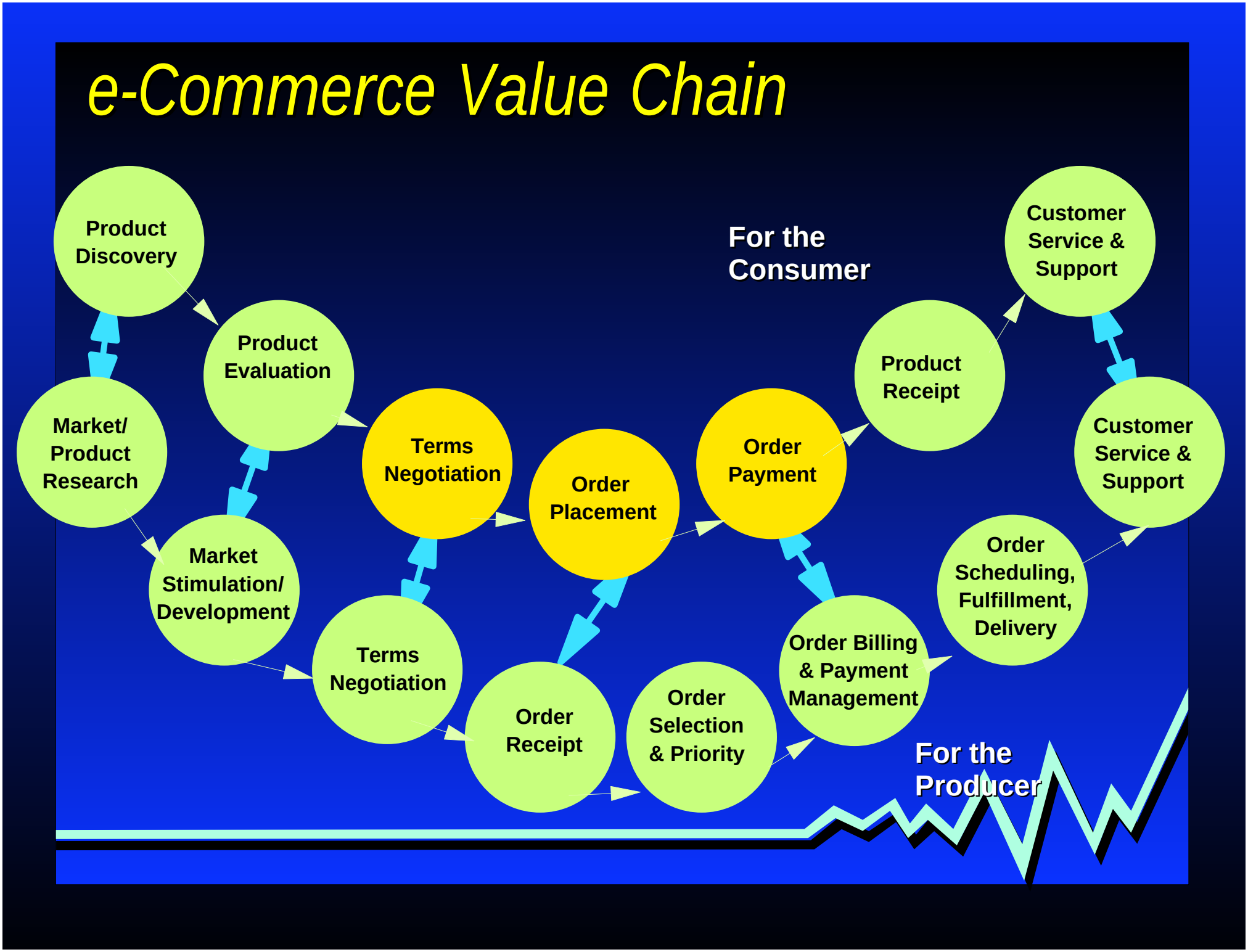
- Electronic Commerce Trends
- Technology Implications and Drivers
- Research Challenges
- Software
- Distributed everything
- Business Process and Models
- Objects

Basic Theme

- E-Commerce is huge & immensely challenging
  - trillions and trillions
  - wonderfully corrupting and tempting for researchers
- New world requires both agility and reliability
  - with considerable complexity
- New business structures are fundamentally objects - we'll get to them eventually in the talk
- But they need to be supported in a distributed world of dynamic services driven by business needs

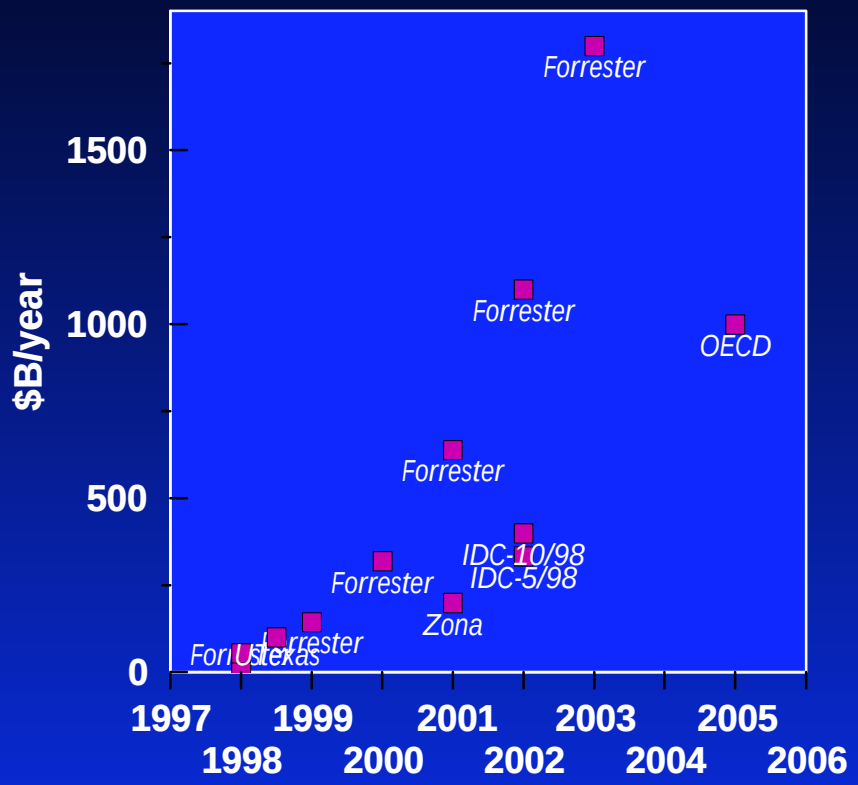


Electronic Commerce - Definition, Growth and Trends

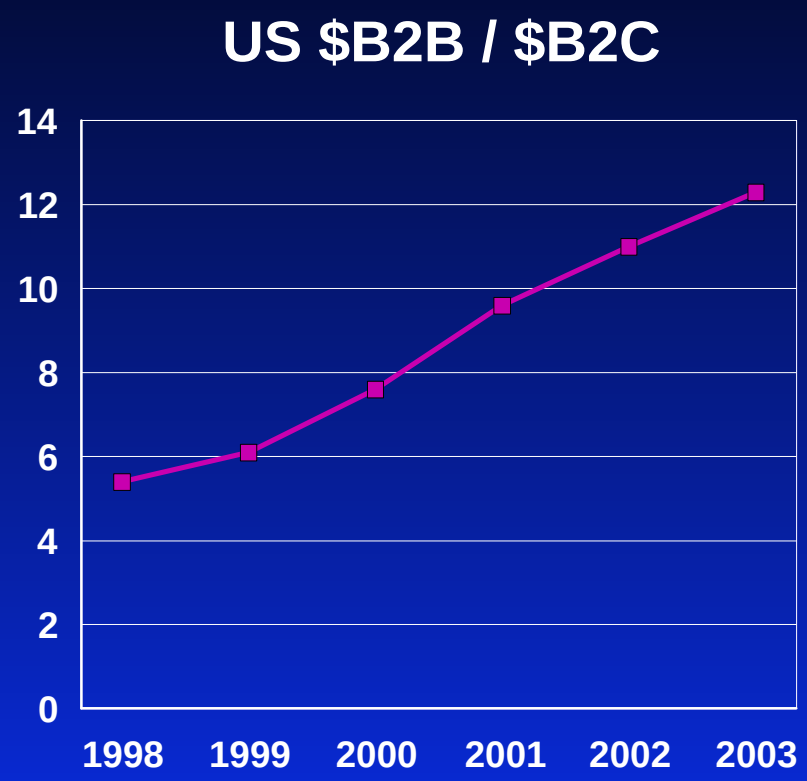

e-Commerce Value Chain
Product Discovery
Product Evaluation
Market/ Product Research
Market Stimulation/ Development
Terms Negotiation
Order Placement
Terms Negotiation
Order Receipt
Order Selection & Priority
Order Billing & Payment Management
Order Scheduling, Fulfillment, Delivery
Order Payment
Product Receipt
Customer Service & Support
Customer Service & Support
For the Consumer
For the Producer

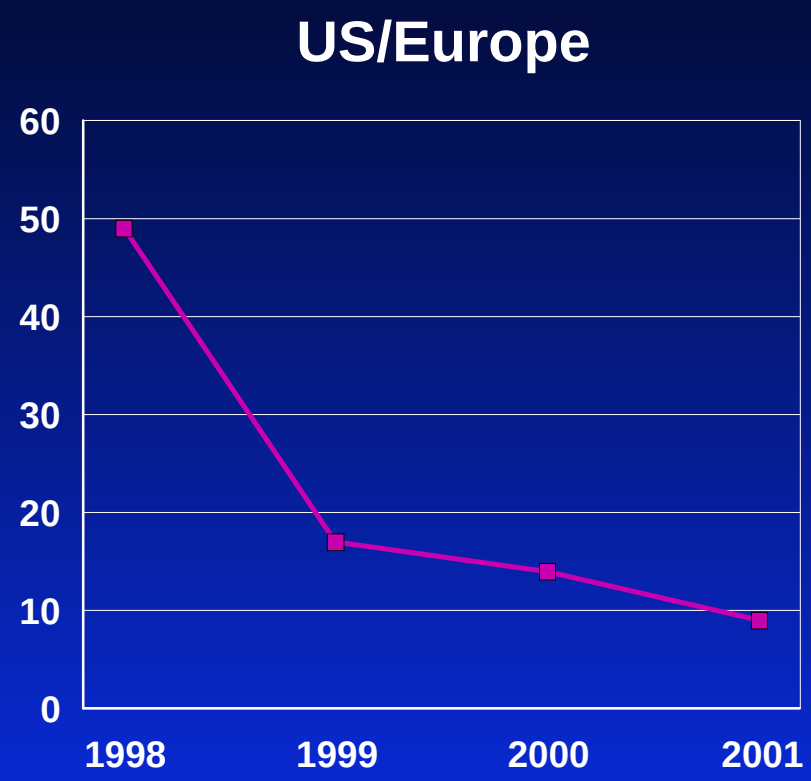
Forecasts

- E-C volume doubles every 9-12 months - pick your forecast
- 1998 estimates: $8B-50B
- 1999 reality: >$100B
- By 2002, E-C >1% of Global Economic Product
- By 2005, E-C>5% of GEP
- US currently dominates
- B2B exceeds B2C by factor of 5-10 through 2005
- Numbers exclude Foreign Exchange ($1.2T/day), Securities (>$100B/day), interbank transfers (>$2T/day)



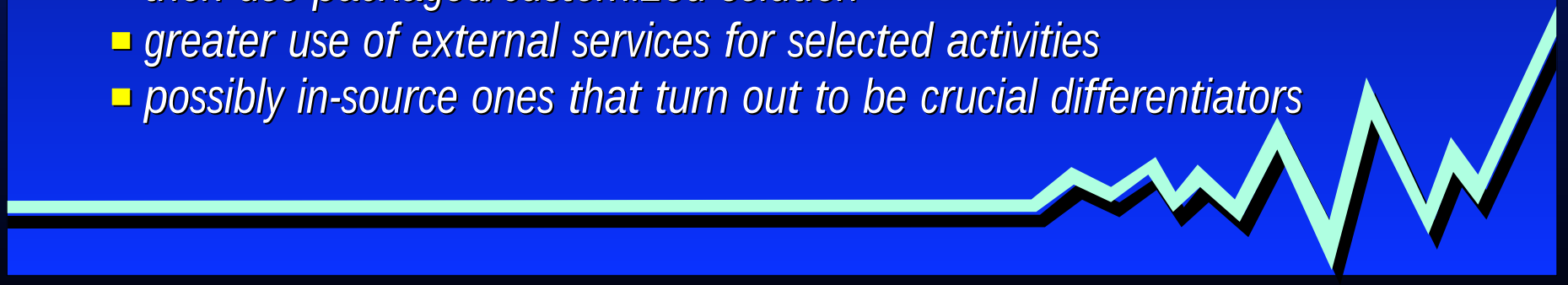
Forrester Consulting Estimate Ratios





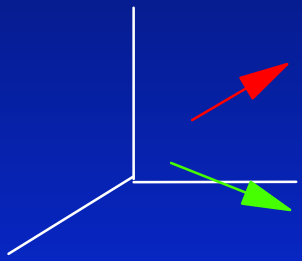
Some E-Commerce Trends

- Need to understand the domain before addressing software
- Technology changes relative costs of factors of production
  - information and communications costs plummet
  - access to information crucial and easier
  - deep calculations and complex software applied to many problems
- Optimal business structures change
  - automated processes, better marketing
  - new types of alliances, broader competition
  - drives toward commoditization, uniqueness
- Execution Models
  - first roll-your-own
  - then use packaged/customized solution
  - greater use of external services for selected activities
  - possibly in-source ones that turn out to be crucial differentiators

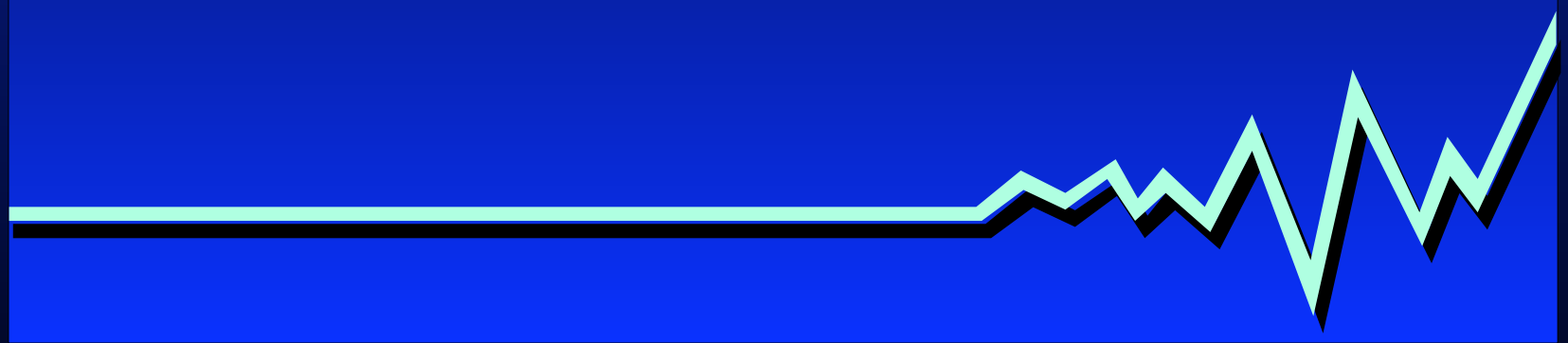


Evolutionary Trends of E-Commerce - Many Trajectories Through Space

1. sell → buy → trade
2. fixed price → auction → negotiate
3. location insensitive ($$,English) → localized → culturally sensitive
4. manual buying → semiautomated → agent-controlled
5. standard goods → parametrized goods → build to order → design to order
6. 1:1 → n:1 → n:m interactions (marketplaces)
7. B2C → B2B → B2B2B, C2C, C2B (technology often first in consumer space)
8. experiment → business sensitive → core business critical
9. fixed plan → decision procedure → deep computing
10. EDI → Web-EDI → Internet EDI
11. run it yourself → hosting
12. ISP → ASP → CSP
13. Roll Your Own → commercial platforms → processes → externalized svcs
14. US → Europe → AP (but starting to change)



Technology Implications, Drivers and Requirements for Growth of Electronic Commerce

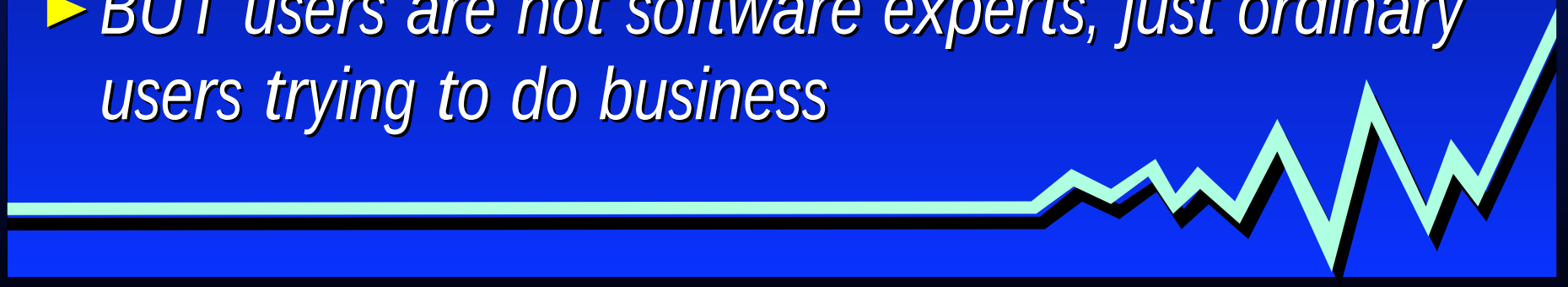


Good News

- Network improvements
  - practical Gb/s on backbone
  - Tb/s deployable
  - access bandwidth rising to Mb/s
- Adequate data and computing capabilities
  - even video, complex search, analysis
- Out of the box software and services supporting complex processes

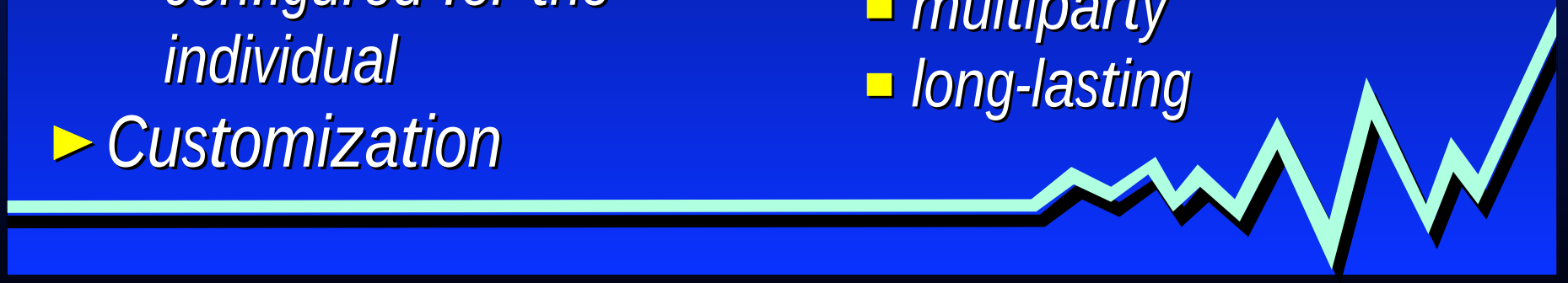
Growing Expectations

- E-Commerce a serious business
- Growth not only fast but irregular
- Legal and economic requirements forcing quality at same time as market drives speed
- Users care about service they get
  - on an end-to-end basis
  - not how they get it
- BUT users are not software experts, just ordinary users trying to do business



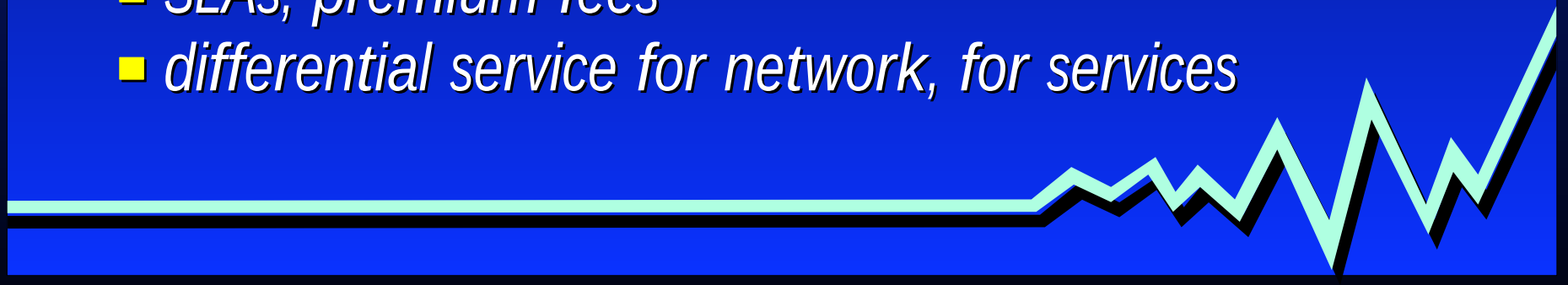
E Commerce - Examples of New Business Functionality

- Payment
  - e-till: cash, check, debit, credit, ...
  - presentment
  - business vs consumer
- Catalog sales
  - fancy (3-D, video,...)
  - configured for the individual
- Customization
- Negotiation
  - auctions, RFPs
  - brokerage
- Logistics optimization
- Virtual Enterprises
- New marketplaces
- Transactions
  - multiparty
  - long-lasting



Performance and Delay

- What are specs for quality of service
  - delay
  - jitter (average, worst case)
- How do you measure
  - over a billion-node network
  - with a changing server load and application set
- What are acceptable
  - SLAs, premium fees
  - differential service for network, for services

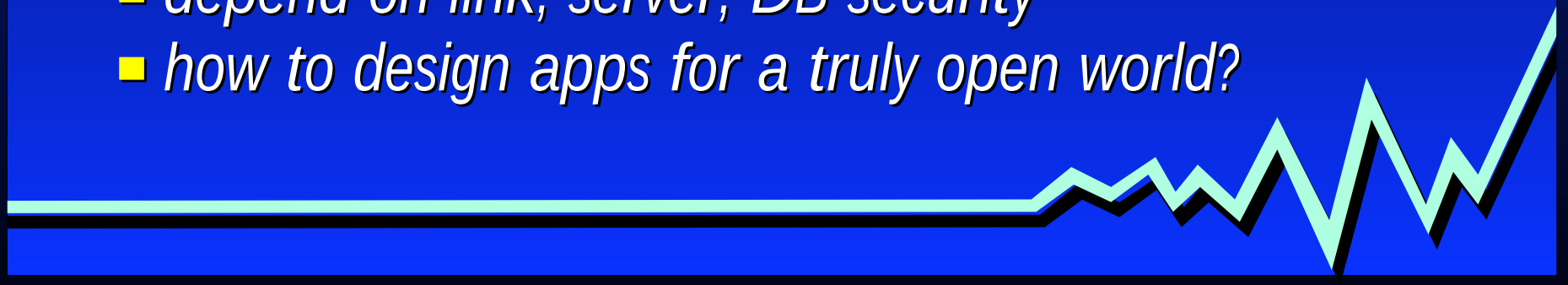


Interrelated Components - All Must work together

- *Users*
- *User Interfaces*
- *Network*
- *Servers*
- *Data sources*
- *Services*
- *Middleware*

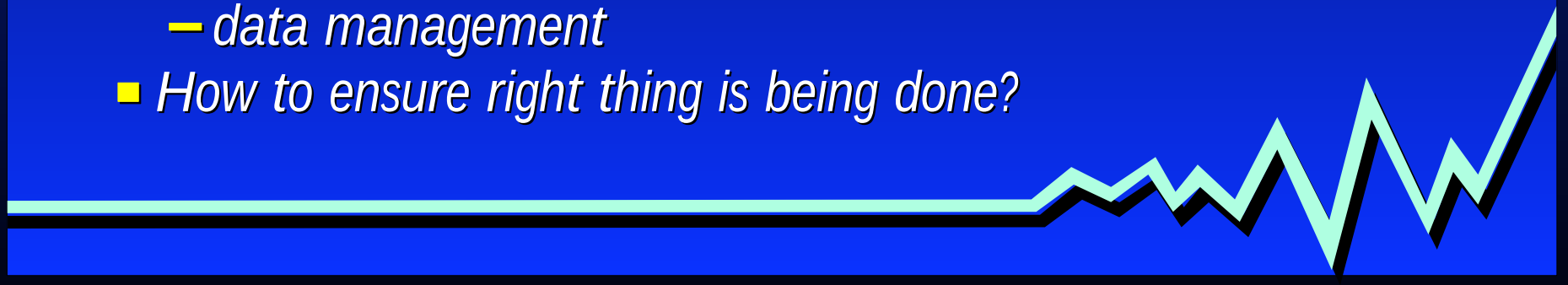
Security and Confidentiality

- Security is essential to run reliable business or to maintain privacy
  - what are threats
  - what if the hardware is penetrable?
  - how do you get people to comply with rules
- Problems at every stage
  - do all security end-to-end, app-to-app?
  - depend on link, server, DB security
  - how to design apps for a truly open world?



Privacy

- Rising social and legal concern
  - political decisions and impacts
  - who owns the information
    - different views in Europe and US
- Technological tug of war
  - individuals can negotiation, protect selves
    - anonymizers etc.
  - enterprises need to manage data as they agreed
    - policy management
    - data management
  - How to ensure right thing is being done?



Availability

- Web apps are becoming business critical
  - users will expect telco standards:
    - switches 99.9995% (3 min outage/yr)
    - individual access 99.99% (53 min outage/yr)
  - but the apps are more complicated
  - and the value they carry is higher
- Real 24x7 = Continuous availability =>
  - in-place upgrades: OS, hardware, app, data schema, ...
- Techniques
  - replication
  - geographic diversity
  - bullet-proof (?) software

Reliability and Functionality

- *Do we know what the app is supposed to do?*
- *Does the code meet those conditions?*
  - *on-line distributed version of unsolved software engineering problems*
- *Dependencies on environment*
  - *applications, not just network protocols*

Convenience and Ease of Use

- *Will people want to use it*
  - *comprehensibility, uniform model, error-proneness, training time*
- *The next frontier of business success and technical difficulty*

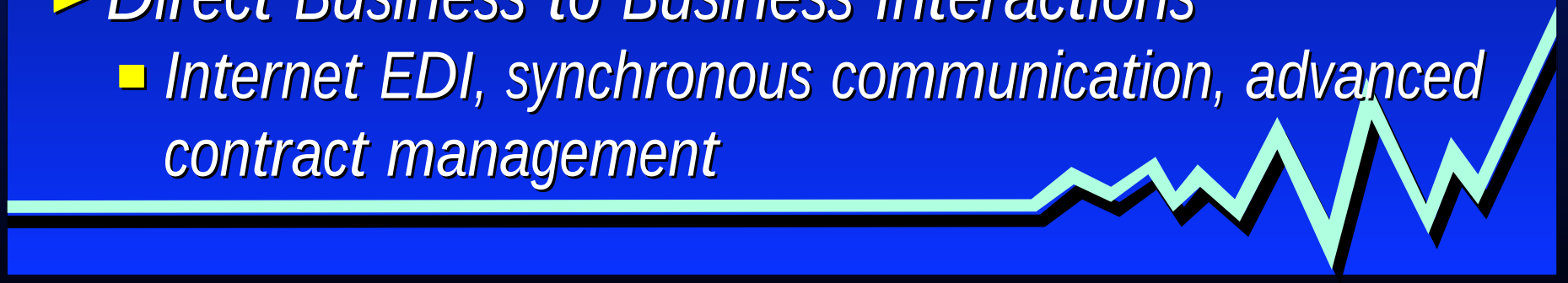
Some Research Challenges

Research Field and Opportunities

- ACM has new SIGecom
  - first conference here this week
- First degree programs
  - several MS and MBA concentrations underway
  - many more specialized master's degrees in 2000
  - first PhD programs announced
- Journals
  - several
- Core subjects
- Many conferences and workshops

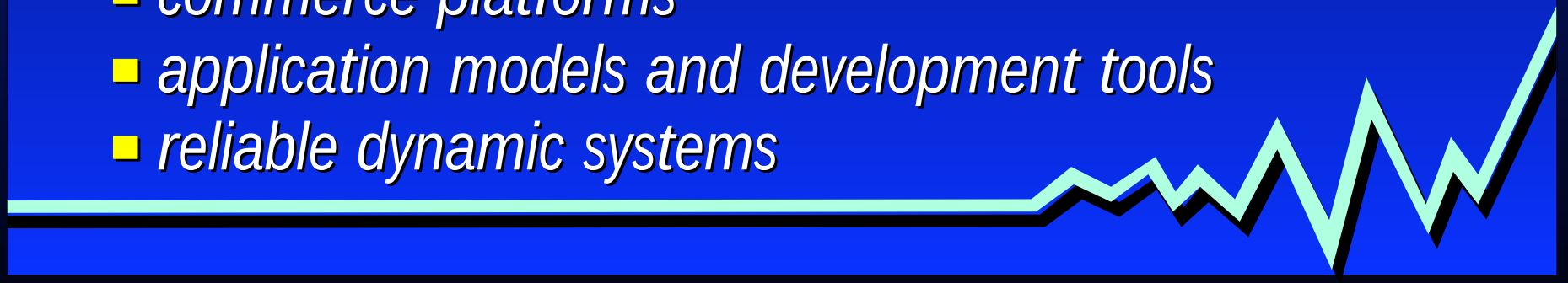
IAC: Eight Research Themes & Related Projects

- Evolving Marketplace
  - e-marketplaces, brokerage, information economies, multi-agent systems
- Privacy
  - policy, P3P standard, Enterprise Privacy Mgmt
- Variable Prices and Negotiated Dealings
  - auctions, advanced negotiations
- Direct Business to Business Interactions
  - Internet EDI, synchronous communication, advanced contract management



IAC: Eight Research Themes & Related Projects (continued)

- Managing the End Customer
  - personalization, customization, inteligence
- Impact of Globalization
  - security issues for contracts, inter-culturalization
- Deep Computing for Commerce
  - personalization, finance, datamining
- System Foundations
  - commerce platforms
  - application models and development tools
  - reliable dynamic systems



Software: Structure, Development, Evolution

Role of Software

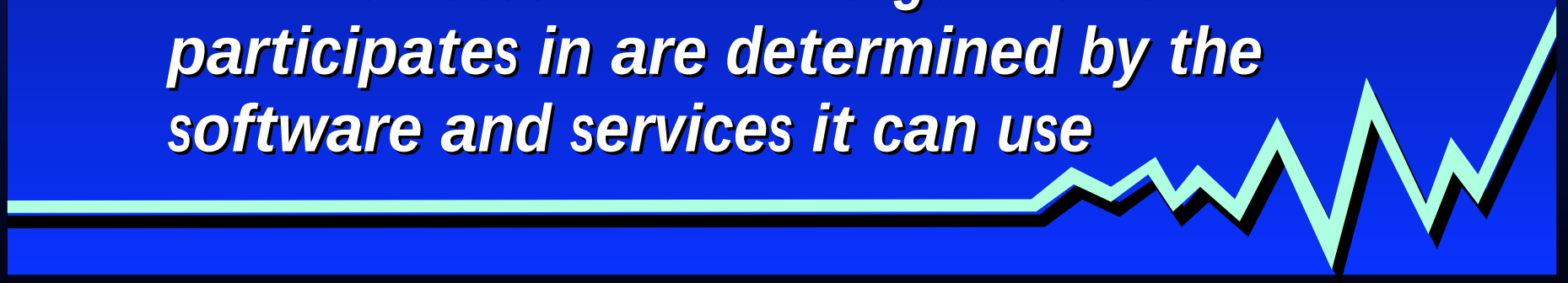
- Traditional
  - structure of software is determined by structure of the organization that creates it

Role of Software

- *Traditional*
  - *structure of software is determined by structure of the organization that creates it*
- **New**
  - **structure of the organization is determined by structure of the software that it uses**

Role of Software

- *Traditional*
  - *structure of software is determined by structure of the organization that creates it*
- **New**
  - **structure of the organization is determined by structure of the software that it uses**
- ***Newer***
  - ***the businesses that an organization participates in are determined by the software and services it can use***



Realistic Time Scales for Change

tinker with software	days
upgrade business-critical software	4-12 months
transform business processes and systems	years
make fundamental modifications to essential systems	years
change social & political habits & expectations	decades

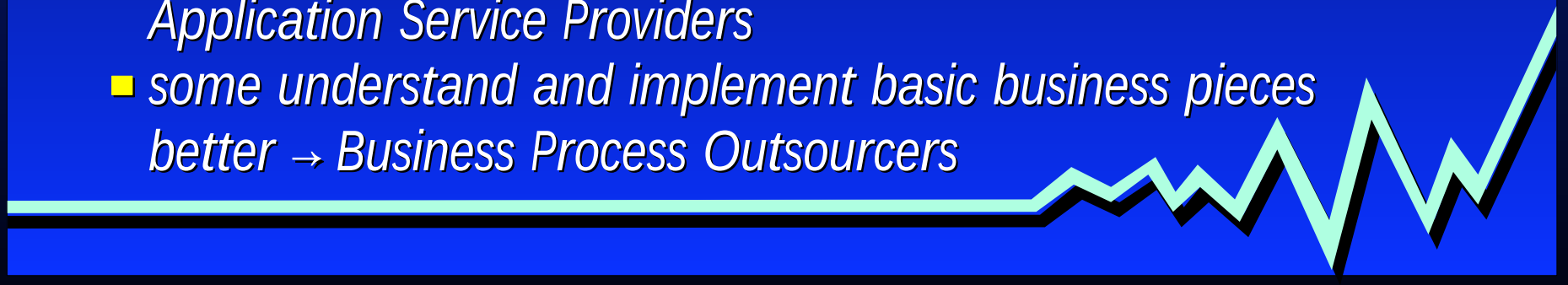
How to Break The Barriers?

- Standardized interfaces
- Better building tools
- Reliable building blocks
  - shrink-wrap services as well as software

Distributed Dynamic Everything Everywhere

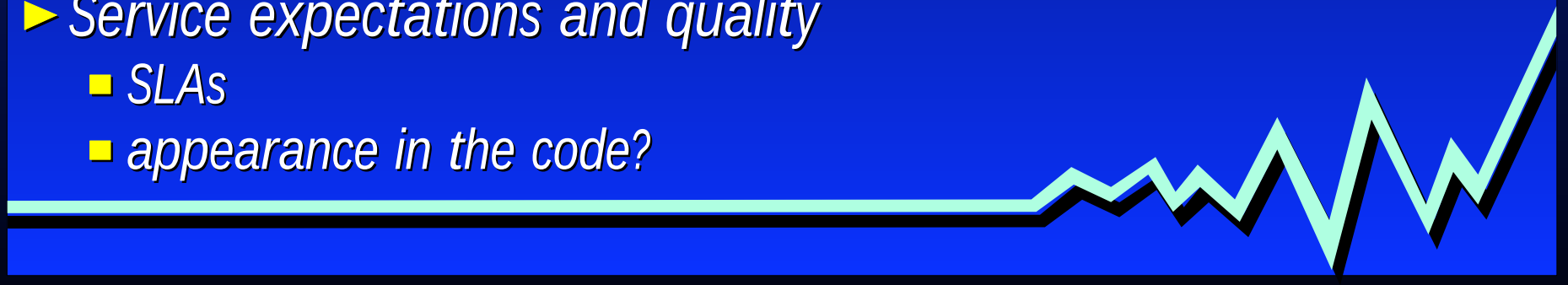
New Service Businesses

- *Assumption: the Network is here and it works*
  - *distributed execution is a realistic fact of life*
  - *can utilize distant services as easily as local ones*
- *Differential advantage*
  - *some producers of software do it better → Independent Software Vendors*
  - *some producers of services do it better → Independent Service Vendors*
  - *some operators of servers do it better → outsourcing, Application Service Providers*
  - *some understand and implement basic business pieces better → Business Process Outsourcers*



Dynamic Interactions

- Standard syntax for interfaces
  - XML is default answer
  - but how many DTDs will there be?
- Well defined service interfaces
  - not yet - they change abruptly
  - who controls, owns, checks?
  - what to do if they do change
- Service content
  - no standard representation, description, etc.
  - DTD is just the start
- Service expectations and quality
  - SLAs
  - appearance in the code?



Dynamic Evolution

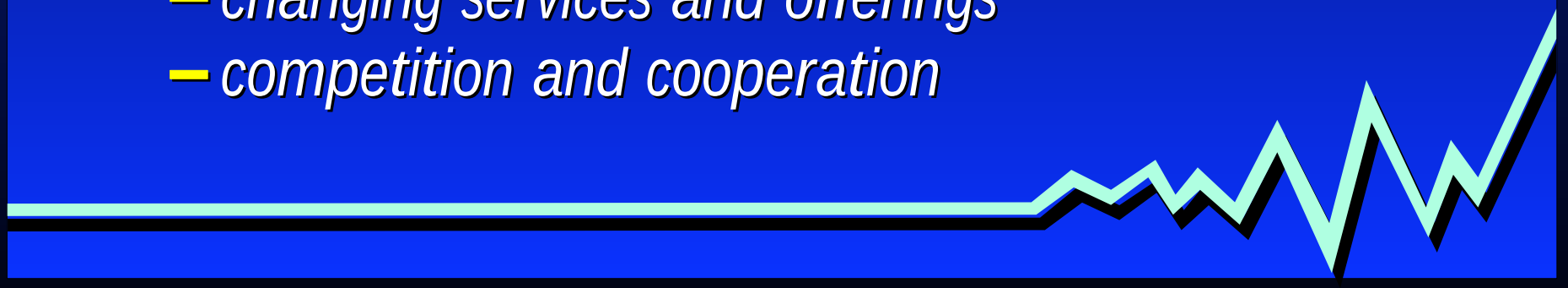
- We have trouble running single systems
  - now we presume to offer widely distributed generalization
- Load balance and capability sharing
  - Management of billions of distributed objects
- Evolution of capability in face of
  - ongoing search and discovery
  - business challenges and competition
  - mission creep
  - technology improvements
  - new service offerings

Distributed Data

- Terabytes are common
  - some online sites have multiple terabytes of web data - not simple relational
  - large enterprises have 10 TB - 100 TB online
  - petabytes no longer a dream
- Sharing become a reality
  - geographic issues
  - separate control
  - mergers and de-mergers

Distributed Businesses

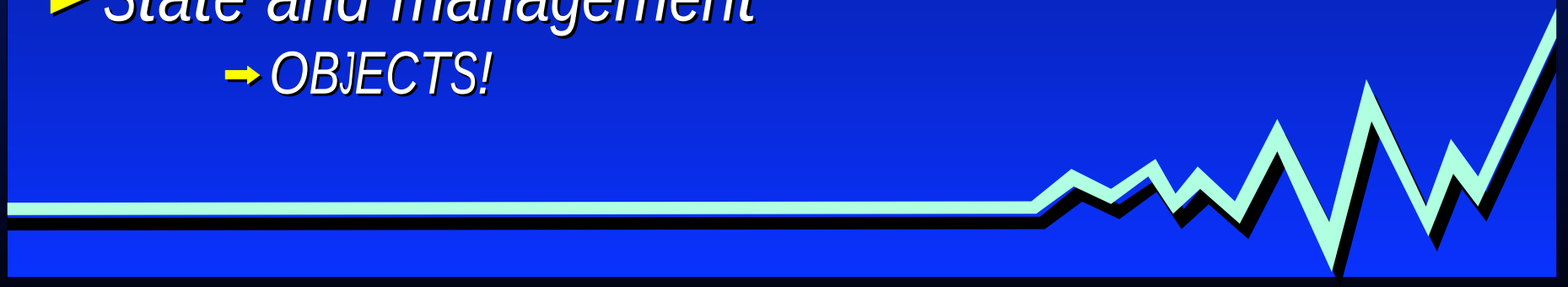
- Physically distributed firms
- Virtual enterprises
  - short and long term
- Marketplaces
  - "next big thing" in E-Commerce
  - controlled shared environment with
    - shifting roles and members
    - changing services and offerings
    - competition and cooperation



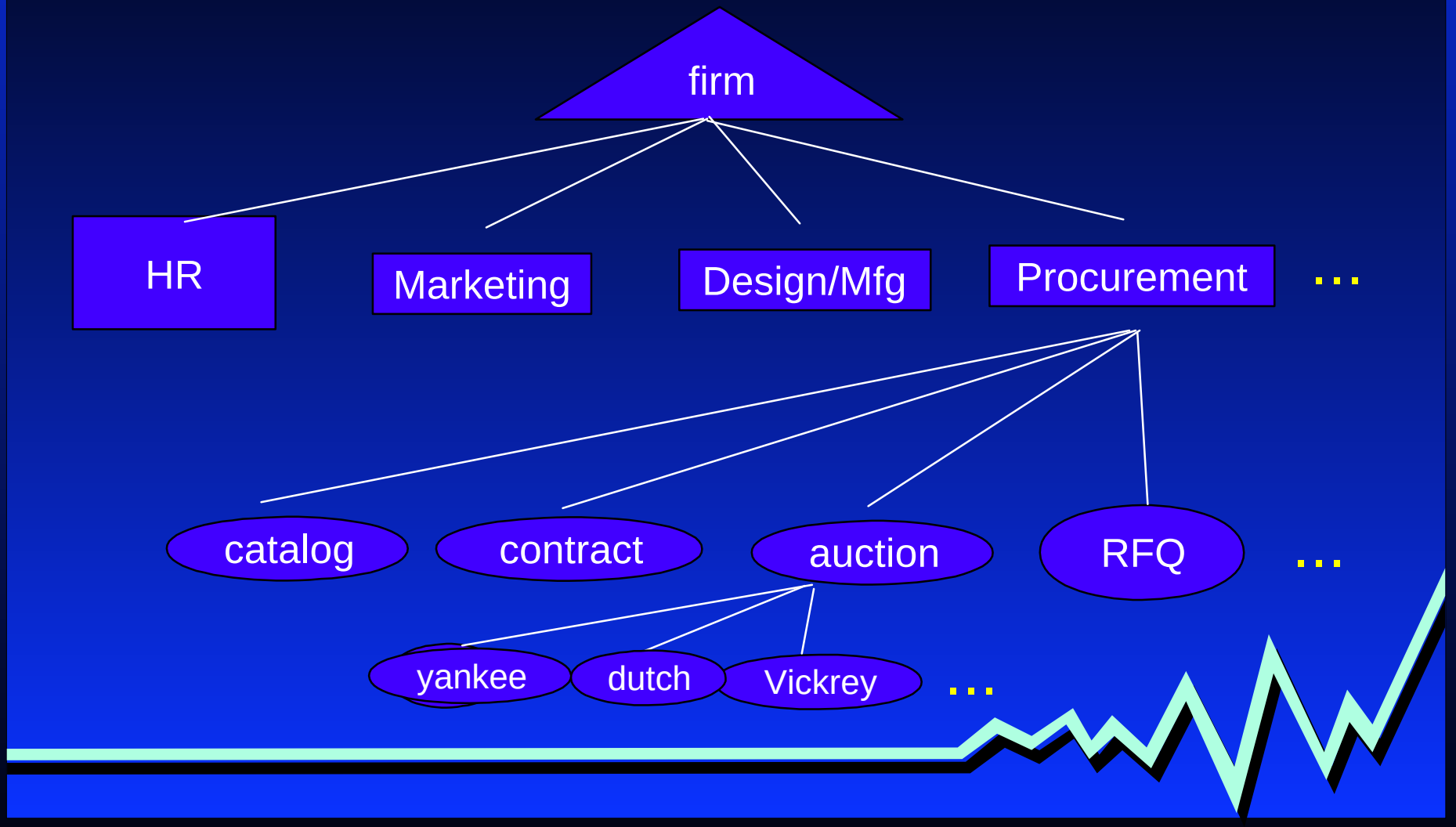
Business Processes & Business Models

Business Processes

- Fundamental unit of activity
  - some quite standard
  - some specific to the business
- Mixture of automated and human activities
  - Roles and responsibilities
  - monitoring, execution, etc.
- Variants and sharing
- State and management
  - → OBJECTS!



Business Processes - Granularity



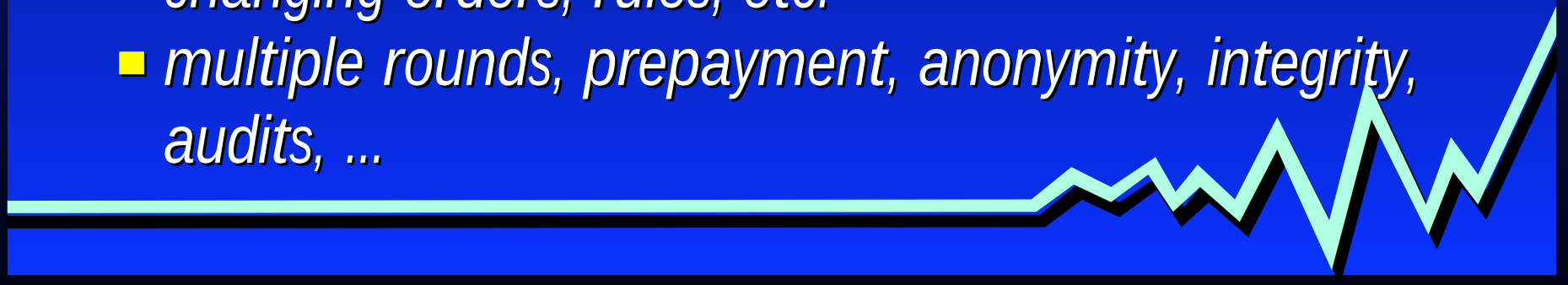
Process Composition and Programming

- *Composition and sequencing*
- *Subclassing and variation*
- *Execution sequences and logic in a distributed world*
  - *construction*
  - *debugging*

All "Just a Simple Matter of Programming" :-(

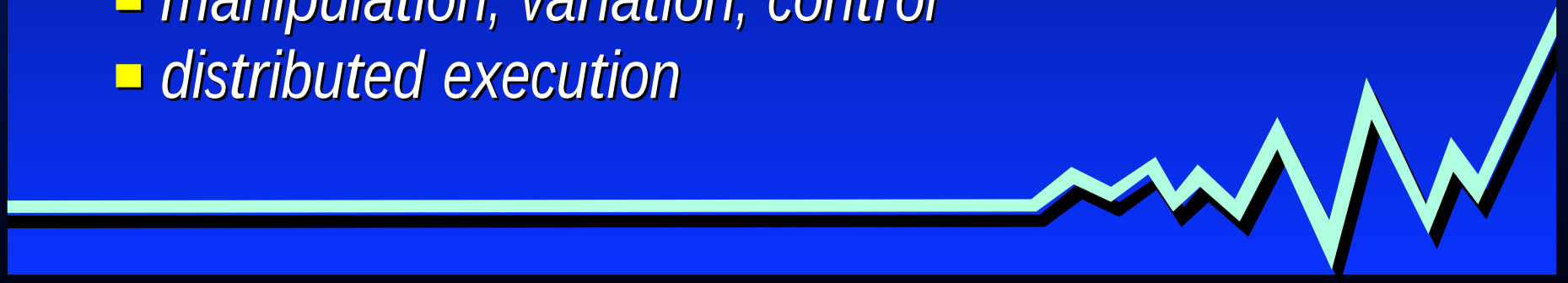
Example - Auctions

- *Basic sequence for a single auction*
  - *establish offer, rules, advertising*
  - *members (identificaiton, qualification)*
  - *execution (style, rules, timing, ...)*
  - *determination of winners, prices*
  - *exchange of money and goods*
- *But many alternatives*
  - *changing orders, rules, etc.*
  - *multiple rounds, prepayment, anonymity, integrity, audits, ...*



Business Models

- *The next frontier*
- *Basis of an organization's entire activity*
  - *how it is structured*
  - *how it makes profit (economic, social, etc.)*
- *Patentability*
  - *and rigorous specification*
- *Technical OBJECT definition*
  - *manipulation, variation, control*
  - *distributed execution*



Objects of E-Commerce

Basic Object - Make Money

Some Technical Objects

- *Business Models*
- *Business Processes*
- *Basic enablers and capabilities*
- *Documents and contracts*

Examples - Coarse-Grained Processes

- Payments
  - bill presentment
- Payment gateways
- Catalog
  - management
  - presentment
- Virtual catalog
- Community services
  - chat rooms
  - community-specific content and search
- Privacy services
- Search
- Workflow and dataflow management
- Document management
  - reliable delivery
  - multiple modalities
  - auditability
- Marketplace services
  - negotiation
  - exchanges
  - auctions
  - brokerage

Summary

- *Growth of E-Commerce is pushing the limits of software development and execution*
- *New valuable forms of object are appearing, representing new businesses activities*
- *Business and execution models will be increasingly dynamic and distributed*
- *Excellent opportunities for new tools, technologies, and research*

E-Commerce and Related Disciplines