MSc in SCM • 24-25 January 2013 • ISLI-BEM, Bordeaux, France

SCM

SYSTEMS AGE – DECISIONS in CONTEXT

Dr Shoumen Datta
End of the Information Age
Statistically documented discontinuity can be traced to critical engineering and organizational advances connected with the electrification of industry. These developments marked the culminating phase in the diffusion of the "dynamo" as a general purpose technology that enabled significant fixed-capital savings, while simultaneously increasing labor productivity. A narrow technological explanation of the post-WWI industrial productivity surge proves to be inadequate. It neglects the concurrence of those developments with important structural changes in US labor markets and fails to do justice to the significance of complementarities that emerged between managerial and organizational innovations and the dynamo-based factory technology, on the one hand, and, on the other, between both forms of innovation and macroeconomic conditions of 1920’s.
Slow pace of adoption prior to the 1920’s was attributable largely to the lack of profitability of replacing still serviceable manufacturing plants adapted to the old regime of mechanical power derived from water and steam. Coexistence of older and newer forms of capital often restricted the scope for exploiting electricity’s potential. Prior to 1920, the group drive system of within-plant power transmission remained in vogue. With this system (in which electric motors turned separate shafting sections, so that each motor drove related groups of machines) primary electric motors often were merely added to the existing stock of equipment. With the favorable investment climate of the 1920’s, firms had the opportunity to switch from group drive to unit drive transmission, where individual electric motors were used to run machines and tools. Advantages of the unit drive extended well beyond savings in fuel and in energy efficiency. They also made possible single-story, linear factory layouts with reconfigured machine placement permitting flow of materials through the plant that was both more rapid and more reliable. Rearrangement of the factory contributed to cost savings in materials handling operations.
Transforming EBM to ABM

Cross-docking Variables: Decouple ‘Chains’ to Include/Exclude Local Effects

Traditional EBM (CLRM example): Sales of Aspirin and Variables that Impact Sales

\[ y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \cdots + \beta_K x_{Kt} + \varepsilon_t \]

Example of X:
[1] Inventory
[2] Price
[K] Expiration

Inventory Agent
Price Agent
Expiration Agent

ABM - Agents in EBM DSS

Transformed EBM plus ABM within CLRM construct: Sales of Aspirin
Decoupling Equation-Based Models (EBM) prevalent in SCM

Agent-integrated business models rapidly respond to changes in value network partners and incorporate local changes for global optimization.

\[ y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \ldots + \beta_K x_{Kt} + \varepsilon_t \]

**Mode 1**

**Mode 2**

**Mode 3**

**CROSS-DOCKING VARIABLES**

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
VAR-GARCH

Auto id nodes in Supply Network Planning

10 locations

\[
Y_{1t} = \beta_0 + \sum_{k=1}^{K} \sum_{i=1}^{N_{x_{kt}}} \alpha_{ki} x_{kt-i} + \phi_{11} Y_{1t-1} + \phi_{12} Y_{2t-1} + \epsilon_{1t}
\]

\[
Y_{2t} = \beta_0 + \sum_{k=1}^{K} \sum_{i=1}^{N_{x_{kt}}} \alpha_{ki} x_{kt-i} + \phi_{21} Y_{1t-1} + \phi_{22} Y_{2t-1} + \epsilon_{2t}
\]

Will ROI increase if business process is optimized before tech investment?

Will precision of forecasting depend on an optimized supply network planning?
Multi-Parametric Risk Analysis and Distributed Intelligent Decisions

Open Grid Services Architecture
Multi-Agent Systems
SEMANTIC CONNECTIVITY

Compliance Agent

Policy Status
Update

Mandates

Storage

Confirmation

Ship Order

real time inventory

Air
Land
Water

Traffic

Air
Land
Water

Air
Land
Water

Air
Land
Water

Air
Land
Water

Air
Land
Water

Air
Land
Water

Bio
Chem
Mat

NORA Agents

Client

Transport
Agents

DC

Global

National

Local

dMDM

Government

CUSTOMS

Exceptions
Alerts
Warnings

DHS

SOX 401

Business

Paused

SOX 404

LABOUR

Contracts

Biometrics

NORA Agents

Biocom
Chem
Mat

Government

Business

DHS

NORA Agents

Multi-Parametric Risk Analysis and Distributed Intelligent Decisions

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
End of the Information Age

Welcome to the Systems Age
Devices that can be networked

Noncomputer objects will soon account for the vast majority of networked devices. The market for such things is enormous.
Devices that can be networked will soon account for some 10% of the market for some applications.

**Billions of Objects**
- 3.0 J & J
- 10.0 Kimberly Clark
- 15.0 Tesco
- 20.0 Unilever
- 25.0 Philip Morris
- 30.0 Wal-Mart
- 31.0 P&G
- 53.0 International Paper
- 200.0 Coca-Cola
- 205.0 US Post

**Octillions of Identifiers**
- 200.0 Coca-Cola

**Trillions of Processes**
- 200.0 Coca-Cola

- EPC 64-bit: 18,446,744,073,709,551,616 (1.8\times10^{19})
- EPC 96-bit: 79,228,162,514,264,337,593,543,950,336 (7.9\times10^{28})

Objects with RFID tags possess id; excludes “process” information.
Data

Trillions of Sensors

- Temperature
- Light
- Moisture
- Magnetic Field
- Weight
- Tilt
- Chemical

Universal Identifier (UI) with Sensors

Electromagnetic Return Signal

local computer

PC
Process, Data, Information

Trillions of Sensors

ID + Temperature, Light, Moisture, Magnetic Field, Weight, Tilt, Chemical = Status
Data is not Information

Universal Identifier (UI) with Sensors

ID

Temperature + Light + Moisture + Magnetic Field + Weight + Tilt + Chemical = Status

PC

Local computer

Electromagnetic Return Signal
Customs: Information Arbitrage

The Systems Age

*The World Is Not Flat*

- Interoperability
- Transparency
- Collaboration
- Adaptability
- Identity

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation)
Obvious vs Non-Obvious Relationship Analysis

CUSTOMS

- Duty
- Excise
- Security
- Supply Chain
- Drugs

Obvious: Duty, Security, Supply Chain
Non-Obvious: Excise, Drugs
Uncertainty fuels demand for Risk Simulation

Assigning the correct degree of fear to distant elephants!

Customs – Security Risk
Business – Supply Chain Risk
## Operation Safe Commerce: Answers, not Numbers

<table>
<thead>
<tr>
<th>Goal</th>
<th>Identify Weak Links in Supply Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Use GPS-RFID track &amp; trace from overseas origin to US destinations</td>
</tr>
<tr>
<td>Users</td>
<td>Included Sara Lee and Motorola</td>
</tr>
<tr>
<td>Duration</td>
<td>2002-2005</td>
</tr>
<tr>
<td>Ports</td>
<td>SEA-TAC, LA, NY-NJ</td>
</tr>
<tr>
<td>Cost</td>
<td>$75 million</td>
</tr>
<tr>
<td>Report</td>
<td>Due 2005 February</td>
</tr>
<tr>
<td>Published</td>
<td>None Released</td>
</tr>
<tr>
<td>Rumour</td>
<td>Companies know very little about their supply chain</td>
</tr>
</tbody>
</table>
Operation Safe Commerce > SCM & Logistics Transparency

C-TPAT > Customs-Trade Partnership Against Terrorism (may be mandated 2008)
ACE > Automated Commercial Environment (the enterprise system equivalent)
ATDI > Advanced Trade Data Initiative (may be necessary for C-TPAT Tier 3)
ATS > Automated Targeting System (in operation since 1990’s)

Data in multiple databases. Lack of interoperability creates blind spots.
Global Security Risk: System of Systems

Section 401 of the Sarbanes-Oxley Act (SOX) require companies to account for risk in off-balance-sheet transactions, supply chains. Companies need to have controls to protect against adverse events in their supply chains.

Section 404 of Sarbanes-Oxley (SOX) require companies to establish controls that provide reasonable protection against preventable events that may impact a company’s value. Labour personnel links to organized crime.

Section 409 of the Sarbanes-Oxley Act (SOX) require reports ‘on a rapid and current basis’ events that could have some material impact. Near-real time track and trace data or status.
• 3.9 million miles of public roads
• 600,000 bridges
• 1.2 million trucking companies
• 15.5 million trucks
• 42,000 hazardous material (HAZMAT) trucks
• 10 million commercial vehicle drivers
• 2.7 million HAZMAT drivers
• 2.2 million miles of hazardous liquid & gas pipeline
• 120,000 miles of major railroads
• 500,000 train stations
• 15 million daily riders on mass transit
• 25,000 miles of commercial waterways
• 361 ports
• 250,000 containers per day
• 9.0 million containers through 51,000 port calls
• 11.2 million containers via Canada and Mexico
• 19,576 public airports, heliports and landing strips
• 459 Federalized commercial airports
• 211,450 general aviation aircraft
• 77% of all flights are general aviation
Automatic ID Systems

- Real-time locating systems (RTLS)
- UWB
- Active RFID
- Passive RFID
- Very short range passive RFID
- Manual entry
- Bar code
- GSM
- Satellite
- GPS

Cost vs. Automation
Auto ID - Dynamic Planning Model for US DoD Army Materiel Command Readiness

Acknowledgement: General Paul Kern, Commanding General and Dr Benson Adams, Deputy CG, US DoD Army Materiel Command HQ, Fort Belvoir, Virginia

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Bosnian ITV Capability

All ALOC Shipments From New Cumberland & All Containers Shipped From USAREUR Are Tagged

Interrogators also installed at:
- Miesau
- Germersheim
- ERF
- Baumholder
- Bad Kreuznach
- Baumholder Railhead
- Weillerbach Railhead
- Coleman Barracks Railhead

Data Passed via Phone Line to LOGSA Within 15 Minutes of Reading Tag

QUALCOMM Provides Visibility of Truck Convoys & Rail Movements Data Passed to Paris Hub via Satellite Dispatch Stations Access Paris Hub via Modem/Phone Line

Source: US DoD
Visibility Technology: **Value** is more important than Cost

Layer 5: Movement Vehicle
Layer 4: Container
Layer 3: Unit Load
Layer 2: Transport Unit
Layer 1: Packaging
Layer 0: Item

- Blue Ocean
- UWB
- RFID
- Satellite
- GSM 802.16e
Visibility Networks

- Individual Item
- Passive RFID & Barcode
- Individual Item in Master Carton
- Master Carton on Pallet
- RFID Tag
- 16 Items per Carton
- 288 Items on a Pallet

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
GE VeriWise Case
Border: Finland-Russia
24 Oct 2006
1400 hours
Vyborg
26 Oct 2006
1500 hours
Route:
Stolen Trailer
GE VeriWise Systems: Global Track & Trace

USPS

WAL*MART
46,000 trailers
System of Systems: Network Integration and Interoperability

Model A

Model C

Model B

Database A

Database B

Database C
Smart Planning with Intelligent Objects

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)

---

**AGENT**

Inventory Early Warning Agent

**EVENT**

**ACTION**

**REPLENISHMENT**

- X days ?
- Y days ?

**MANUFACTURER**

Plant

2 days

**Distribution Center**

3 days

**RETAILER**

Store 1

Store 2

Store 3

Store n

**AGENT**

Information Agent

RFID Data

Inventory Consumption
Multi-Agent System

Data Agents collect ► Data
Monitoring Agent triggers ► Alert
Inventory Management Agent executes ► Substitution

M2 can be substituted for SKU M1
Inventory of M2 is 2000

OOS Danger
Less chance of a stockout with substitution via agent actions (M1 & M2)

Source: SAP AG
GE VeriWise Systems: Predictive Analytics

GARCH in Forecasting and Value at Risk
'Wiki City Rome' at MIT obtains data anonymously from phones and devices to map Rome in real time.
8 corners of larger cube
8 Agents repeated 8 times

8 corners of this cube
1 corner = 1 Agent
8 Agents connected

8 Agents

= 512

Society of Mind by Marvin Minsky

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Data Cube

Organize information
- collection of independent variables
- Relationship analysis

Large Hadron Collider (2007)
800 million collisions/second (12 DVD/min)
- Courses and trajectory changes
- Energies of particles involved in collisions
- Where and when

Meteorology – climate models
Epidemiology – spread of infection (H5N1)
Cube-on-Cube: Step 4

Agents interconnected

8 X 512 = 4096
Repeat this cube-on-cube pattern 10 times (10 steps).

Supercube \(8^{10} = 1,073,741,824\) will contain over 1 billion Agents.

Each Agent in the original smallest cube (of 8 Agents) can communicate with 1 billion Agents (sources, variables) in 10 steps.

Link each Agent to 50 other Agents: Each Agent communicates with >15 billion Agents in 6 steps \((50^6)\).

CocaCola can monitor nearly each RFID tagged unit case of its product. Real-time data can be collected by an Agent (Agency) in mere 6 steps for analysis (inventory, distribution, storage, transit, temperature). In 2004, CocaCola produced 19.8 billion unit cases.
By 2008, P&G will have shortened the end-to-end replenishment cycle for a box of Tide from four months to one day. Here's how:

1. It’s 2008, and P&G has replaced its numerous specialized plants with a few “flex-plants” – highly versatile facilities with quick turnaround capabilities.

2. Software agents of a key supplier detect a looming hurricane that threatens a Puerto Rico operation. They alert P&G’s software agents and work with them to create an alternative delivery schedule so P&G’s Miami plant doesn’t face a material shortage.

3. The Miami facility, like every P&G plant, bids via software agents for its next production run based on its capability to deliver its current job, its queued work orders and its just-in-time materials supply capability. Its low-cost bid to produce Tide wins.

4. When pallets of Tide reach P&G’s distribution centers, they’re dynamically dispatched, with priority given to retailers whose inventories are very low.

5. When a tire blowout threatens to delay a shipment of Tide, P&G’s agents detect it and prequalify an alternative trucker, who picks up the product and delivers it to Wal-Mart just in time.

6. Wal-Mart has replaced all of its costly warehouses with docking facilities it shares with suppliers. These docking/distribution facilities ship products like Tide to stores within hours of receiving them.

7. Software agents collect real-time sales data on each P&G product from multiple retail stores. They aggregate it and relay it to P&G’s sales and marketing for trend analysis.

8. Wal-Mart’s smart shelves alert a stocker to immediately retrieve Tide from the back room and place it on the shelf. Tide is restocked just seconds before the last box would have been taken off the shelf.

SOURCE: FORRESTER RESEARCH INC. AND
Global Data Synchronization

System A

System B

?
Electronic Product Code (64-bit)

01.0203D2A.916E8B.0719BAE03C

- **Header**: 4 bits = 16
- **ePC Mgr**: 16 bits = 65,536
- **Object Class**: 16 bits = 65,536
- **Serial Number**: 28 bits = 268,435,456

\[ 2^{64} = 1.8 \times 10^{19} \]

*Designed for object identification as data from radio frequency tags, such as, RFID.*

*Not designed for syntax and information processes of the type who, where, when.*
Information Identification
Electronic Product Code (64-bit)

01.0203D2A.916E8B.0719BAE03C

EPC

$2^{64} = 1.8 \times 10^{19}$

IPv6

$2^{128} = 3.4 \times 10^{38}$

128-bit EPC form proposed in 1998 by Sanjay Sarma & Dan Engels of MIT is not used by EPC Global

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Why ? How ??

IPv6

Global Agreement
Internet Protocol version 6

But not necessarily a panacea!
Identification: Think Identity!
Relativistic Identification

Identical Results

Identical Numbers 120

Different Identities

Sir Clive Granger 120CG

Blood Glucose 120 mg/dl

Prof Gunnar Stefansson 120GS

Blood Glucose 120 mg/dl
Executive Summary

- Concept: Relative Identification
- Tools: IPv6 Format and Semantics
- Benefits: Global Standard, Systems Interoperability

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Problem Space

Object-centric Identification
Isolated, Inadequate, Heterogeneous

- Variable formats
- Systems incompatibility
- Master Data mis-Management
- Object data not linked to process
- Data, analytics, information - disconnected
• Variable formats
• Systems incompatibility

• GIAI – Global Individual Asset Identifier
• GLN – Global Location Number
• SSCC – Serialized Shipping Container Code
• GTIN – Global Trade Item Number
• GUID – Globally Unique Identification
• UCR – Universal Consignment Reference
• EPC – Electronic Product Code
Master (?) Data mis-Management

Here

METRO AG
Heinz Ketchup
Store Id 6174523211

3PL Database
Store Database
Region DC Database
3PL Database
Warehouse Database

RFID: Automatic Identification

01.0203D2A.916E8B.0719BAE03C

There

Heinz Ketchup
Manufacturer’s EPC
010203D2A916E8B

01.0203D2A.916E8B.0719BAE03C

Manual Identification

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Systems Incompatibility, Master Data mis-Management

Networks Lack Functional Integration, Interoperability
Systems Solution Requires

Unique Identification
Objects, Process, Information, Decisions

• Not a new standard format
• Heterogeneous systems compatibility
• Syntax and semantic relationships - defined
• Data, analytics, process, information - linked
IPv6
Use Internet Protocol version 6 Format

- Not a new standard – agreed for adoption
- Heterogeneous systems compatibility – proven
- Syntax & semantics – unique id possible using URI
- Data, analytics, process, information – can be linked
IPv6

OSI Reference Model

Internet Protocol Suite

Application

Presentation

Session

Transport

Network

Link

Physical

FTP, Telnet, SMTP, SNMP

NFS

XDR

RPC

TCP, UDP

Routing Protocols

IP

ICMP

ARP, RARP

Not Specified

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
IPv6 Format

128-bit IPv6 address in binary form is divided along 16-bit boundaries:

```
0010000111011010  0000000110100111  0000000000000000  0010111100111011
0000001010101010  0000000011111111  1111111000101000  1001110001011010
```

Each 16-bit block converted to colon hexadecimal form

```
21DA : 00D3 : 0000 : 2F3B : 02AA : 00FF : FE28 : 9C5A
```

With leading zero suppression

```
21DA : D3 : 0 : 2F3B : 2AA : FF : FE28 : 9C5A
```
IPv6

21DA : D3 : 0 : 2F3B : 2AA : FF : FE28 : 9C5A

- Not a new standard – agreed for adoption
- Heterogeneous systems compatibility - proven
- Data, analytics, process, information – transmission
- New revenue potential for telecommunications including P2P
- Not everything needs routing but FORMAT is globally adopted
IPv6 Routing

UNICAST
Single host to single receiver.
Packets to specified interface.

MULTICAST
Single host to multi receiver.
Defined devices listen for multicast packets.

ANYCAST
Single sender to address list.
Packets to specified interfaces including nodes & routers.
**IPv6 Routing**

**How is this helpful in operations?**

**MULTICAST**
- Single host to multi receiver.
- Defined devices listen for multicast packets.

**ANYCAST**
- Single sender to address list.
- Packets to specified interfaces including nodes & routers.

**UNICAST**
- Single host to single receiver.
- Packets to specified interface.

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
IPv6 Routing

Data Routing
➢ Where?
➢ What?

MULTICAST
☑
☒
☑
Single host to multi receiver. Defined devices listen for multicast packets.

ANYCAST
☒
☒
Single sender to address list. Packets to specified interfaces including nodes & routers.
<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>J &amp; J</td>
</tr>
<tr>
<td>10.0</td>
<td>Kimberly Clark</td>
</tr>
<tr>
<td>15.0</td>
<td>Tesco</td>
</tr>
<tr>
<td>20.0</td>
<td>Unilever</td>
</tr>
<tr>
<td>25.0</td>
<td>Philip Morris</td>
</tr>
<tr>
<td>30.0</td>
<td>Wal-Mart</td>
</tr>
<tr>
<td>31.0</td>
<td>P&amp;G</td>
</tr>
<tr>
<td>53.0</td>
<td>International Paper</td>
</tr>
<tr>
<td>200.0</td>
<td>Coca-Cola</td>
</tr>
<tr>
<td>205.0</td>
<td>US Post</td>
</tr>
</tbody>
</table>

32-bit address space (IPv4) allows $2^{32}$ or 4,294,967,296 possible unique addresses (id). A 128-bit address space used for the design of the IP version 6 allows for $2^{128}$ or 340,282,366,920,938,463,463,374,607,431,768,211,456 ($3.4 \times 10^{38}$) possible unique addresses. EPC is a 64-bit format for 18,446,744,073,709,551,616 or $1.8 \times 10^{19}$ unique object id. 96-bit identifies 79,228,162,514,264,337,593,543,950,336 ($7.9 \times 10^{28}$) objects with RFID tags but excludes “process” id.
Billions of Objects
Trillions of Processes
Octillions of Identities
Exabytes of Data

Mobile Dynamic Network

Dr. Shoumen Datta
http://dft.ba/-shoumen
(fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Why IPv6

Billions of Objects
Trillions of Processes
Octillions of Identities
Exabytes of Data

IPv6 converges object, process, location, data

Manufacturer
- 3PL
- Goods Receipt
- Distribution Planning
  - Transportation Zone
  - Distribution Center
    - Store Identifier
    - Receiving Personnel
    - Plan-o-gram Compliance
      - Shelf
      - B/A Value-Pack Present
        - GIFT BOX RFID Tag
        - GIFT BOX Acrylic Casing
        - GIFT BOX
          - WiMax-WiFi Connect Card
          - GIFT SET
            - XBOX GAME
            - CD Book+Soundtrack
            - DVD Item
              - DVD Disc
              - DVD Case

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
IPv6 converges object, process, location, data


21DA : D3 : 0 : 2F3B : 2AA : E0 : FE07 : 9B2D
IPv6 converges 
object, process 
location, data

DVD “item” id

21DA : D3 : 0 : 2F3B : 2AA : E8 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E0 : FE07 : 9B2D

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT) 75
DVD "item" includes DVD disc id and DVD case id as subsets

IPv6 converges object, process location, data
Value-Pack id as a domain (super-set)

IPv6 converges object, process, location, data
Value-Pack id as a domain (super-set)

IPv6 converges object, process location, data

Re-inventing EPC?
Electronic Product Code (64-bit)

01.0203D2A.916E8B.0719BAE03C

**EPC**

\[ 2^{64} = 1.8 \times 10^{19} \]

**Header:** 4 bits = 16

**ePC Mgr:** 16 bits = 65,536

**Object Class:** 16 bits = 65,536

**Serial Number:** 28 bits = 268,435,456

Designed for object identification as data from radio frequency tags, such as, RFID.

Not designed for syntax and information processes of the type who, where, when.
Value-Pack id as a domain (super-set)

IPv6 converges object, process location, data mapping EPC

Map EPC to

01.0203D2A.916E8B.0719BAE03C
IPv6 converges object, process location, data

Shelf has id and process

Domain change

21DA : D3 : 0 : 2F3B : 2AA : 2F : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E1 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E2 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E3 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E4 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E5 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E6 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E7 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E8 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E9 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : 2E0 : FE07 : 9B2D

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
IPv6 converges object, process location, data

Plan-0-Gram is a process

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
IPv6 converges object, process location, data

Domain change

Plan-0-Gram is a process

21DA : D3 : 0 : 2F3B : 2AA : FF : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : EE : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E1 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E2 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E3 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E4 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E5 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E6 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E7 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E8 : FE07 : 9B2D
21DA : D3 : 0 : 2F3B : 2AA : E0 : FE07 : 9B2D
Domains maps for who, where, why possible in IPv6. Convergence of object, process location, data.
Unique id relates to all information and data subsets.

IPv6 converges object, process location, data
IPv6 converges object, process, location, data
How is this helpful in operations?
IPv6 converges object, process, location, data

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
IPv6 converges object, process, location, data
IPv6 converges
object, process
location, data

** 3PL transmits
21DA : D3 : 0 : 2F3B : 2AA : FF : FE28 : 9C50
to Regional Distribution Center & Store
Manufacturer is automatically updated.

** 3PL transmits
21DA : D3 : 0 : 2F3B : 2AA : FF : FE28 : 9C50
Manufacturers automatically updated.

MULTICAST
Single host to multi receiver. Defined devices listen for multicast packets.

IPv6 converges object, process location, data
** 3PL transmits
21DA : D3 : 0 : 2F3B : 2AA : FF : FE28 : 9C50

Why?
Id transmitted is different than id linked.

MULTICAST

Single host to multi receiver.
Defined devices listen for multicast packets.
IPv6 converges
object, process
location, data

Id transmitted is
id shown +
arrival times.

** 3PL transmits
21DA : D3 : 0 : 2F3B : 2AA : FF : FE28 : 9C50
to Regional Distribution Center & Store
Manufacturer is automatically updated.

MULTICAST

Single host to multi receiver.
Defined devices listen for
multicast packets.
IPv6 converges object, process, location, data

** 3PL transmits to Regional Distribution Center & Store
Manufacturer is automatically updated.

Manufacturer is a “defined device” process.
Benefit from IPv6 Format with Data Routing

Related Information Integration and Systems Interoperability

- System A
- System B
- System C

Data Routing: Benefits from IPv6 Format

Related Information Integration

Systems Interoperability

Database A

Database B

Database C
Data

Trillions of Sensors

- Temperature
- Light
- Moisture
- Magnetic Field
- Weight
- Tilt
- Chemical

Universal Identifier (UI) with Sensors

Electromagnetic Return Signal

Local computer

PC
Dr. Shoumen Datta

Process, Data, Information

Trillions of Sensors

ID + Temperature = Status

IPv4

Local computer

Electromagnetic Return Signal

Universal Identifier (UI) with Sensors

Sensors

Tag

Reader

Middleware

Internet
MANET (Mobile ad hoc Networks)

Cube-on-Cube
MANET (Mobile ad hoc Networks)

Cube-on-Cube
MANET (Mobile *ad hoc* Networks)

60 billion interfaces per square mm requires unique id
MANET (Mobile *ad hoc* Networks)

- 60 billion interfaces per square mm
- Requires unique ID

1 mm x 1 mm x 1 mm
MANET (Mobile ad hoc Networks)

Layer is 100 km deep or 1,000,000,000 mm

60 billion interfaces per square mm requires unique id
Examples of Mobile *ad hoc* Networks: Automobile Industry & Civil Engineering

Layer is 100 km deep or 1,000,000,000 mm

60 billion interfaces per square mm with unique IPv6 id

DEEPLY EMBEDDED SENSOR NETWORKS

**Automobile Building**
MANET (Mobile ad hoc Networks)

Cube-on-Cube

Layer is 100 km deep or 1,000,000,000 mm

60 billion interfaces per square mm Earth with unique IPv6 id

DEEPLY EMBEDDED SENSOR NETWORKS

Earth’s Surface
Transportation = Mobile ad hoc Networks

Layer is 100 km deep or 1,000,000,000 mm

Deeply Embedded Sensor Networks

Logistics Network

60 billion interfaces per square mm Earth with unique IPv6 id
End of the Information Age

Making Sense of Data

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
End of the Information Age

Welcome to the
SYSTEMS AGE

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Making Sense of Data: Introducing Elementary AI

Basic Neural Circuits

Source: From Neurons to the Brain

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Difference Engines (1950)

Source: Marvin Minsky, AI Lab, MIT

Dr Shoumen Datta [http://dft.ba/~shoumen](http://dft.ba/~shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
# Rule Based Applications

<table>
<thead>
<tr>
<th>Banking/Finance</th>
<th>Insurance</th>
<th>Manufacturing</th>
<th>Government</th>
<th>Other Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Mortgage Underwriting</td>
<td>Point-of-Sale Underwriting</td>
<td>Parts Selection</td>
<td>Welfare Eligibility Determination</td>
<td>Transportation</td>
</tr>
<tr>
<td>Credit Scoring</td>
<td>Claims Processing</td>
<td>Order Configuration</td>
<td>Regulatory Compliance</td>
<td>Retail</td>
</tr>
<tr>
<td>Portfolio Management</td>
<td>Renewal Processing</td>
<td>Production</td>
<td>Tax Assessment</td>
<td>Petroleum/Oil &amp; Gas</td>
</tr>
<tr>
<td>Cross Selling</td>
<td>Intelligent Policy Configuration and Pricing</td>
<td>Planning/Routing</td>
<td>Entitlements and Benefits Determination</td>
<td>Health Care</td>
</tr>
<tr>
<td>Fraud Detection</td>
<td>Eligibility Determination</td>
<td>Production Scheduling</td>
<td>Pension Plan Forecasting</td>
<td>Telecom</td>
</tr>
<tr>
<td>Overdraft Authorization</td>
<td>Cross Selling</td>
<td>Maintenance and Labor Scheduling</td>
<td>Worker’s Compensation Claims</td>
<td>Pharmaceutical</td>
</tr>
<tr>
<td>SEC Regulatory Compliance</td>
<td>Fraud Detection</td>
<td>Material Safety Data Sheets</td>
<td></td>
<td>Utilities</td>
</tr>
<tr>
<td>Risk Management</td>
<td></td>
<td>Distribution Management</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)

**Training**

- Input data
- Input data
- Input data
- Input data
- Input data
- Input data

**Effect**

- Training Algorithm
- Weight adjustment

**Cause**

**Prediction**

- Anticipate component failure
- Replace part prior to failure
- Preventive maintenance plan
- Improve customer response
- Reduce repair cycles
- Support performance metrics
- Better identify causes of problems
- Learn to adapt to the environment

- Outcome
- Outcome
- Outcome
- Outcome
- Outcome
- Outcome
- Outcome
May I help?
AI Lesson from Ants
Swarm Intelligence: Ant–based Algorithms

- Pheromone
Adaptive?
Smart Agents

Collaborative Learning Agents

COOPERATE

LEARN

AUTONOMOUS

Interface Agents

Collaborative Agents
In brief ...

- **Concept**: Relative Identification
- **Application**: Logistics, SCM, Healthcare, Security, eGov
- **Tools**: IPv6 Format and Semantics
- **Benefits**: Global Standard, Systems Interoperability

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Structure, Relations

<CompanyData>
  <CompanyName>
    MIT
  </CompanyName>
  <Location>
    Cambridge
  </location>
  <CallData>
    <RecordDate>
      Thu 7 Jun 2007
    </RecordDate>
    <CallsPerDay>
      536
    </CallsPerDay>
  </CallData>
</CompanyData>
Structure, Relations, Syntax

“CallsPerDay”

<CompanyData>
  <CompanyName>
    MIT
  </CompanyName>
  <Location>
    Cambridge
  </Location>
  <CallData>
    <RecordDate>
      Thu 7 Jun 2007
    </RecordDate>
    <CallsPerDay>
      536
    </CallsPerDay>
  </CallData>
</CompanyData>
"CallsPerDay"

vocabulary

grammar

Structure, Relations, Syntax, Semantics

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering,
Data, Structure, Relations, Syntax, Semantics

"CallsPerDay"

vocabulary

grammar

data

<CompanyData>
  <CompanyName>
    MIT
  </CompanyName>
  <Location>
    Cambridge
  </location>
  <CallData>
    <RecordDate>
      Thu 7 Jun 2007
    </RecordDate>
    <CallsPerDay>
      536
    </CallsPerDay>
  </CallData>
</CompanyData>
Semantic Layers

Tim Berners-Lee, MIT

Trust

Proof

Logic framework

Rules

Ontology

RDF Schema

RDF M&S

XML

Namespaces

URI

Unicode

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Semantic Layers
Tim Berners-Lee, MIT

<CompanyData>
  <CompanyName>
    MIT
  </CompanyName>
  <Location>
    Cambridge
  </Location>
  <CallData>
    <RecordDate>
      Thu 7 Jun 2007
    </RecordDate>
    <CallsPerDay>
      536
    </CallsPerDay>
  </CallData>
</CompanyData>

XML
XML: Languages & Open Standards

XML Core

XML eXtensions
1969  General Markup Language (GML) - Charles Goldfarb, Ed Mosher, Ray Lorie

1971  Document Type Definition (DTD)

1975  Document Composition Facility (DCF)

1978  Standard General Markup Language (SGML) ANSI Initiative

1983  SGML Computer Graphics Association (CGA)

1986  SGML - International Organization for Standardization (ISO)

1989  HyperText Markup Language (HTML) - Tim Berners-Lee, CERN

1993  HTML Browser Mosaic - Marc Andreessen
      National Center for Supercomputing Applications (NCSA) University of Illinois

1996  eXtensible Markup Language (XML)
      World Wide Web Consortium (W3C)

1998  eXtensible Markup Language (XML)
      World Wide Web Consortium (W3C) Initiative

1999  XML-based Physical Markup Language (PML)
      RFID Object Description Language (AIDC, MIT)

2003  Ontology Working Language (OWL) DAML + OIL
      DARPA Agent Markup Language + Ontology Inference Layer
XML Explosion ......

[Image of an XML-related diagram]
Houston, we have a problem ...
Semantic Layers: Relationships
Tim Berners-Lee, MIT

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Ontological Framework

Philosophy  Reflection  Noun  Object  Metaphor  Observatory
Ontological Framework + Unique IPv6 Identifier

MIRROR

Philosophy → Reflection → Noun → Object → Metaphor → Observatory

2007.db8.617.5ca.20a.95ff.abcd.999c

This is a proposed idea by the author. It is not a fact or form of identification of ontologies, in practice.
Ontological Framework + Unique IPv6 Identifier

This is a proposed idea by the author. It is not a fact or form of identification of ontologies, in practice.
Unique IPv6 id: Ontological Identifier

This is a proposed idea by the author. It is not a fact or form of identification of ontologies, in practice.
Universal Resource Identifier
URI: Universal but not Unique Identifier

Universal Resource Identifier

- XML
- RDF M&S
- RDF Schema
- Ontology
- Logic framework
- Proof

Trust
Signature
Encryption

Namespaces
Unicode

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Digital Ontology: Use IPv6 id over URI?

This is a proposed idea by the author. It is not a fact or form of identification of ontologies, in practice.

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, Schoo) © Shoumen Datta 141
This is a proposed idea by the author. It is not a fact or form of identification of ontologies, in practice.
This is a proposed idea by the author. It is not a fact or form of identification of ontologies.
Unique IPv6 type id as a sub-layer to URI Abstraction?

- **CHEMISE**
  - is a
  - **BLOUSE**
    - is a
    - **SHIRT**
      - is it a?
      - **KAMEEZ**
        - is a?
        - **KIMONO**
          - is it a?

Serial Number:
Additional identification may be included in the encapsulating security header section for data integrity or ‘uniqueness’.

Class:
- **Upperbody Outerwear**

Subclass:
- **Japanese Traditional Outer Garments**

IPv6 Range:
- 2007.db8.617.5ca.20a.95ff.**320a.1617** to 2007.db8.617.5ca.20a.95ff.**320b.0452**
- 2007.db8.617.5ca.20a.95ff.**320c.3211** to 2007.db8.617.5ca.20a.95ff.**320d.2020**
- 2007.db8.617.5ca.20a.95ff.**203f.8080** to 2007.db8.617.5ca.20a.95ff.**202a.7777**
- 2007.db8.617.5ca.20a.95ff.**210f.9344** to 2007.db8.617.5ca.20a.95ff.**400f.8888**

This is a proposed idea by the author. It is not a fact or form of identification of ontologies, in practice.
Why is it necessary to define ontology class with unique id?
Why is it necessary to define ontology class with unique id?

Global Agreement

- Anterior Pituitary is a part of hypothalamus
- Minute Hand is a part of a time clock
Why is it necessary to define ontology class with unique id?

Language Ambiguity
Why is it necessary to define ontology class with unique id?

Western Ontology Classification

Kimono

is a

Shirt

KAMEEZ

is it a?

BLOUSE

is a

SHIRT

is a

CHEMISE
Why is it necessary to define ontology class with unique id?

**Upperbody Outerwear**

- Chemise
  - is a
  - Bouse
    - is a
    - Shirt
      - is it a?
      - Kameez
        - is a?
        - Kimono
          - is a
          - Traditional Garment

Japanese Ontology Classification
Unique id eliminates semantic ambiguity

Upperbody Outerwear

Class

Subclass or a Separate Class:
Japanese Traditional Outer Garments

Range:
2007.db8.617.5ca.20a.95ff.202a.7777
to
2007.db8.617.5ca.20a.95ff.210f.9350

Unique id enables classification agnostic application

Western Ontological Framework

Japanese Ontological Framework

203f.8080

Shoumen Datta, MIT
Semantics

Call
Loud cry, shout

Call
Animal’s call

Call
Telephone call

Call
House visit
Call 1
Loud cry, shout

Call 2
Animal’s call

Call 3
Telephone call

Call 4
House visit
<table>
<thead>
<tr>
<th>Call 1</th>
<th>Loud cry, shout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call 2</td>
<td>Animal’s call</td>
</tr>
<tr>
<td>Call 3</td>
<td>Telephone call</td>
</tr>
<tr>
<td>Call 4</td>
<td>House visit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>喊叫</th>
<th>喊叫</th>
</tr>
</thead>
<tbody>
<tr>
<td>嚎叫</td>
<td>嚎叫</td>
</tr>
<tr>
<td>电话</td>
<td>电话</td>
</tr>
<tr>
<td>需求</td>
<td>需求</td>
</tr>
</tbody>
</table>
Semantic Ambiguity?

Call 1
Loud cry, shout

Call 2
Animal’s call

Call 3
Telephone call

Call 4
House visit

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)

喊叫
嚎叫
电话
需求
[Term]
id: CL:0000236
name: B-cell
is_a: CL:0000542 ! lymphocyte
develops_from: CL:0000231 ! B-lymphoblast

[Term]
id: GO:0030183
name: B-cell differentiation
is_a: GO:0042113 ! B-cell activation
is_a: GO:0030098 ! lymphocyte differentiation
intersection_of: is_a GO:0030154 ! cell differentiation
intersection_of: has_participant CL:0000236 ! B-cell

Data: Suzanna Lewis, GO Consortium and National Center for Biomedical Ontology
**Is it possible?**

**Transition to IPv6 Format**

**OMICS**

**CELL Ontology**

**Augmented GO**

---

**Term**

**id:** CL:0000236
**name:** B-cell
**is_a:** CL:0000542 ! lymphocyte
develops_from:** CL:0000231 ! B-lymphoblast

---

**Term**

**id:** GO:0030183
**name:** B-cell differentiation
**is_a:** GO:0042113 ! B-cell activation
**is_a:** GO:0030098 ! lymphocyte differentiation
**intersection_of:** is_a GO:0030154 ! cell differentiation
**intersection_of:** has_participant CL:0000236 ! B-cell

---

Data: Suzanna Lewis, GO Consortium and National Center for Biomedical Ontology

© Proposed by Shoumen Datta, MIT
Defense: Mobile *ad hoc* Networks in Remote Sensing

Sensors

- Light
- Magnetic
- Vibration

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Defense: Mobile *ad hoc* Networks in Remote Sensing

**Unique Sensor Node**

**Mobile Cluster Agent**

**Sensors**
- Light
- Magnetic
- Vibration

© Shoumen Datta, MIT
Defense: Mobile *ad hoc* Networks in Remote Sensing

**Unique Sensor Node**
Mobile Cluster Agent

**Sensors**
- Light
- Magnetic
- Vibration
\[ \sum (\text{FFee}, \text{FFgg}, \text{FFhh}) = \text{background} \]

\[ \sum (\text{FFcc}, \text{FFbb}) = \text{low} \]

**Unique Sensor Node**

**Mobile Cluster Agent**

**Sensors**

- Light
- Magnetic
- Vibration

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
\[ \sum (\text{FFee}, \text{FFgg}, \text{FFhh}) = \text{background} \]

\[ \sum (\text{FFcc}, \text{FFbb}) = \text{low} \]

Unique Sensor Node
Mobile Cluster Agent

Sensors
- Light
- Magnetic
- Vibration

Single Vehicle Approaching?
∑ (FFee, FFgg, FFhh) = background

∑ (FFcc, FFbb) = low

Unique Sensor Node
Mobile Cluster Agent

Sensors
Light
Magnetic
Vibration

Unique Analysis Id

Single Vehicle Approaching?
Unique Sensor Node
Mobile Cluster Agent

Sensors
Light
Magnetic
Vibration

∑ (FFcc, FFbb) = low

∑ (FFee, FFgg, FFhh) = background

∑ (FFcc, FFdd, ffff) = high

Unique Analysis Id

Single Vehicle Approaching ?
∑ (FFee, FFgg, FFhh) = background

∑ (FFcc, FFbb) = low

∑ (FFcc, FFdd, ffff) = high

Convoy of Vehicles Approaching
2001:db8:310:5ca:20a:95ff:fecd:987a

Unique Information Id

Unique Analysis Id
War Fighter: *Answers, not Numbers*

Defense: Mobile *ad hoc Network Decision Support Systems*
War Fighter: *Answers, not Numbers*

Defense: Mobile *ad hoc* Network Decision Support Systems

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Military Analysis: *Numbers*

Documented with unique id
- Data
- Analysis
- Decision
- Action

Defense: Mobile *ad hoc* Network Decision Support Systems

Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Collaborators

Paul Kern

Paul Kern
Commanding General (fmr), US DoD, US Army, AMC
The Cohen Group, Washington DC
www.cohengroup.net/about/teammember.cfm?id=7

Joe Salvo

Dr Joseph Salvo
Director, Pervasive Decision Systems Laboratory
GE Global Research, New York

Collaboration Acknowledgement:

General Paul Kern
Commanding General (fmr), US DoD, US Army, AMC
The Cohen Group, Washington DC
www.cohengroup.net/about/teammember.cfm?id=7

Dr Joseph Salvo
Director, Pervasive Decision Systems Laboratory
GE Global Research, New York

Dr Shoumen Datta http://dft.ba/-shoumen (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
Dr Shoumen Datta [http://dft.ba/-shoumen](http://dft.ba/-shoumen) (fmr Research Director, Forum for Supply Chain Innovation, School of Engineering, MIT)
IPv6 Systems Solution

May Offer Unique Identification for Objects, Process, Information, Decisions

- Pre-agreed for global adoption
- Systems and platform agnostic
- Syntax and semantic relationships - defined
- Data, analytics, process, information - linked
“Did not entail being right all the time. It was rather to dare, to propose new ideas, and then to verify them and to know how to admit errors.”

Professor Pierre-Gilles de Gennes* (1932-2007) after receiving the 1991 Nobel Prize for Physics

* Died 18 May 2007
Thank you!

Questions?

shoumendatta@gmail.com
“Mr. Datta may I be excused? My brain is full.”