

Navigating the Production Maze: The Topic Mapped Enterprise

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Y-12 National Security Complex



Y-12 National Security Complex: Specialized Manufacturing for DOE

- Established as part of Manhattan Project
- Oak Ridge Centers for Manufacturing Technology
- National Prototype Center
- Major site for nuclear weapons production

The Manufacturing Enterprise

- The factory
 - Buildings and shops
 - Equipment
 - Material streams
 - Staff
- The products
 - Current products
 - Legacy products

Y-12 Facilities

- About a dozen major production facilities
- Multiple shops in some facilities
- About 140 numerically controlled tool centers
- Coordinate-measuring machines, X-ray systems, and other inspection tools
- Smelters, rolling mills, forming presses up to 7500 tons, heat treatment furnaces
- Chemical facilities
- Environmentally controlled facilities

Y-12 Products: Assembled Systems

- Start from raw or recycled materials
- Cast, pressed, or forged/rolled blanks or rough shapes
- Machining to final shapes
- Assembly of components
- Certification of parts and assemblies at almost every stage

Other Products: Dismantlement

- Retire obsolete systems
- Meet treaty requirements
- Recover materials
- Destroy classified shapes

Issues: Products

- DOE expects us to be able to refurbish systems in Enduring Stockpile with 36-month lead time.
- Some systems were last made over a decade ago, and staff have retired and equipment may be out of service.
- Decades-old systems are coming back for retirement/dismantlement.
- Health, safety, and environmental requirements may have changed since systems were produced.

Issues: Equipment and Facilities

- Site was designed for Manhattan Project, 60 years ago.
- Facilities are scattered over large campus.
- Machine tools were acquired for height of cold-war production.
- Even when old tools are still functional, computer support is obsolete (e.g., early '90s technology).

Issues: New Techniques and Technologies

- Agile machines
- New computers
- Better chemical processes
- New processes (e.g., microwave smelting)

Why a Topic Map

- Need to deal with multithreaded information
- Need to have multiple views into information
- Need to harmonize diverse data sources and formats
- Need more flexibility than RDF allows
- Already have Topic Map projects under development

Mapping the Enterprise

- Analyze products
- Analyze material streams
- Trace products through processes
- Catalogue equipment and facilities
- Link processes to equipment
- Locate equipment in facilities

Looking for Destinations

- Determine requirements for production
 - Materials
 - Equipment and facilities
 - Processes
 - Staff
- Look for effects of change
 - Materials
 - Equipment and facilities
 - Processes
 - Staff

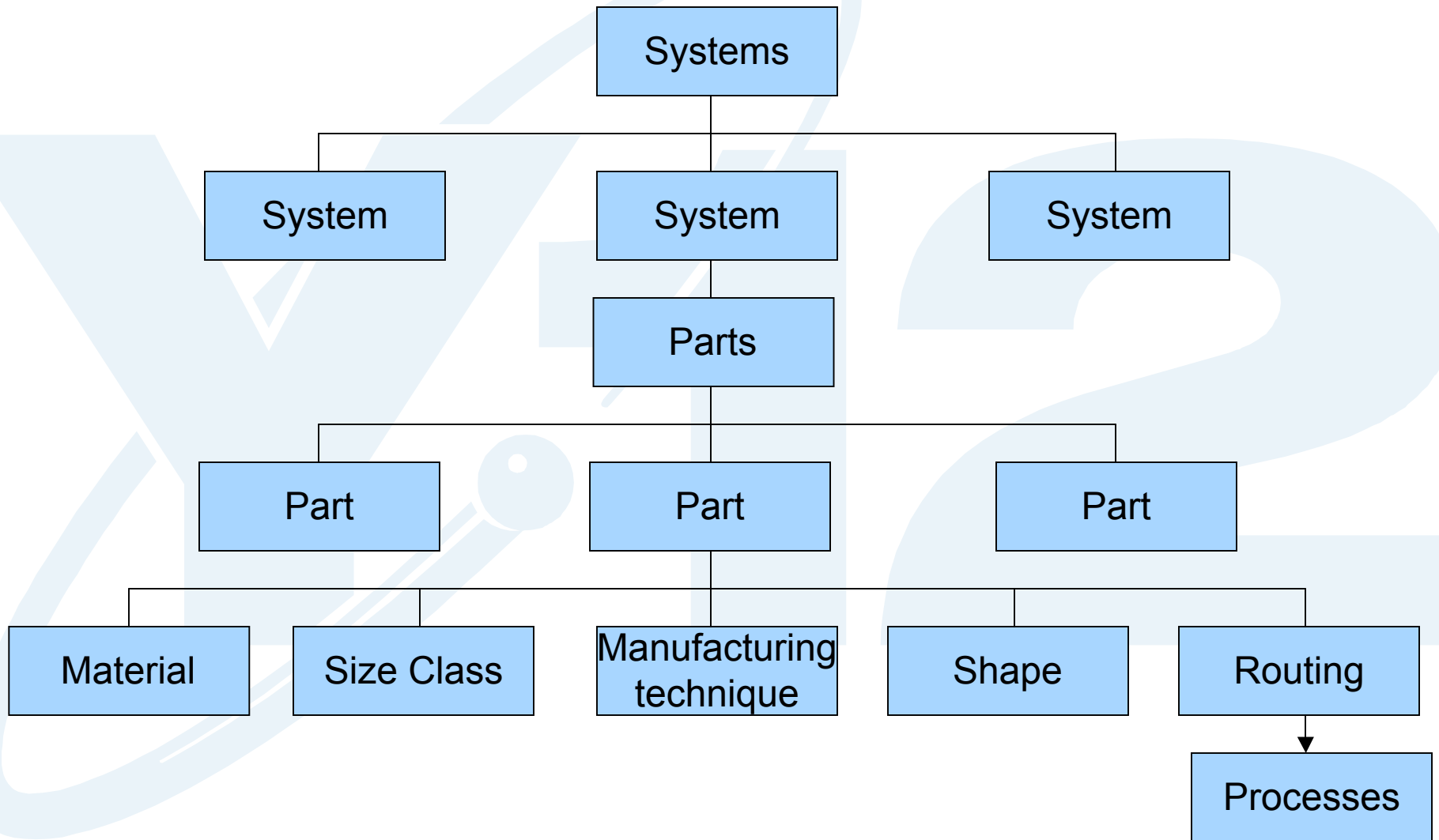
Charting the Map

- Develop ontologies of parts, materials, processes, equipment
- Collect and convert data
- Design interface: views of data

Ontology: Products

- Systems
- Assemblies/subassemblies
- Parts and characteristics
 - Generic manufacturing process
 - Generic shape
 - Material
 - Mass
 - Routing (sequence of production steps)
- Component identification

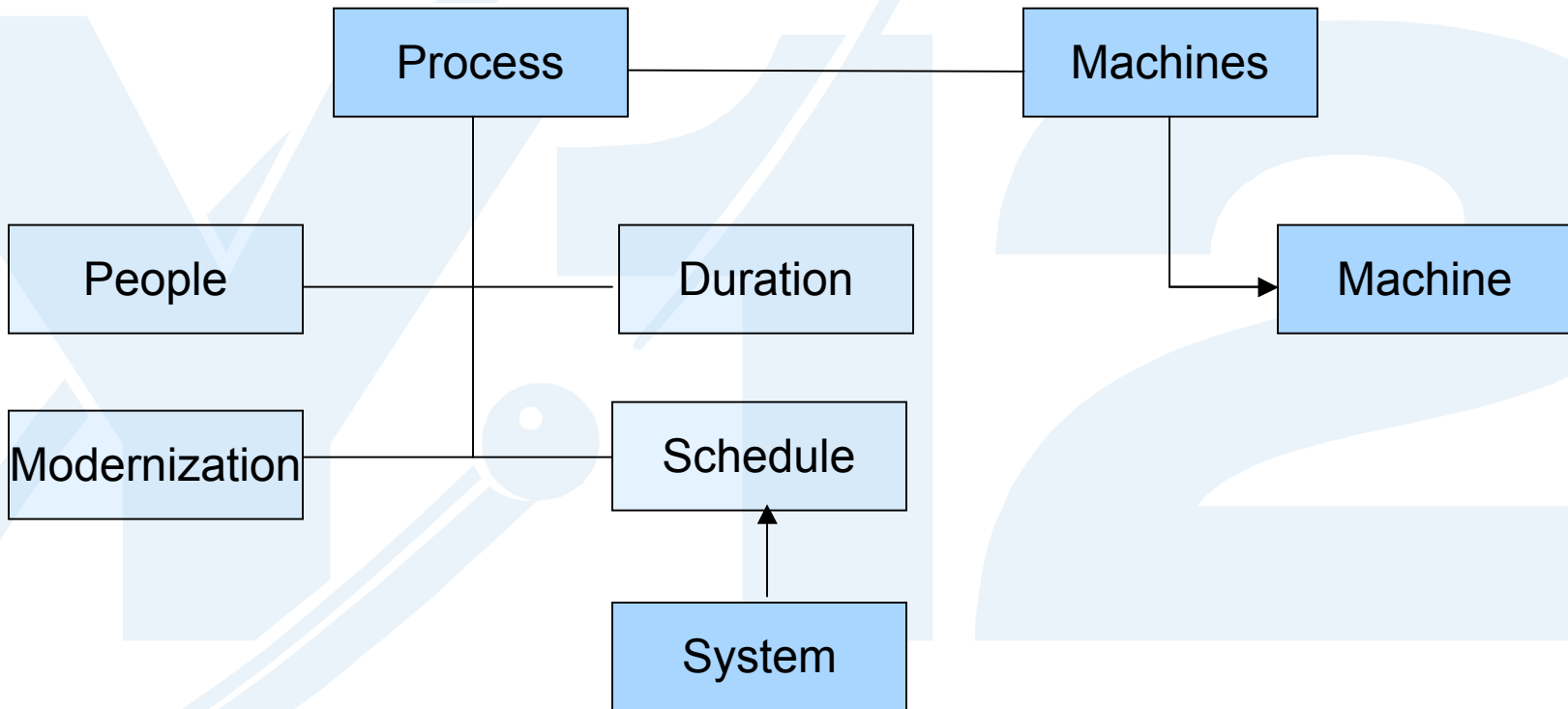
Parts Hierarchy



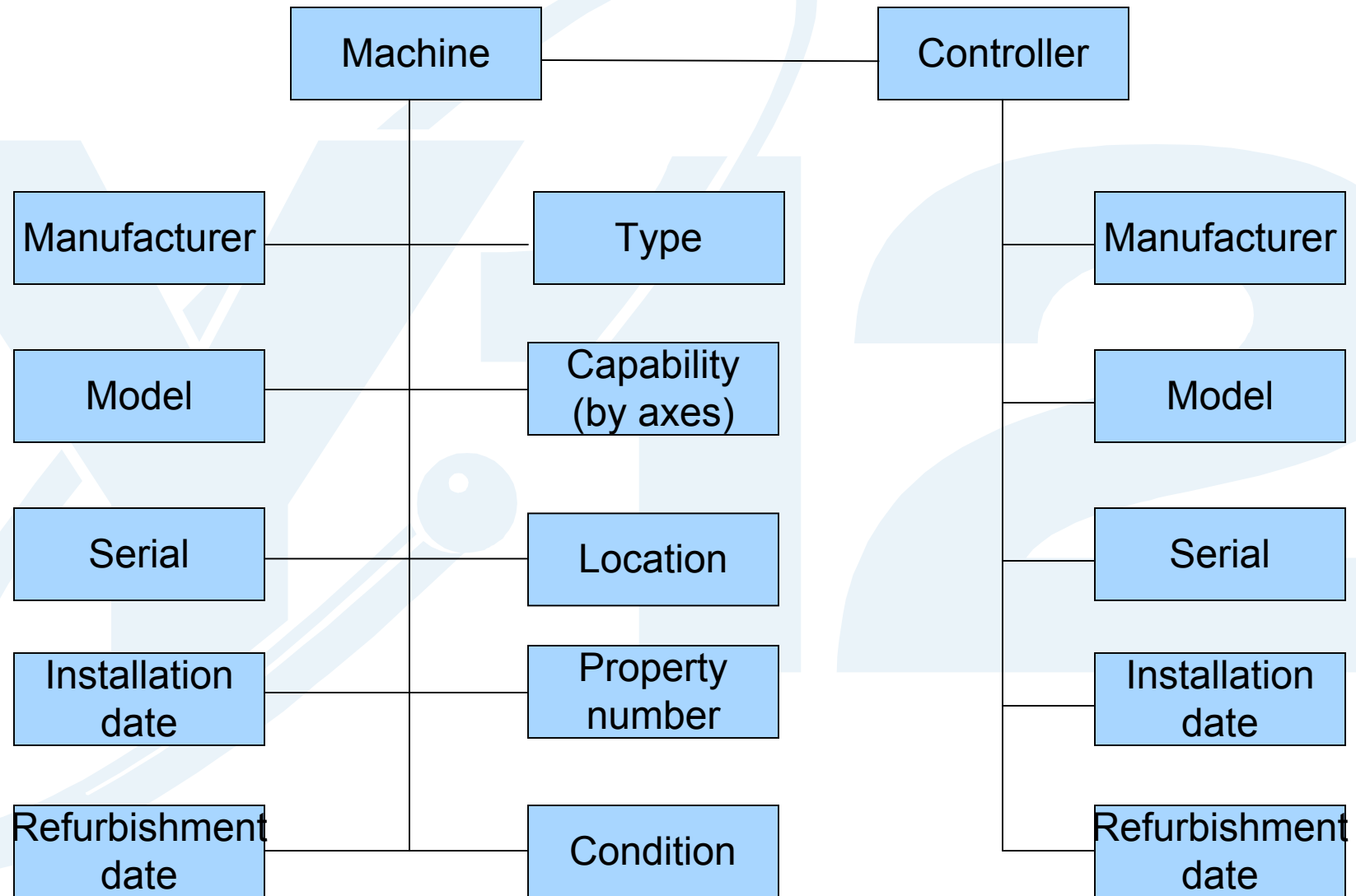
Ontology: Production

- Processes
 - People
 - Schedules
 - Planning
- Machines
 - Manufacturers and models
 - Capabilities
 - Inventory data
 - Schedules for maintenance and refurbishment

Process Structure



Machine Data



Using the Map

- Systems entrance
 - Systems
 - Parts
 - Materials
- Equipment entrance
 - Locations
 - Makers
 - Inventory

Destination: Part

- Identification numbers
- Parent
- Related parts (cousins from other versions of parent)
- Material (generic and named)
- Shape
- Routing

Destination: Tool

- Maker and model
- Controller
- Capabilities
 - Axes
 - Range and precision
- History
- Evaluation
- Inventory

Many Paths through the Map

- System → Parts → Materials
- System → Part → Machines
- Part → System
- Material → Parts → Machines
- Machine → Parts → Systems
- Shop → Machines
- Machine → Shops

Live Demonstration



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Topic Mapped Enterprise

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It's not the destination but the journey!

- Data is not new (available from other sources)
- TM allows integration
- Paths through data are as important as nodes