Concept Modelling and The Data-Process Connection:

How Concept Modelling Supports Business Process Change and Business Analysis

Adept Events Data Warehousing and Business Intelligence Summit
27 naart 2024 in Utrecht NL

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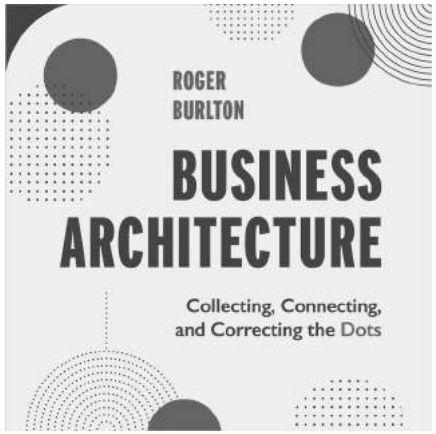
Presentation background…



- First requested for IRMUK's EA-BPM Conference – I introduced my *data* approach to *process* folks
- Then, adapted for IRMUK's ED-BIA Conference – I introduced my *process* approach to *data* folks
- Then, asked by Adept to put them together leading to today's session – *The Data-Process Connection* – techniques & *examples*
- *The plan…*

Note – I won't go through every slide – some are included for reference

Reminders: how "process people" and "data people" complicate things

A few points about Process & Data

How Concept Modelling (Data Modelling) supports Business Analysis, Process Change, and Architecture

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"Process people" make "process" far too difficult

1 – No clarity on what "Business Process" means…

We need some help with our *Product Lifecycle Management* process.

I spend all day writing business processes, like the process to *Revise Product Brochure Image.*

Not a single process – it's a *family* of multiple business processes (a *process area* or *process domain*)

Not an entire process – it's a *procedure* providing instructions for a single task (SWI – standard work instructions)

A whole *spectrum* of interpretations of *process.*

Seek balance – a "business process" lies between the extremes

Most people hear *process* and think *procedure!*

The key issues – granularity and orientation

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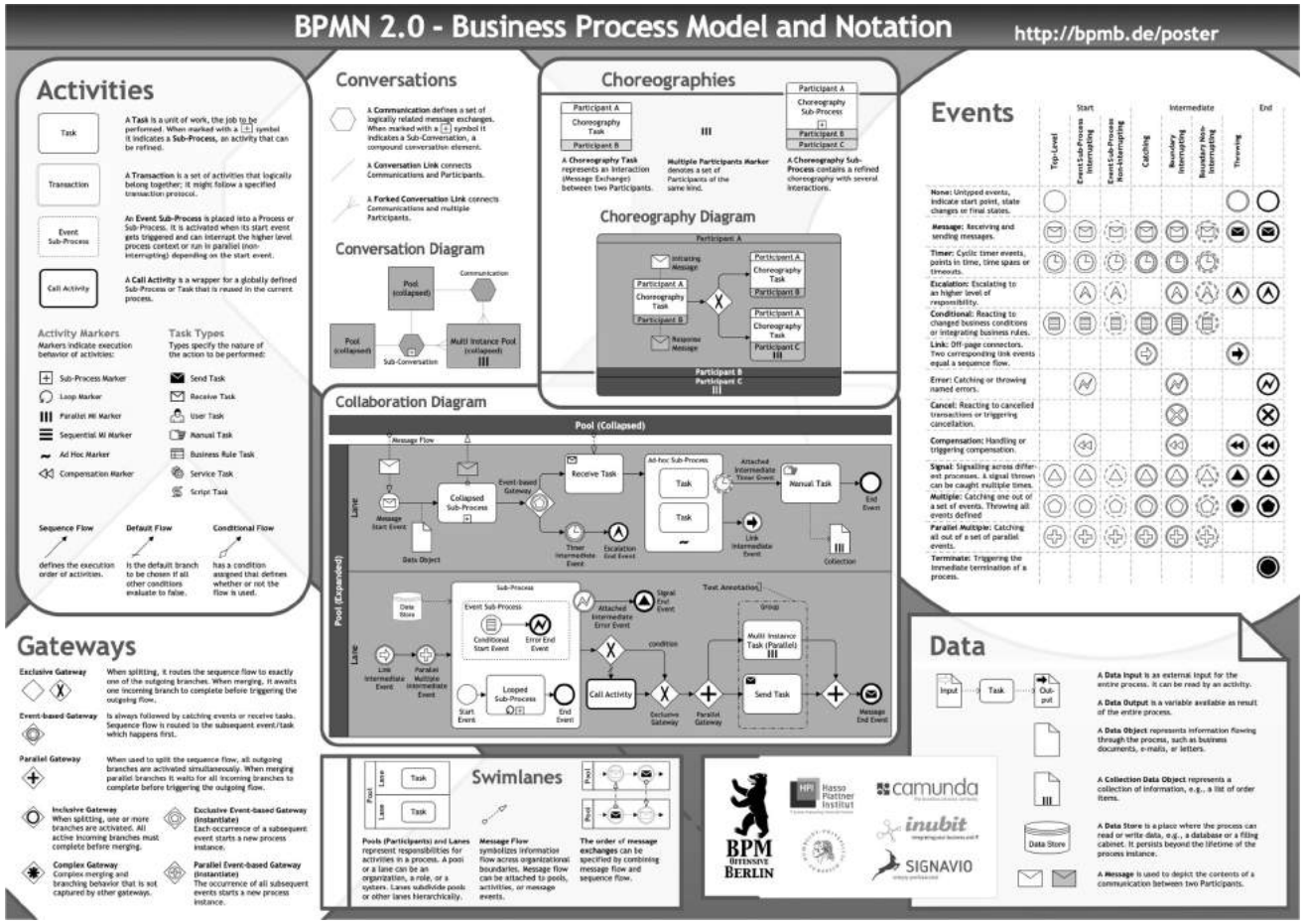
"Process people" make "process" far too difficult

2 – Technically oriented standards…



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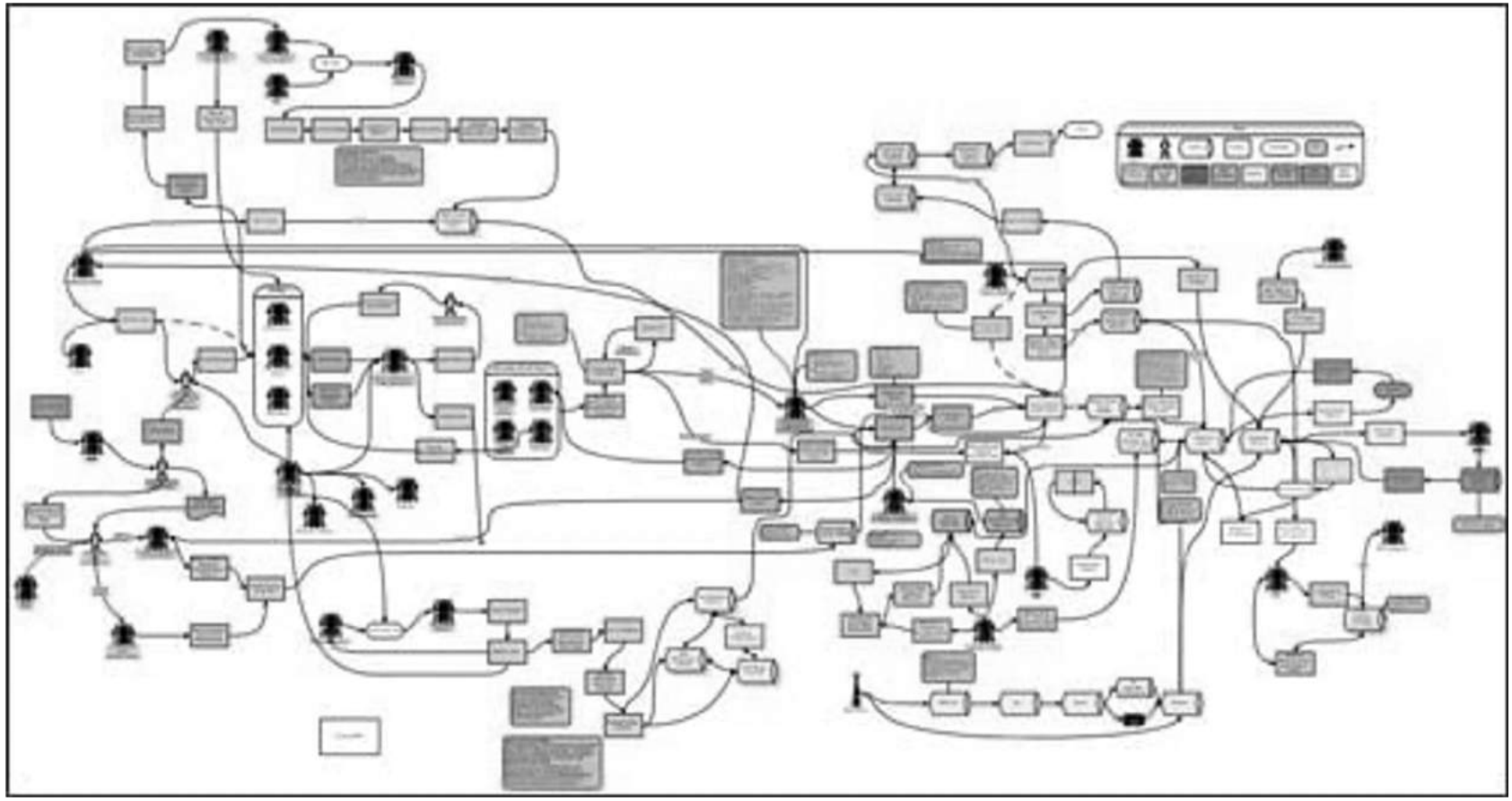
"Process people" make "process" far too difficult

3 – The sudden deep dive into detail…



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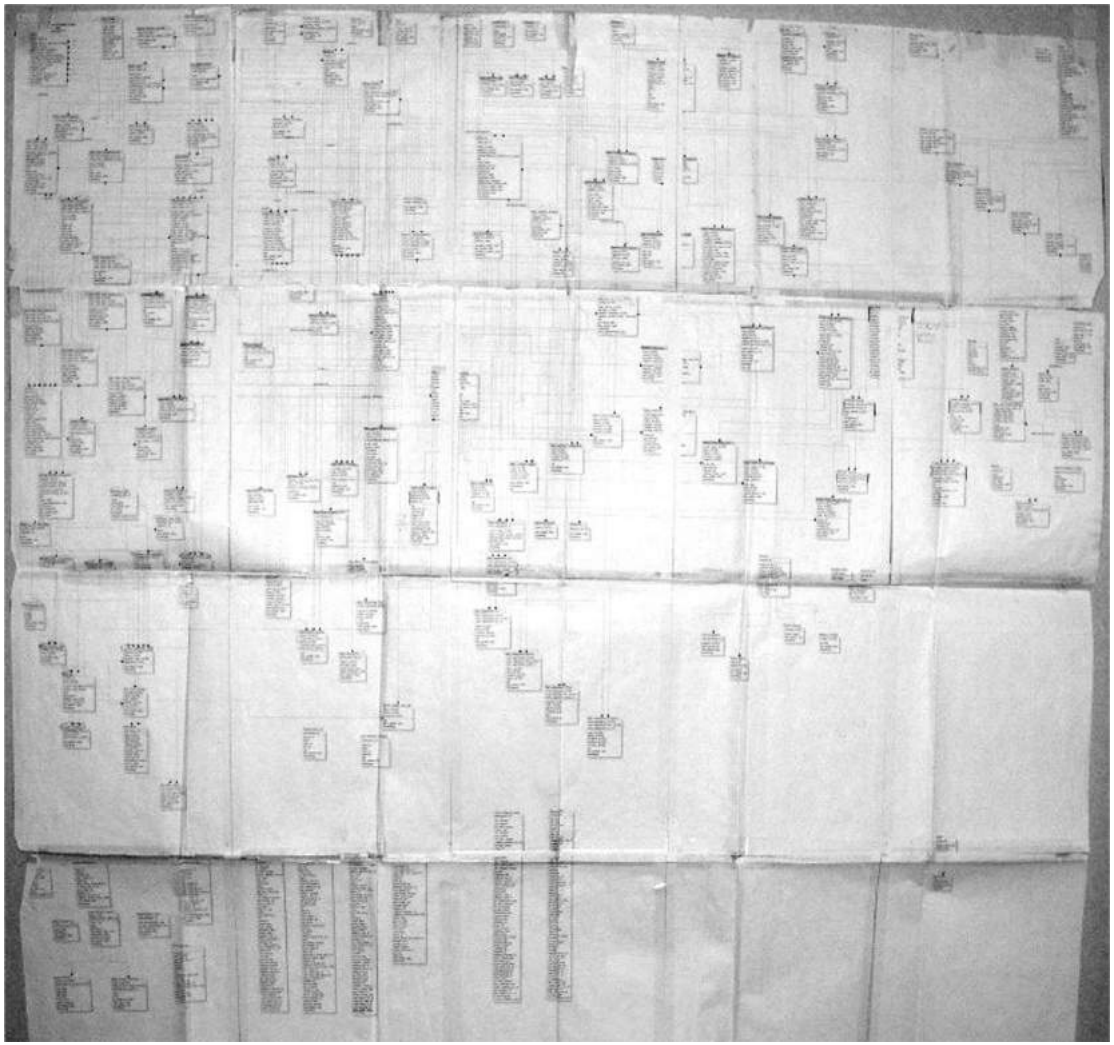
"Data people" make "data" far too difficult

1 – Confusion between data modelling and database design…

"Help – everyone hates our data model."



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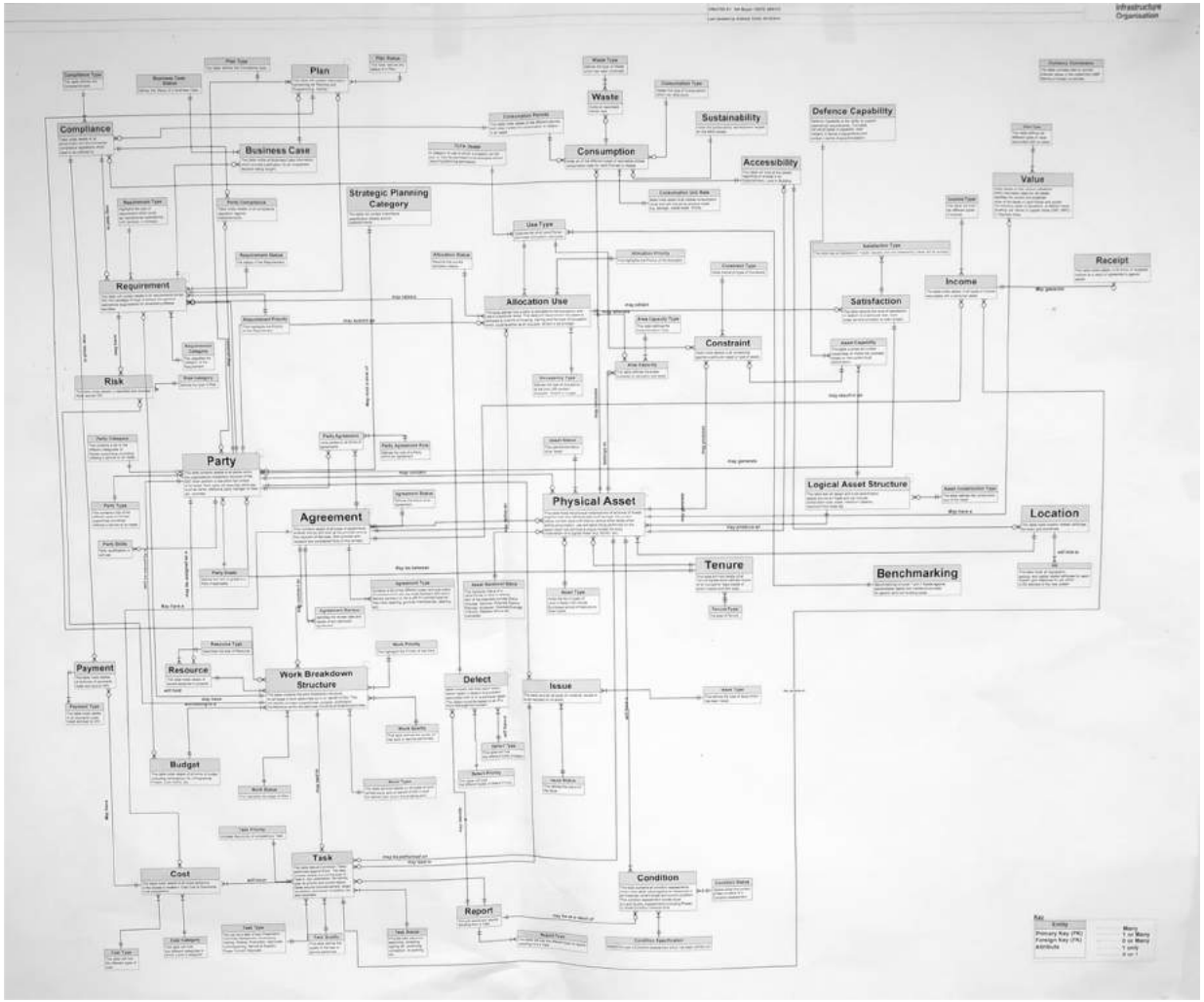
"Data people" make "data" far too difficult

2 – Terrible diagramming…



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For review: specifics – contextual, conceptual, logical

My most plagiarised diagram ever!

1 Contextual (Scope)	2 Conceptual (Overview)	3 Logical (Detail)
Agree context or "big picture" – the scope in terms of topics or subjects that are in or out, plus core terms and definitions • May be a simple block diagram of topics/subjects, or primarily textual (a list) • Optional – not necessary on smaller projects	Agreement on basic concepts and rules • Ensures everyone is using the same vocabulary and concepts before diving into detail • Overview: main entities, attributes, relationships, rules • Lots of M:M relationships • Relationships show cardinality • No keys • Few or no reference entities • Unnormalised – most M:M relationships unresolved, many attributes will be multi-valued, redundant, and non-atomic • Verified directly by clients plus other techniques: Use Cases… • A "one-pager" • 20% of the modelling effort	Full detail for physical design • Provides all detail for initial physical database design and requirements specification • Detailed: ~ 5 times as many entities as the conceptual model • M:M relationships resolved • Relationship optionality added • Primary, foreign, alternate keys • Lots of reference entities • Fully normalised – no multi-valued, redundant, or non-atomic attributes. All attributes defined and "propertised" • Verified by other means: sample data, report mockups, scenarios, … • May be partitioned • 80% of the modelling effort

3 – No clarity on different types of models for different perspectives

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The Lost Art of Conceptual Modeling

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I've been making this point for a long time…

- 2004 DAMA – The Human Side of Data Modeling
- 2005 DAMA Symposium panel
- 2006 DAMA – Lost Art of Conceptual Modeling

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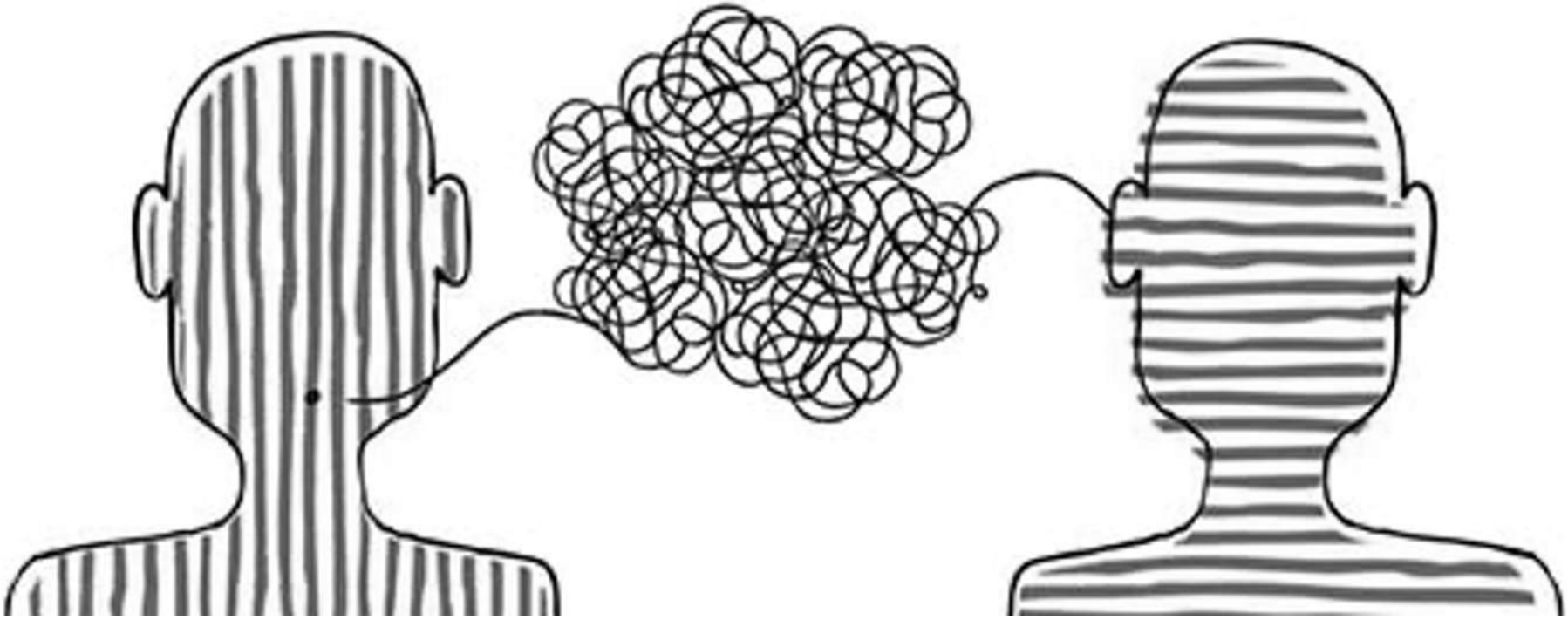
And, of course, they usually don't understand each other



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Moving along…

Reminders: how "process people" and "data people" complicate things

A few points about Process & Data

How Concept Modelling (Data Modelling) supports Business Analysis, Process Change, and Architecture

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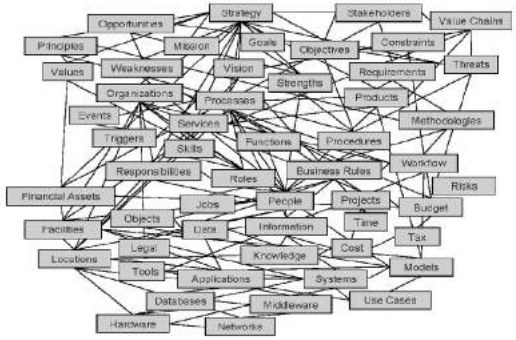
So, a few central ideas…

- *"Data modelling" tools confused data modelling* with detailed *database design* – this discouraged the use of concept modelling / data modelling –



- Professional data modellers often make it too *complex*, too *detailed*, too *abstract*, too *soon!*

- Initially, “data” is not the issue – we model:
  - the “things” / concepts a business cares about: terms and definitions, policies and rules
  - “things first, data later”

- A business-oriented “concept model” provides a great platform for requirements discovery, package selection, business process change, architecture development, etc.

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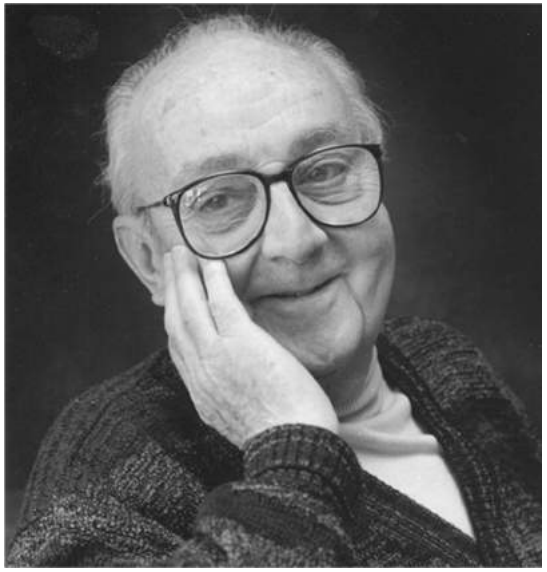
A core idea – "essential" models

"All models are wrong, but some are useful."



George E. P. Box
1919–2013

Two especially useful models

- Business Process Scope Model
- Business Concept Model
  (a.k.a Conceptual Data Model)

Both are "essential" – they show the essence – the "what" – of a subject with no reference to who, how, why, etc.

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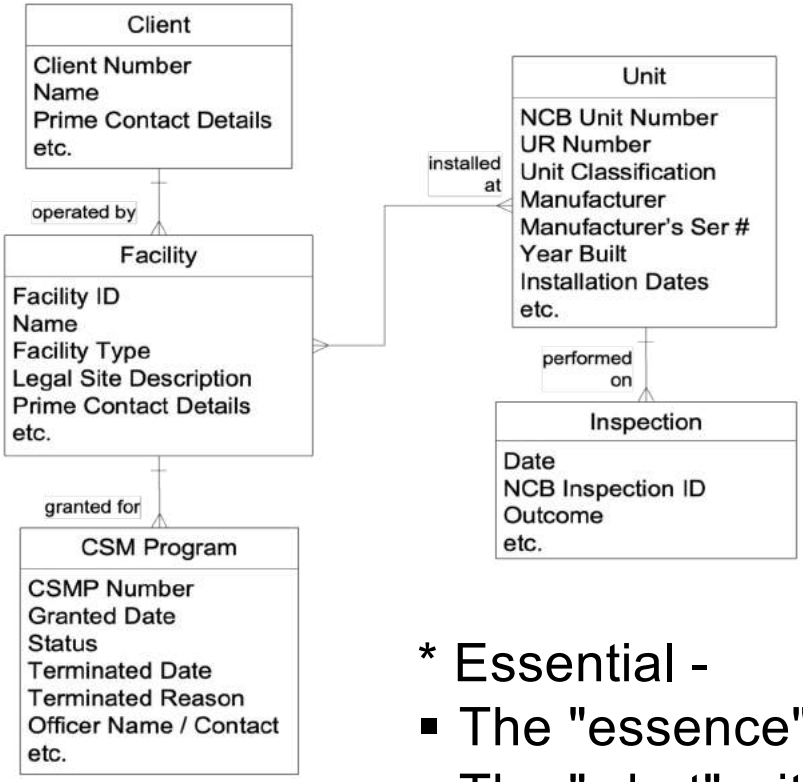
Concept Model – an Essential model*

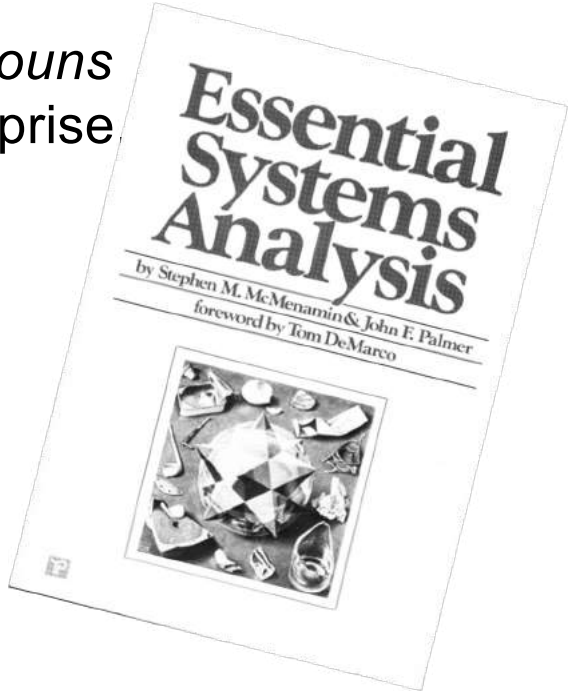


A description of a business in terms of

- what *things* it needs to know about to operate – entities, business objects, classes, *things,* …
- what *facts* it needs to know about those things – relationships & attributes
- what *policies & rules* govern those things– definitions, constraints, and assertions

A *shared language* of the *nouns* that are central to the enterprise

Always start here!



* Essential -

- The "essence" of the subject
- The "what" with no reference to "who" (role or organisation) or "how" (implementation or technology)

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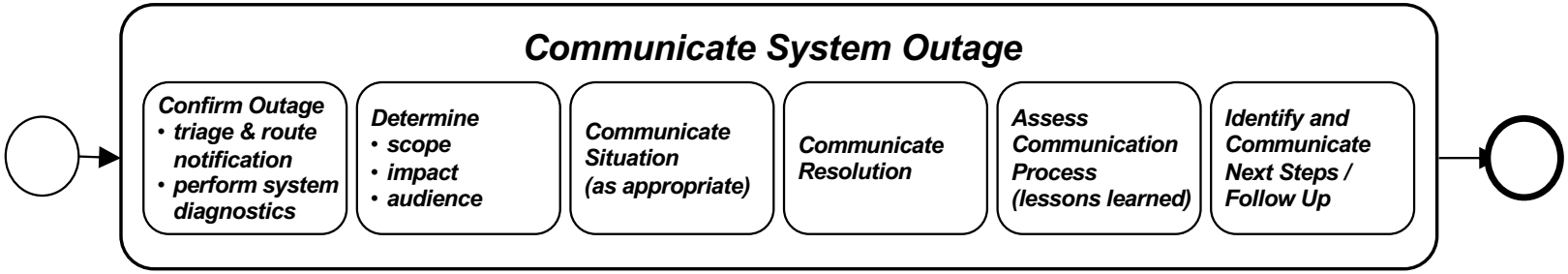
Process Scope Model – an Essential model*



Triggering Event:

Notification of degradation or lack of Service
- internal system
- external provider
- calls to Service Desk

Cases:
- new
- recurring

Other factors:
- severity
- key operations periods / areas (registration, summer, course evaluation season)
- time of year
- time of day

Results:

Communications about the Outage and the progress on resolving it are delivered:
- internally and externally
- informally and formally

Final Results:

Service is restored and root cause is known (or is determined to be unknowable) and resolution is communicated:
- Externally ("good news")
- Internally ("cause & resolution)

Process Scope Model using "TRAC" -
what is the Trigger, *what* are the Results,
what are the main Activities
(7 ± 2 milestones, phases, or subprocesses,)
and *what* are the main cases or variations?

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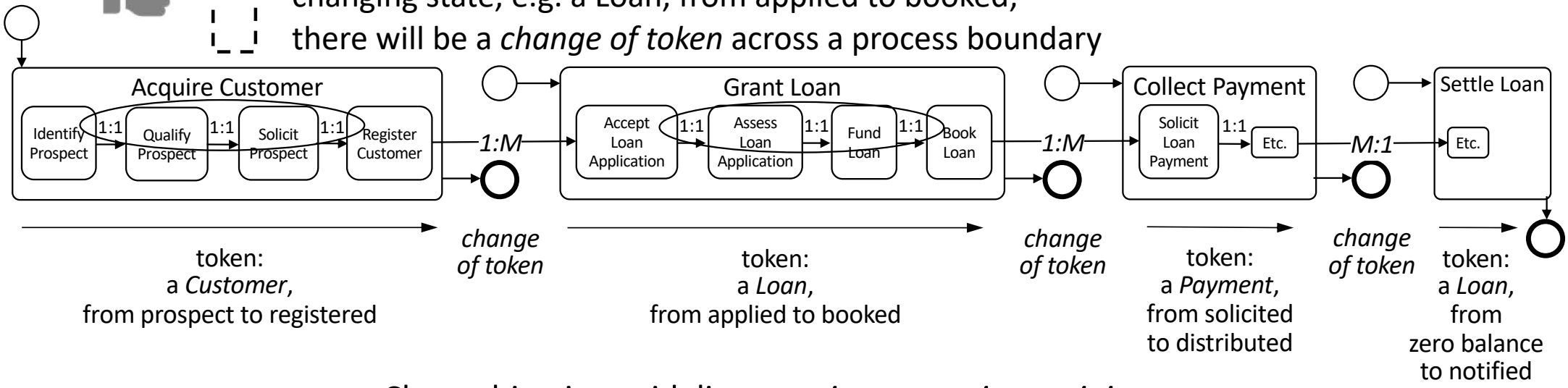
Reminder – nouns (entities) help identify processes

1. "Active verb – noun" naming that indicates primary result
2. Triggered by an event (decision, time, data) outside process' control
3. At the end are results that makes one or more stakeholders happy
4. In between are ~5 to 7 phases, milestones, or major activities
5. Activities linked *1:1* are probably part of the same process;
   a *1:M* or *M:1* connection between activities is probably a boundary
6. The same *token* moves through the whole process,
   changing state, e.g. a Loan, from applied to booked;
   there will be a *change of token* across a process boundary



Clear, objective guidelines – *science, not just opinion*

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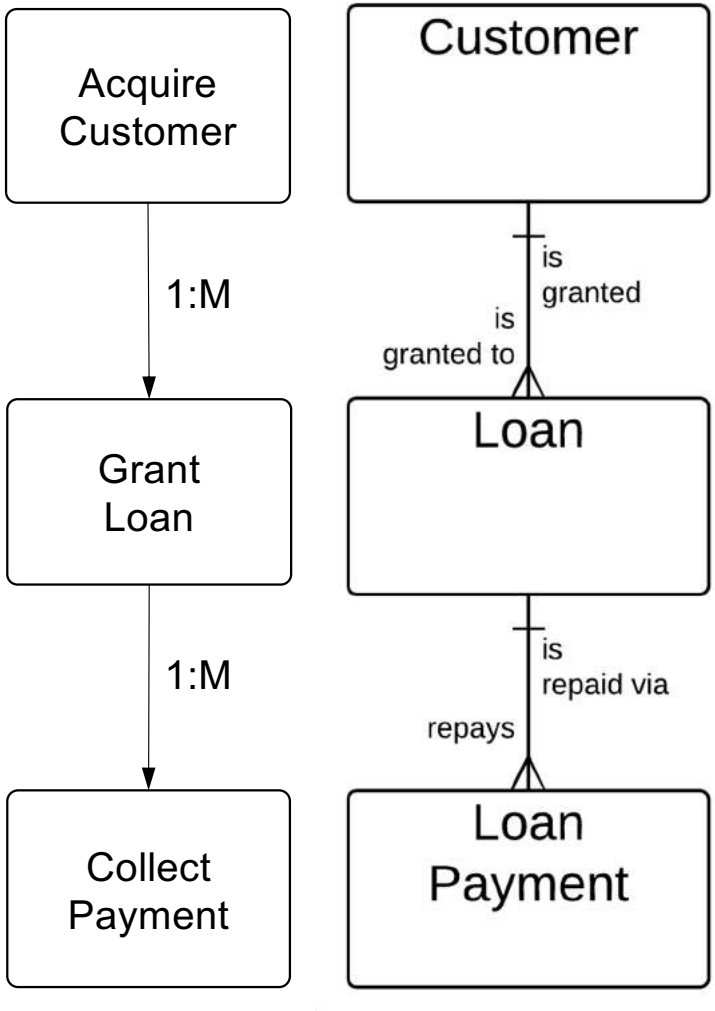
Correspondence to the Concept Model



- The nouns in your verb-noun *process* name are most often the *entities* in your Concept Model, and each will usually have one primary *process*
- The relative number of process instances (e.g., 1:M or M:1) aligns with relationship cardinality
- This *does not* mean there is only one process per entity
  - Assess *Customer* Performance
  - Retire *Customer*
  - Merge *Loans*
  - Write Off *Loan*
  - …

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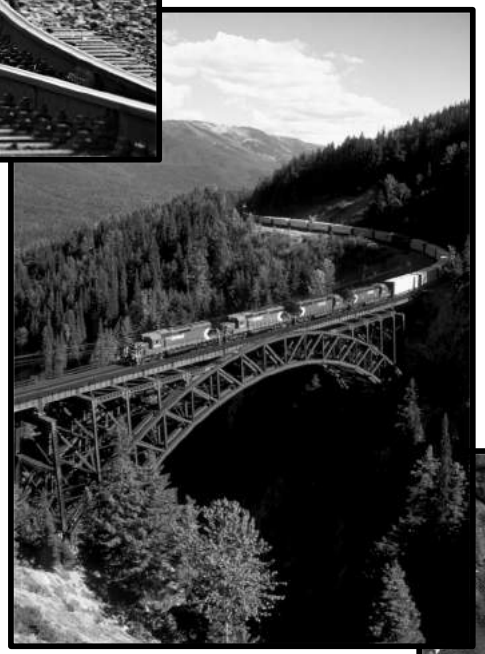
Making concept modelling relevant & accessible

The assignment, a painful but useful lesson – facilitating a concept modelling session for a railway's *Track & Structures* group



I began by explaining data modelling...
"An entity is a uniquely identifiable person, place, thing, event, ..."
Bad idea!!!
"I can't stand you IT guys!"

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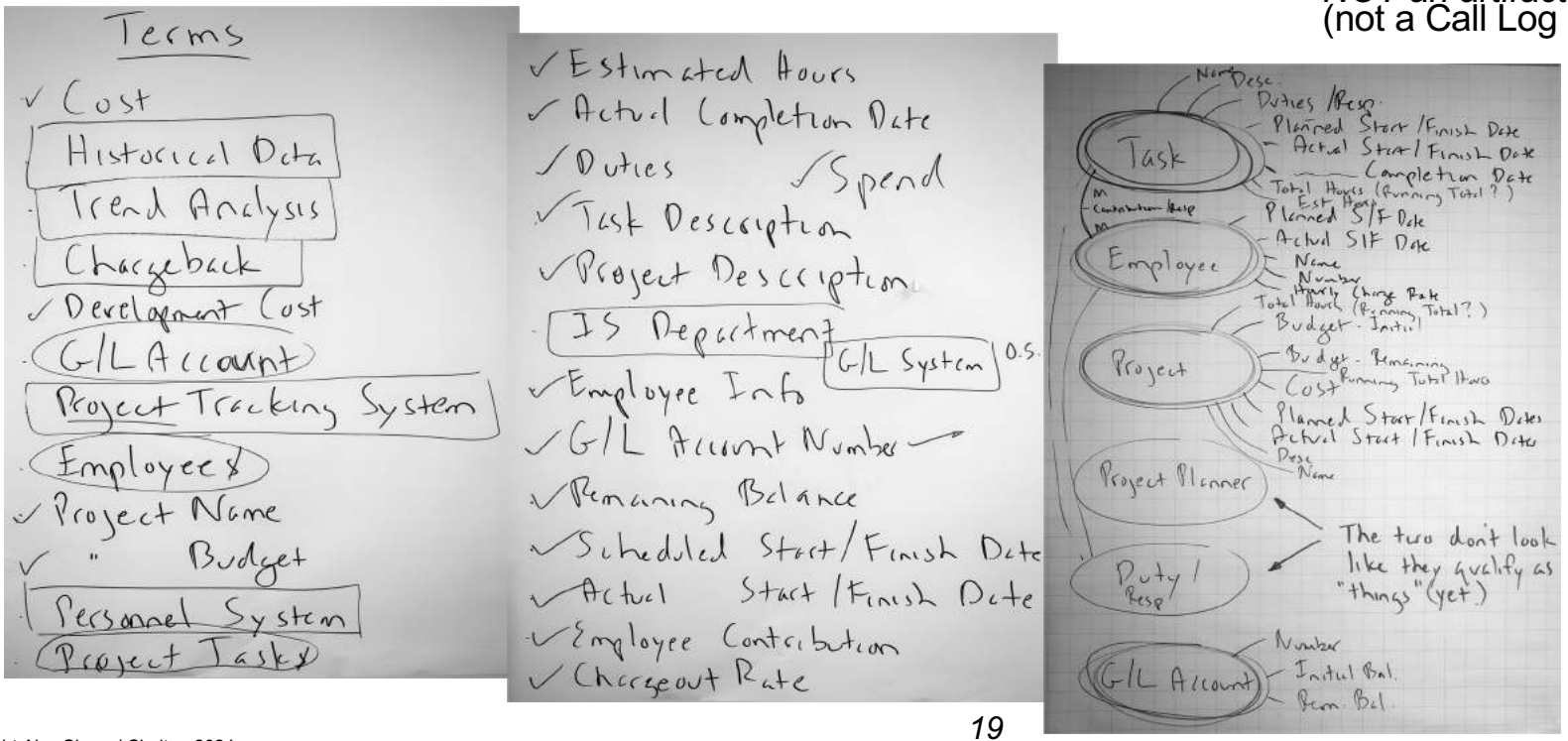
It all begins with language

"Why don't you learn *our* language?" *"Fair point!"*

- Brainstormed over 200 terms –
  Track, Structure, Line, Siding, Mileboard, Segment, Sector, Route, …
- Oh-oh... *"Now what?" Then, an idea!*
- Is this "a thing, a fact about a thing, or other stuff?"
- Here's a Project Management example…

Introduce "thing criteria" as necessary:

- *singular noun* – can talk about *one of them* (*Worker* not *Staff*, *Item* not *Items*)
- *multiple* instances
- must *need to* and be *able to* track *each* instance (uniquely identify each)
- has *facts* that must be recorded
- *NOT an artifact* like a spreadsheet or report (not a Call Log or Worker Directory or…)



Track & Structures were VERY happy with the 40 entity concept model *they* built.

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Or brainwrite, interview, gather by email, virtual whiteboard, …

For a Concept Modelling session with C-level executives and senior managers at a Credit Union ("a Member-owned bank") I sent the participants this email in advance…

Before the session, it would be very helpful if everyone could do two things:

- Spend up to 10 minutes or so listing any terms you use on a frequent basis. Each item in your list could be the name of some thing you need to track, a fact about a thing, a spreadsheet, a report, a metric, a system, a database, or anything else that comes to mind. I'm hoping everyone can list thirty or forty things. There is no "right or wrong" – this helps me learn your language and provides clues to what the most critical terms might be.
- Think of one to three examples of information you'd like to be able to get, but either you can't, or you're not sure how accurate it is. For instance, at a US university last week, a Vice-Provost said she would like to know "How many non-resident, tenure-track Faculty do we have." Of course, this means agreeing what is meant by "Faculty," "tenure-track," and "non-resident." (I've done a LOT of work in higher education, and can promise you there is not agreement on what those terms mean.)

  That's the whole point of our sessions next week. :-)

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More than enough to work with

Hundreds of terms came back – *before* the sessions I selected 35 that looked like "good" entities

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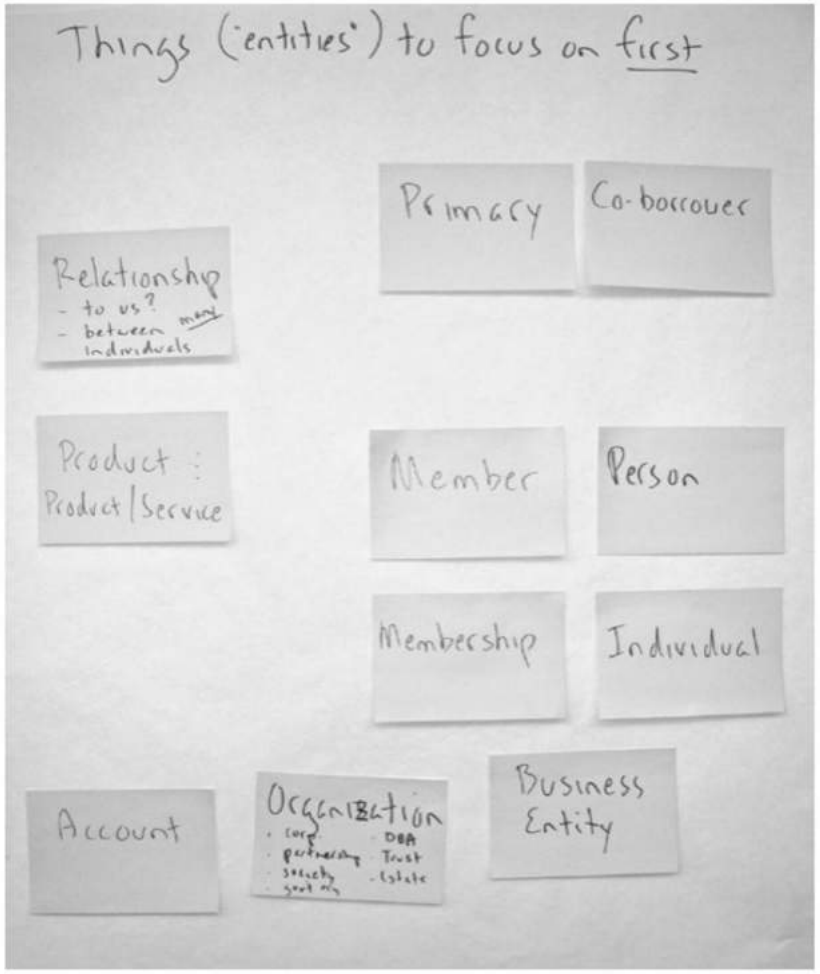
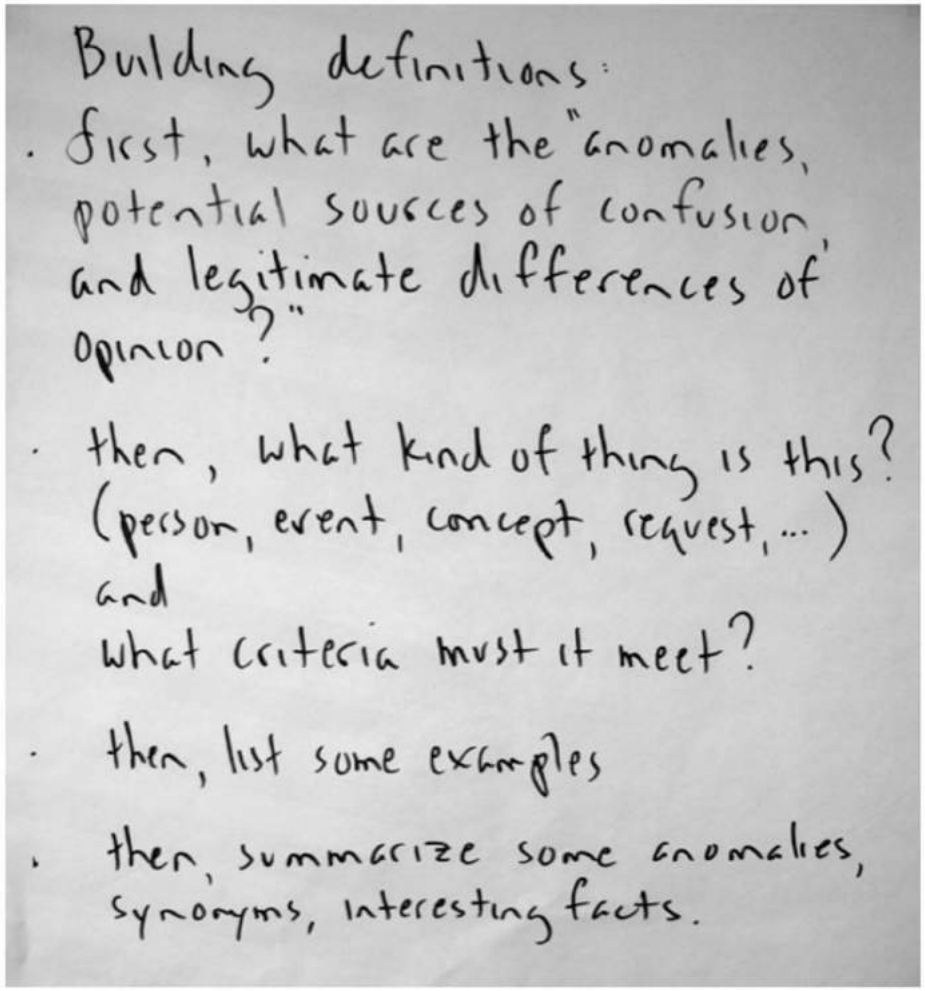
And now we have a plan!





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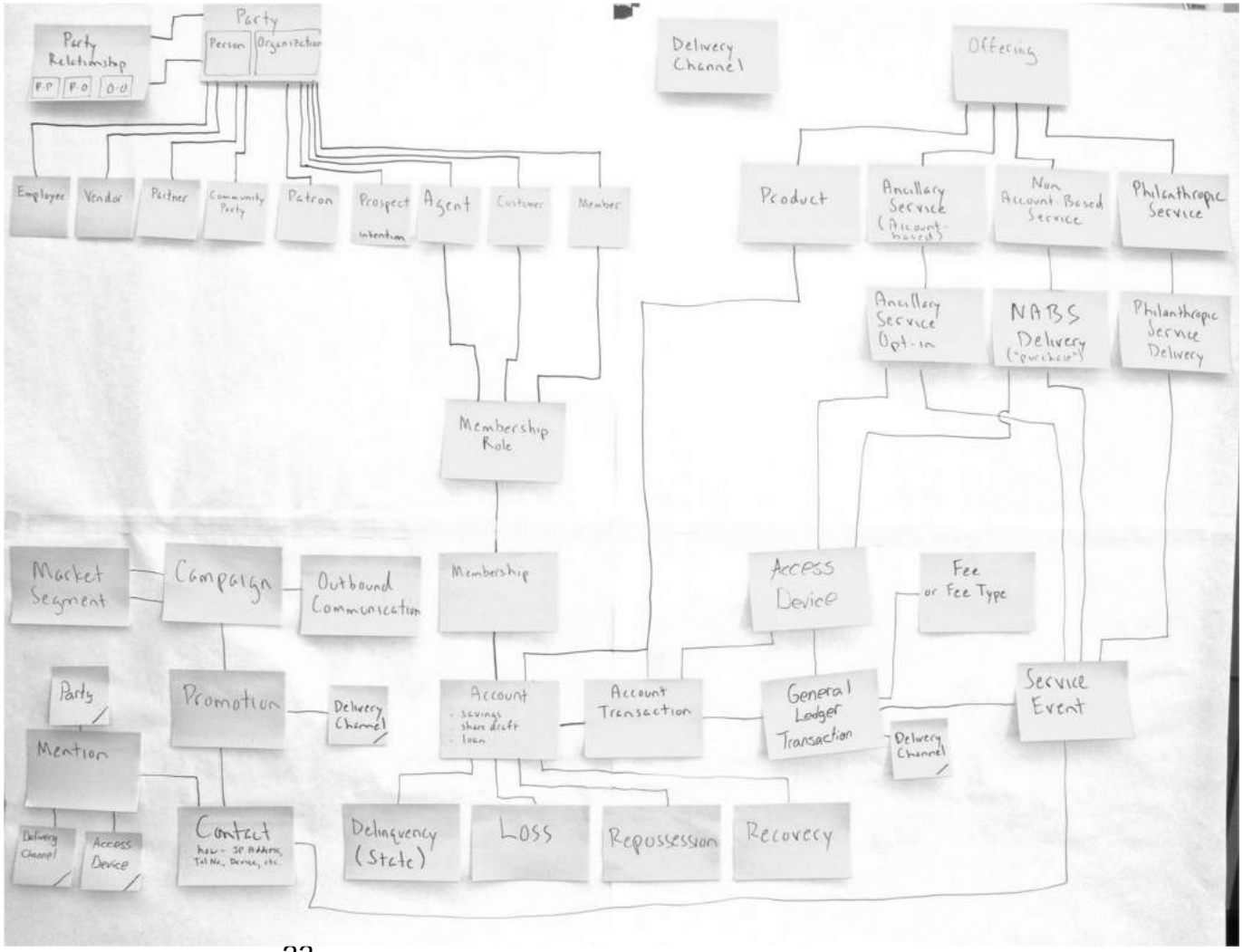
And after three partial days, a ~40 entity concept model

Plus…

- Over 50 flipcharts of notes – issues, goals, decisions, etc.
- Definitions for all entities
- *Very* positive feedback



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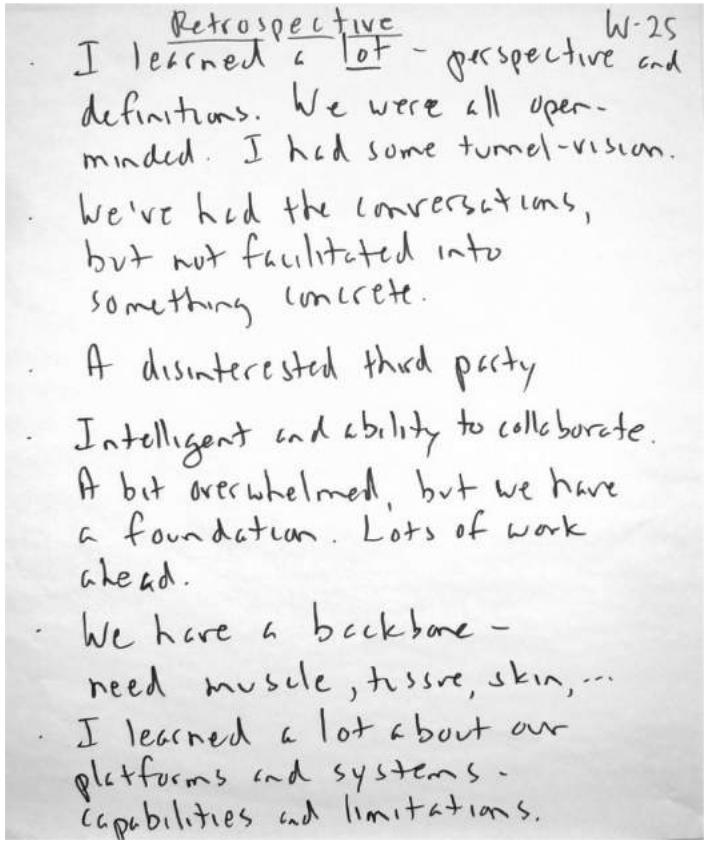
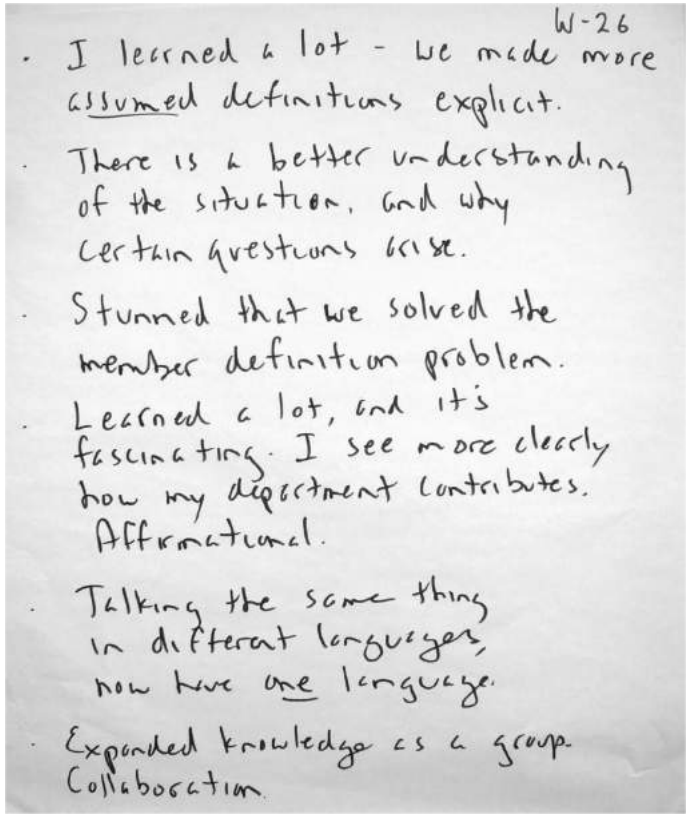
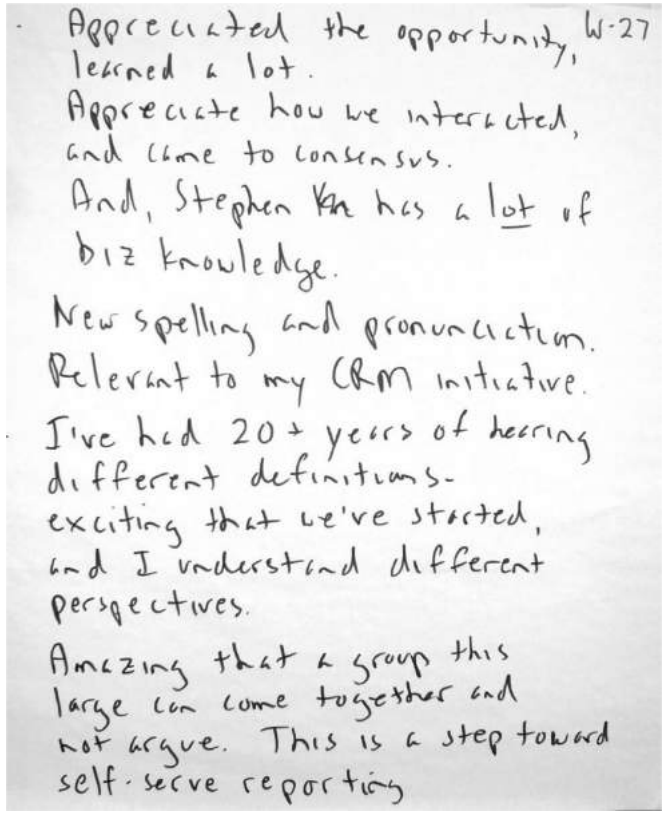
They were very pleased with the outcome







Plus… "we should have done this 20 years ago."

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Putting it together…

Reminders: how "process people" and "data people" complicate things

A few points about Process & Data

How Concept Modelling (Data Modelling) supports Business Analysis, Process Change, and Architecture

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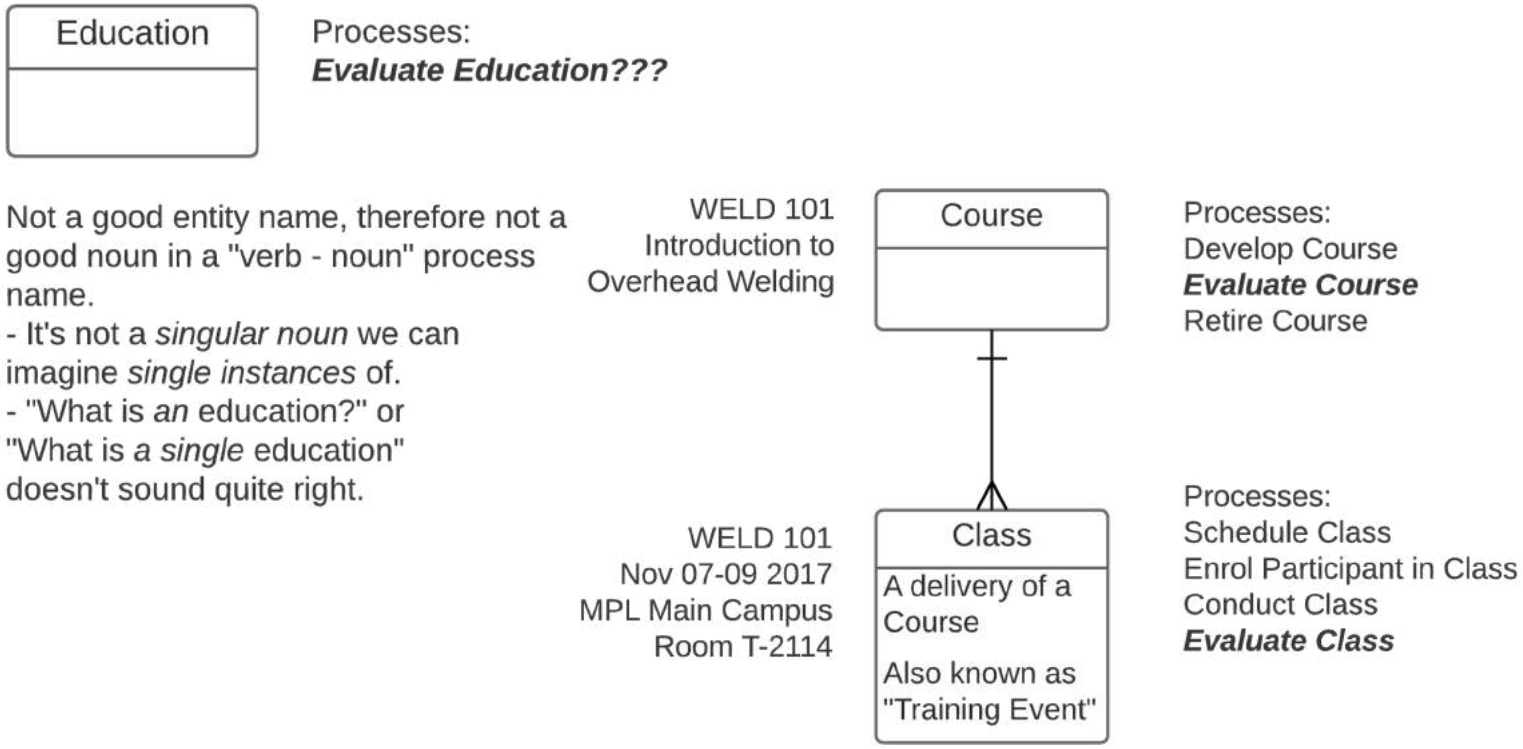
Example – simple Concept Modelling to clarify the process

Analyst struggles to model “Evaluate Education” – timing disconnects, 1:M and M:1 connections within the process, token changes, …

A few minutes of Concept Modelling showed two distinct tokens and processes. “Education” was a “mushy noun.”



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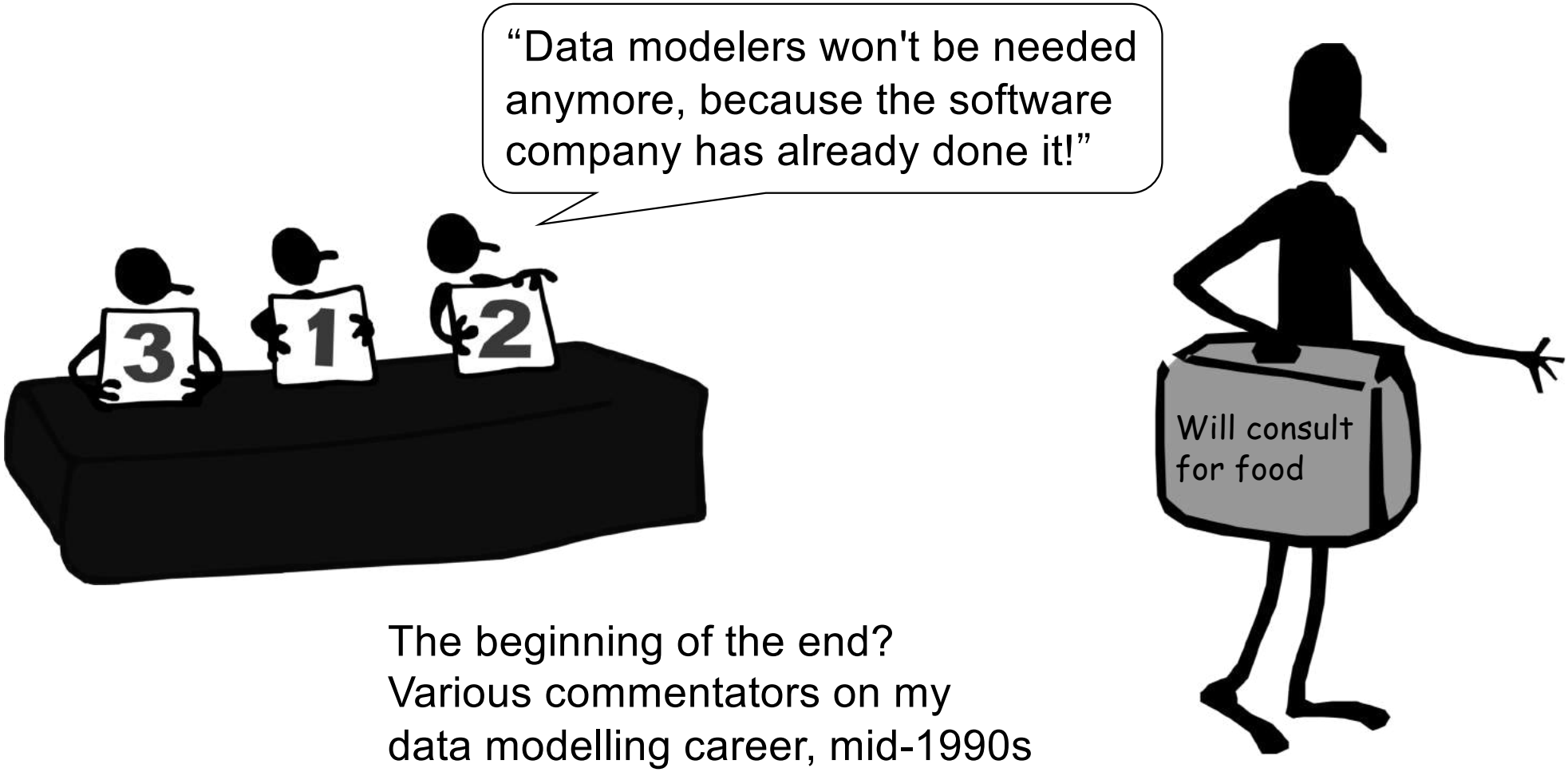
Example – Data Modelling as the basis for COTS configuration



The beginning of the end?
Various commentators on my data modelling career, mid-1990s

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Redemption!

The client...

Could you come on over and do that thing you do?

That entity data stuff with the boxes and lines

We're implementing something called SAP. Our CEO told us to!

When you did that stuff on our Work Order Management System, we all felt we understood our business better than we ever had

They say it's a terrible idea and a waste of time and could you please *just stay home.*

Alec...

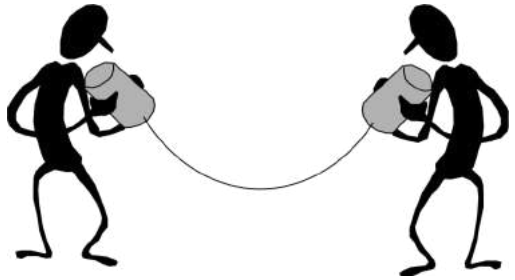
I guess. What thing in particular?

Oh, data modelling.
Sure - what's the project?

Uh-huh. Why do you want my help?

Great! And what do your SAP consultants say about this?

I'm on my way!



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The outcome – using DM for ERP configuration

The situation:

- Manufacturer selects SAP as platform for process transformation
- Desire to understand as-is *business processes* to map to package and decide on configuration options
- Client felt the integrator was coercing them, wanted my help

The #1 reason for unhappiness with the selected COTS solution – *a data model mismatch!*

The approach:

- Team of 7 builds 45 entity *concept model* over two days
- Identify "what's good, what's not good" about current business rules, revise concept model
- Use this knowledge on configuration activities with concept model as an overall map

Vendor
Country
Site
Plant
Plant Location
Equipment Item & Type
PO, PO Line Item
Req'n, Req'n Line Item
Release, Release Line Item
Work Definition, WD Line Item
etc. etc. etc.

The key points:

- ***Client-initiated, not IT***
- Now a global showcase account
- Client – "More value from those two days than anything else we did!"
- Me – "I'm not irrelevant!"

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"Quick wins" example – selecting an application with verbs and nouns

Selecting of new Financials app is hopelessly bogged down despite huge effort to develop and maintain a BDM*

Requirements	D&B	Oracle	SAP	Coda	etc.
1	Y	Y	Y	Y	
2	Y	Y	Y	N	
3	Y	Y	Y	Y	
4	N	Y	N	Y	
5	N	N	Y	Y	
6	Y	Y	Y	Y	
7	Y	Y	Y	Y	
8	Y	Y	Y	Y	
9	Y	N	Y	N	
10	N	Y	N	Y	
11	Y	Y	Y	Y	
12	Y	Y	Y	Y	
13	Y	N	Y	Y	
14	Y	Y	N	N	
…					
…					
858	N	N	N	Y	
859	Y	Y	Y	Y	

*** Big Dumb Matrix**

BDM issues

- Time consuming
- Most apps meet most criteria
- Still can't tell if an app will work well in your environment

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Using DM for purchased application selection – verbs and nouns

The problem:

- Selection of new Financials app is hopelessly bogged down (and a matrix of almost 1000 "requirements" wasn't helping)
- Worse – *matrix points to the app no one wants!*

The approach:

- Small team builds "thing model" (concept model, ~60 entities total, 15 "core")
- For each core entity, identify 3 to 5 life cycle events
- For each event, develop scenario w. data
- Turn over to ***paid*** app vendors – "Show us!"
  - "How do you support the data model?"
  - "How do you handle scenarios?"

"Things we track…"

- **Project, Work Order**
- **Plant, Plant Equipment**
- **Product Type, Product Lot**
- **Product Inventory**
- **Sale, Transfer**
- **Location, Ledger Entity**
- **Financial Category**
- **Responsibility Center**
- **Account, Sub-Account**
- **Fixed Asset**

Events that happen to them…"

Fixed Asset is

- **Acquired or Constructed**
- **Depreciated**
- **Transferred**
- **Disposed Of**

The key points:

- It worked! – saw how an app would support the business
- Didn't initially call it "data modelling"
- Left vendor some room - "Here's how we'd do it."

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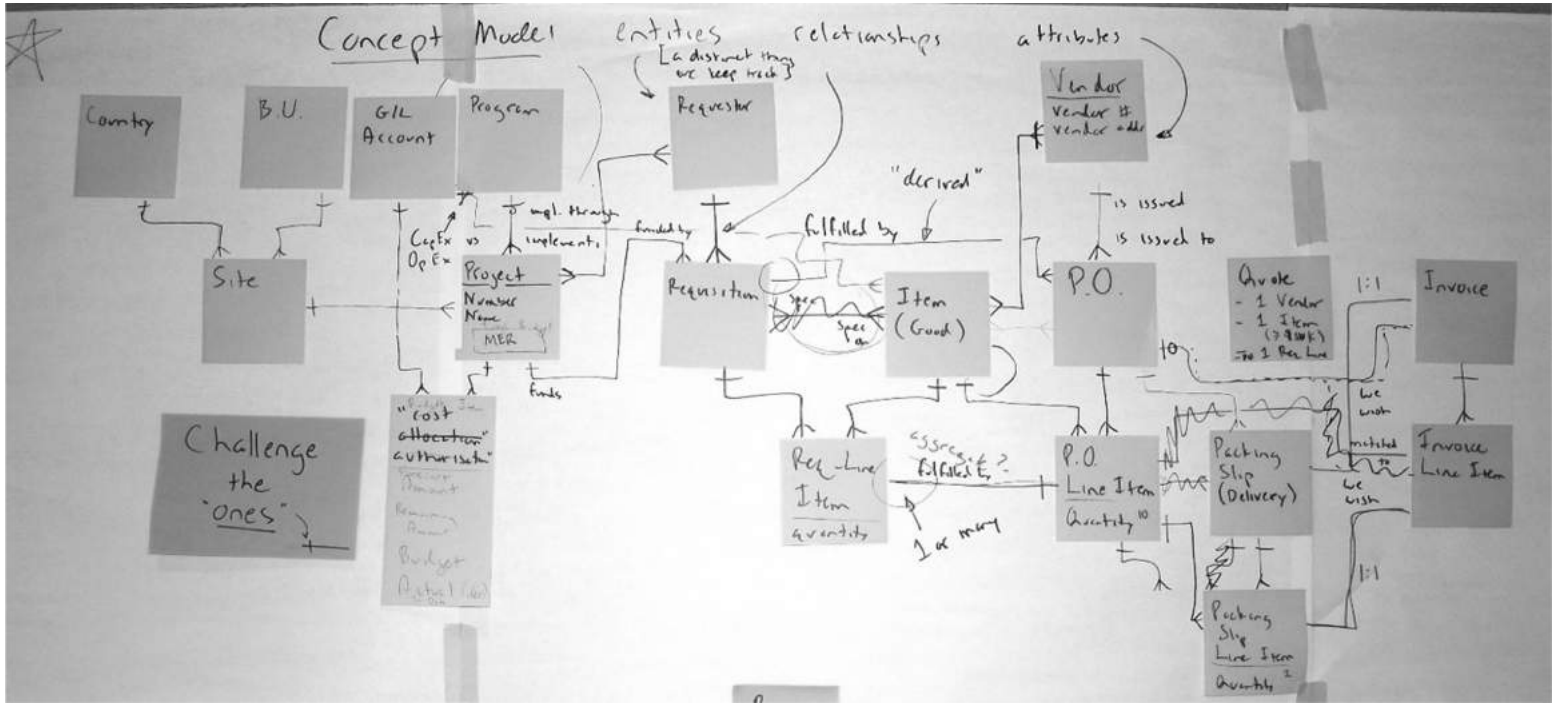
Another example – Concept Model shows possibility of major process change

Global mining company hires me to help with Business Process in support of ERP changeover.



I "snuck in" some quick, informal Concept Modelling.

This highlighted many areas lacking clarity:

- Program vs. Project
- Site vs. BU Location vs. Country
- Requisition vs. Quote vs. Purchase Order
- The 1:1 relationships among PO/PO Line Item, Packing Slip/Packing Slip Item, and Invoice/Invoice Line Item showed that Invoiceless Payment, a major process change, was possible

I did not use any data modelling terminology until the end!

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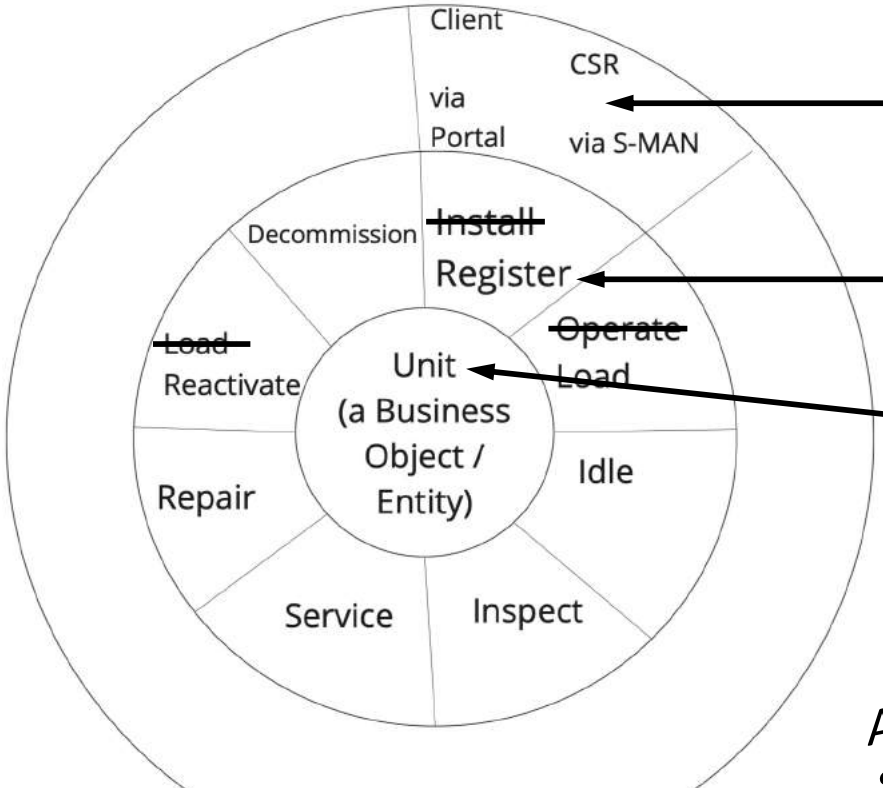
From Entities to Events (Services) to Use Cases

What events happen to a Unit - what are the needed services? (Verb - Noun)

- ...
- ...
- ...
-



Who needs access to each Service, and How?

Use Case	*Use Case or User Story - add Who and How*
Service Specification (Events)	*Service (or Event) - add a Verb to the Noun*
Concept Model	*Entity or simply a "thing" - a core Noun*

A Concept Model is a great starting point for discovering your Services and Use Cases (User Stories)

Supports *Service-Oriented Business Analysis*

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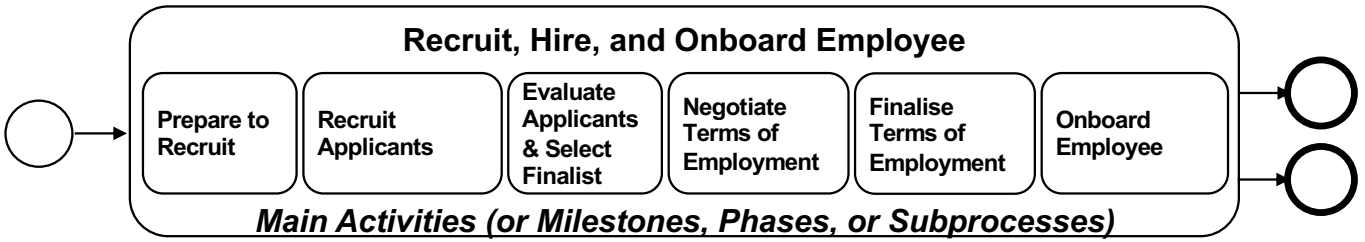
Example – simple Concept Modelling to clarify the process

- University looking to implement e-Signature
- Pilot project selected to test the technology on "Approve Letter of Offer"
- Suggestion – "Get Alec in and be sure you understand the process." *(Thank you!)*
- Everyone fixated on physical “Letter of Offer” (“how”)
- Concept Modelling revealed the “what” –
  actually a selection from a set of *“Standard Employment Terms”*
  formatted using a *standard* (legally unchangeable) *“Employment Offer Template.”*
- ***Major*** *process implications!* E.g., no need for anyone to "see" the actual Letter.

Trigger:
Need to appoint a person to a Position (aka, “hire a person”) due to:
vacant Position
new Position
modified Position
Includes contract expiration/modification



Cases:
Full-time Faculty – tenure-track, non tenure-track, fixed-term research, fixed-term instructional, …
Academic Professionals
*Classified****… and many more***

Customer result:
(hired Employee)
relatively pain-free, timely, correct first pay cheque correctly deposited
Accurate, agreed Terms of Employment (a contract) and Position Description.
etc.

Customer result:
(other Applicants)
receive results before Letter of Offer, but must feel well tested
…and many more for other stakeholders

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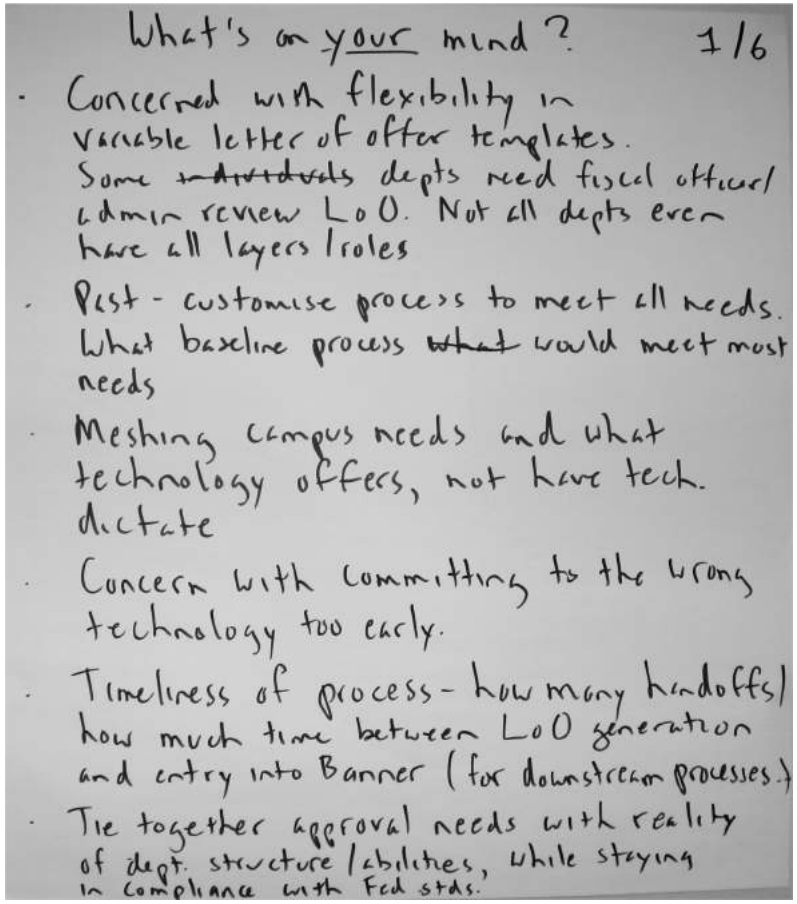
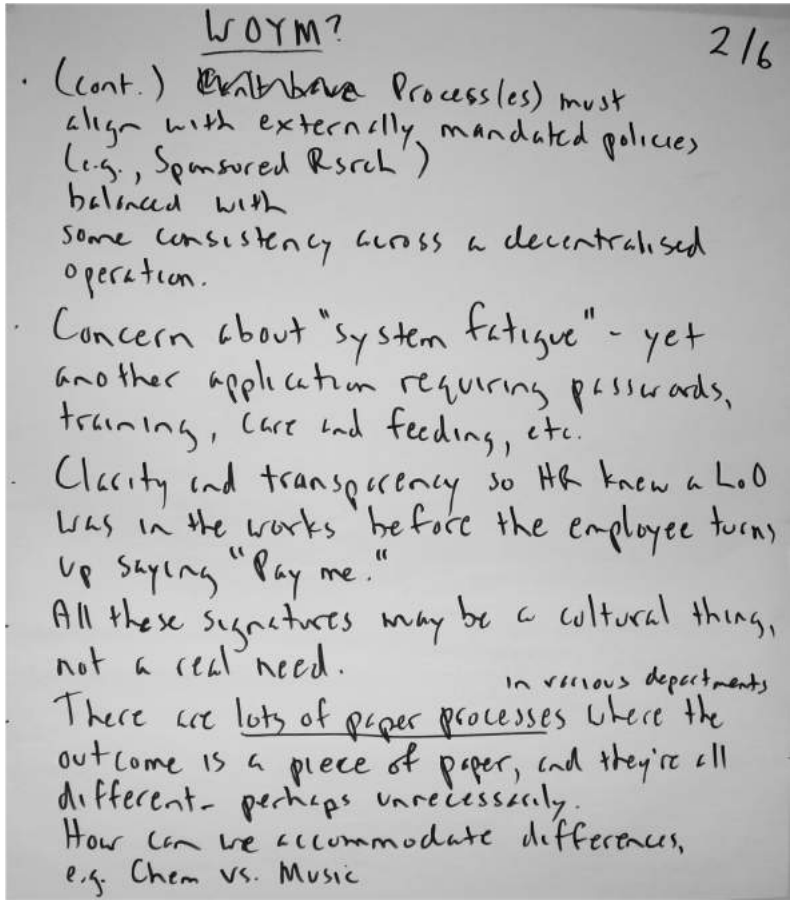
How we got there – Venting! (1 and 2 of 6)





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"Venting" reveals three key points

1. There are MANY more interested parties (stakeholders) than anyone realised

2. Agreement that "Venting" surfaced the main issues and goals of each key Stakeholder – no need to do "Stakeholder-based assessment" later in the plan

3. Everyone fixated on physical "Letter of Offer" ("how")
   but "Venting" revealed "what" – actually a selection from a *standard* set of *"Standard Employment Terms"*
   formatted using a *standard* (unchangeable)
   "Employment Offer Template." ***Major*** *implications!*

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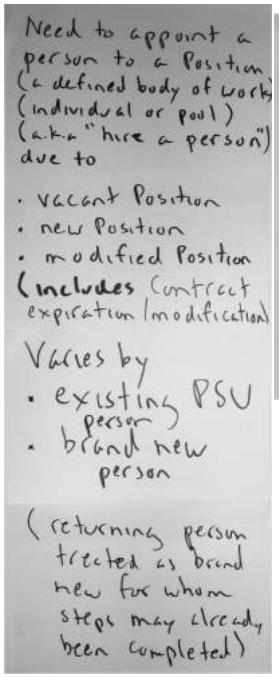
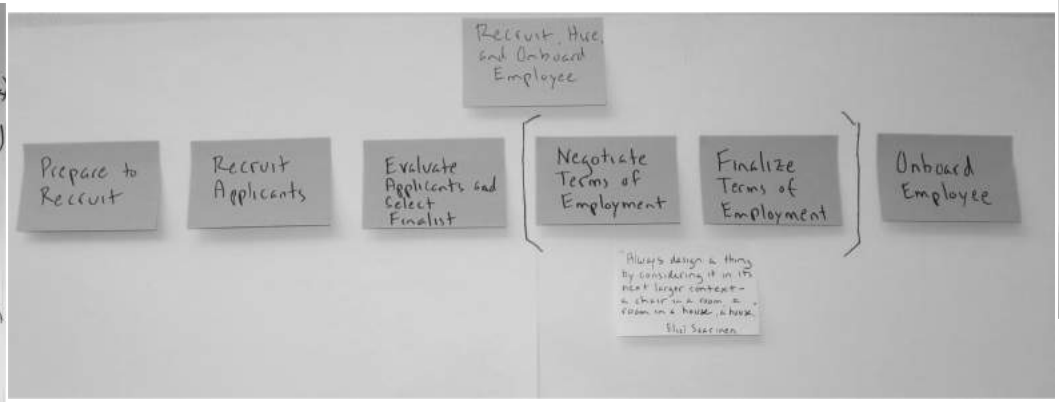
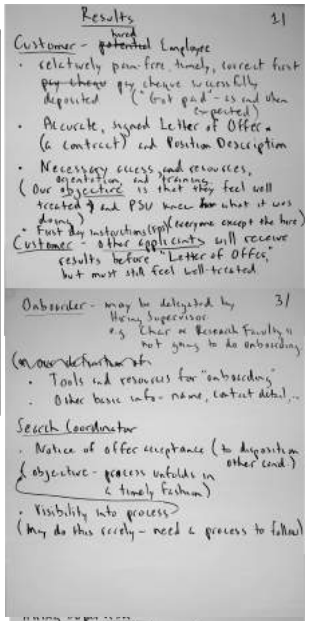
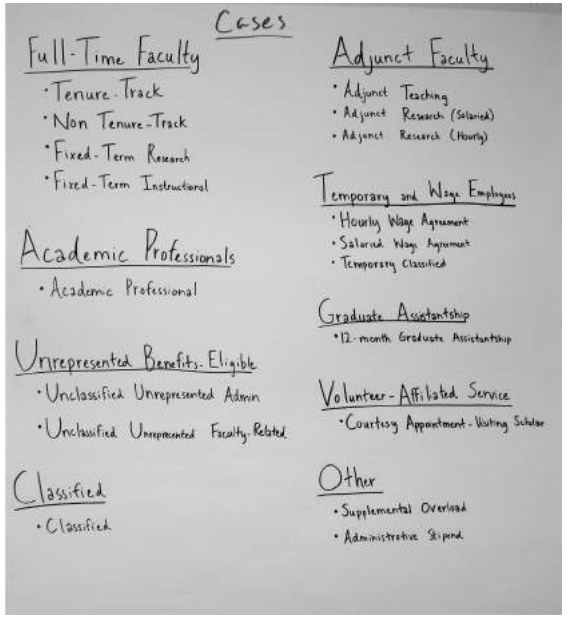
Using TRAC we built a Scope Model









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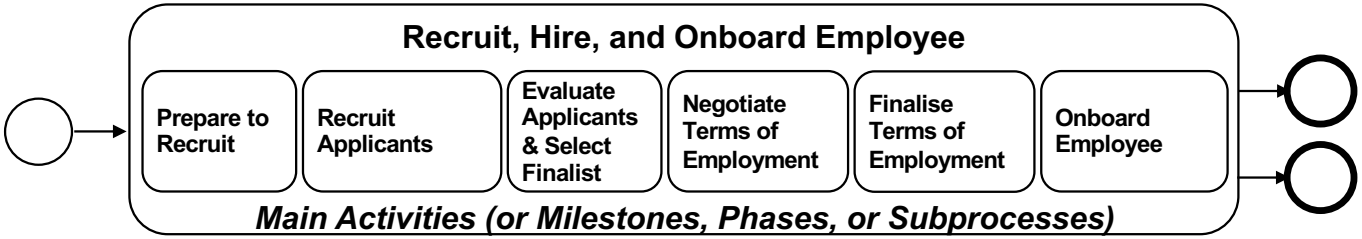
Scope Model (TRAC) – the legible version



Trigger:
Need to appoint a person to a Position (aka, "hire a person")
due to:
vacant Position
new Position
modified Position
Includes contract expiration/modification

Cases:
Full-time Faculty
tenure-track
non tenure-track
fixed-term research
fixed-term instructional
Academic Professionals
academic professional
Unrepresented Benefits-Eligible
unclassified unrepresented admin
unclassified unrepresented faculty-related
*Classified****… and many more***

Customer result:
(hired Employee)
relatively pain-free, timely, correct first pay cheque correctly deposited
Accurate, agreed Letter of Offer (a contract) and Position Description.
etc.
Customer result:
(other Applicants)
receive results before Letter of Offer, but must feel well-tested
Bargaining Unit result:
Notice of Appointment, as appropriate
…and many more for other stakeholders

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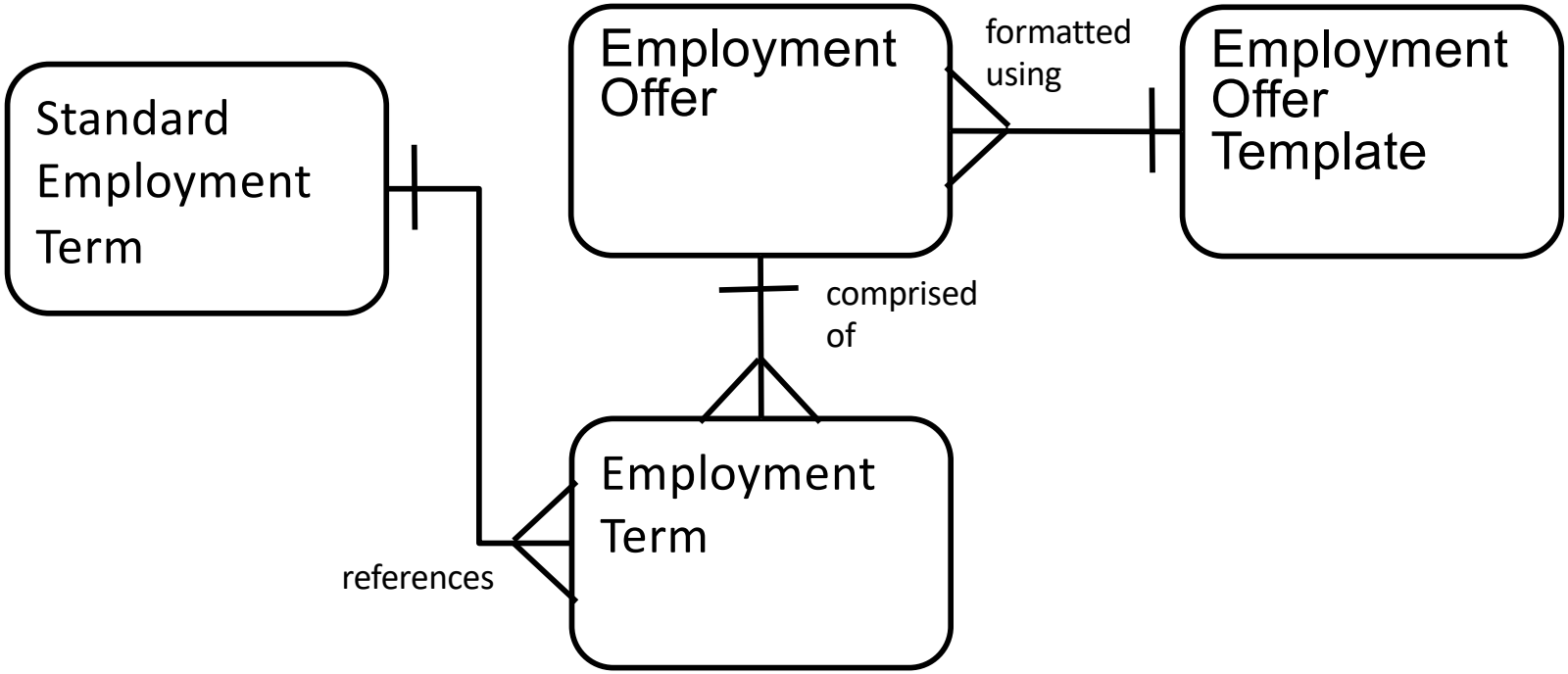
"Letter of Offer" = "Terms of Employment"



Classic *"how"* (Letter of Offer) vs. *"what"* (Employment Offer)

Realisation: if Employment Terms are agreed, and Template is standard and unchangeable, ***no one needs to review the Letter!***

Eventually, the term "Letter of Offer" became unused

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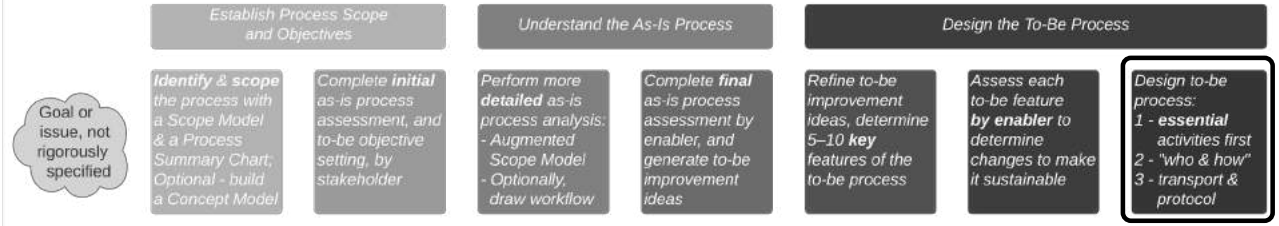
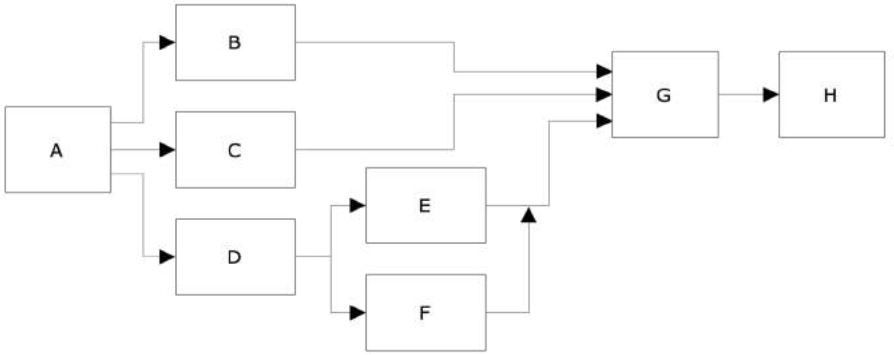
For reference: Design to-be process – overview

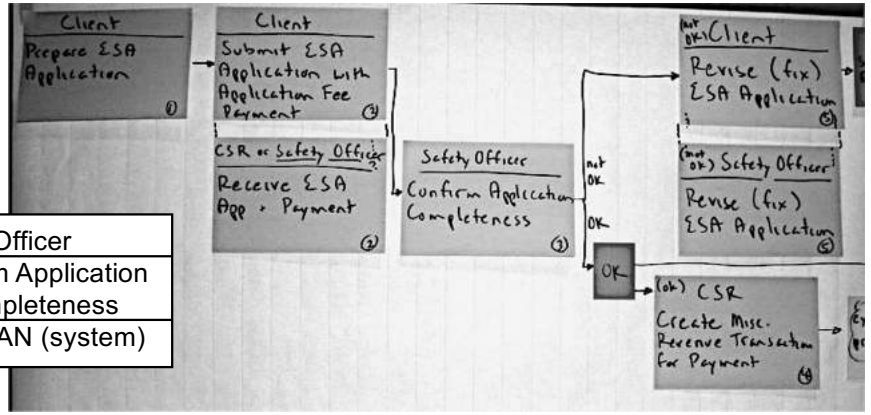
Skip to 43



Key points:
- As with the as-is process – *"What first, who and how later"*
- Design around *essential* steps, not *administrative steps*

- Use an Augmented Scope Model to determine *what* the essential activities are
- Next, factor in *who* will perform each activity, then *how*
  - a person as a manual activity
  - a person interacting with a system, e.g. a use case
  - a system, e.g., RPA (Robotic Process Automation)
- Link essential activities by dependency – a PERT chart
- Adjust – e.g., verify activity is assigned to the correct role
- Only then redraw as a swimlane diagram
- *Finally,* add non-value-added but necessary activities:
  - transport, record keeping, notification, etc.
  - ensure any approval steps are *really* necessary ("Don't confuse notification with approval.")





Who: Safety Officer
What: Confirm Application Completeness
How: S-MAN (system)

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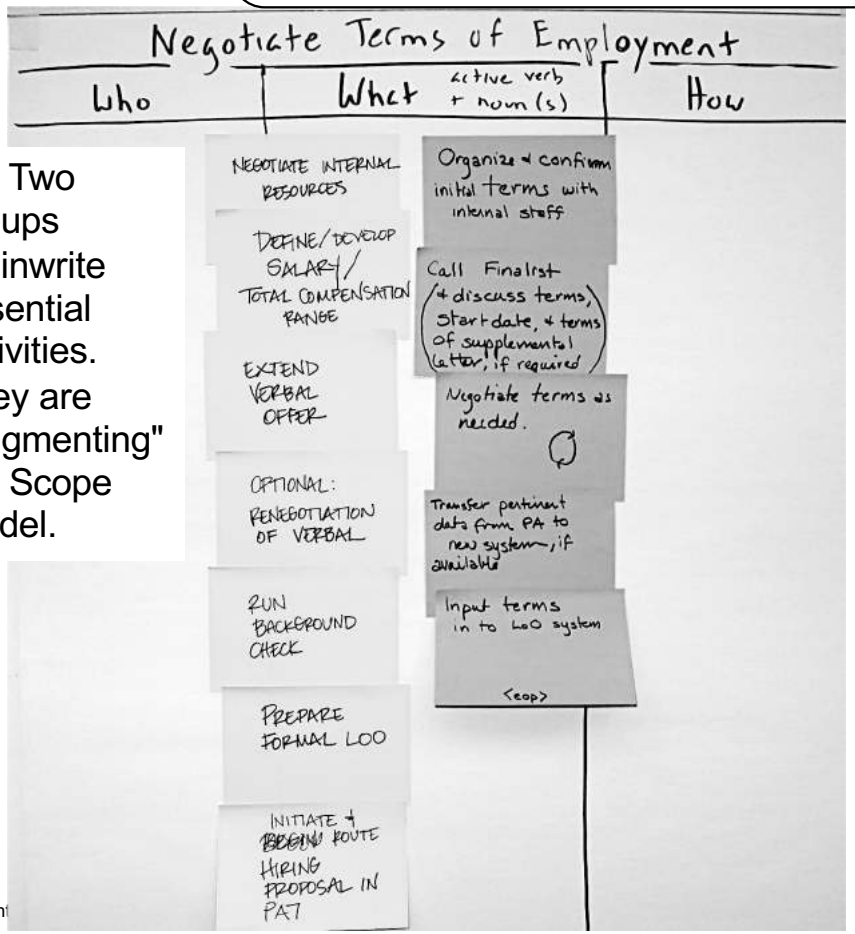
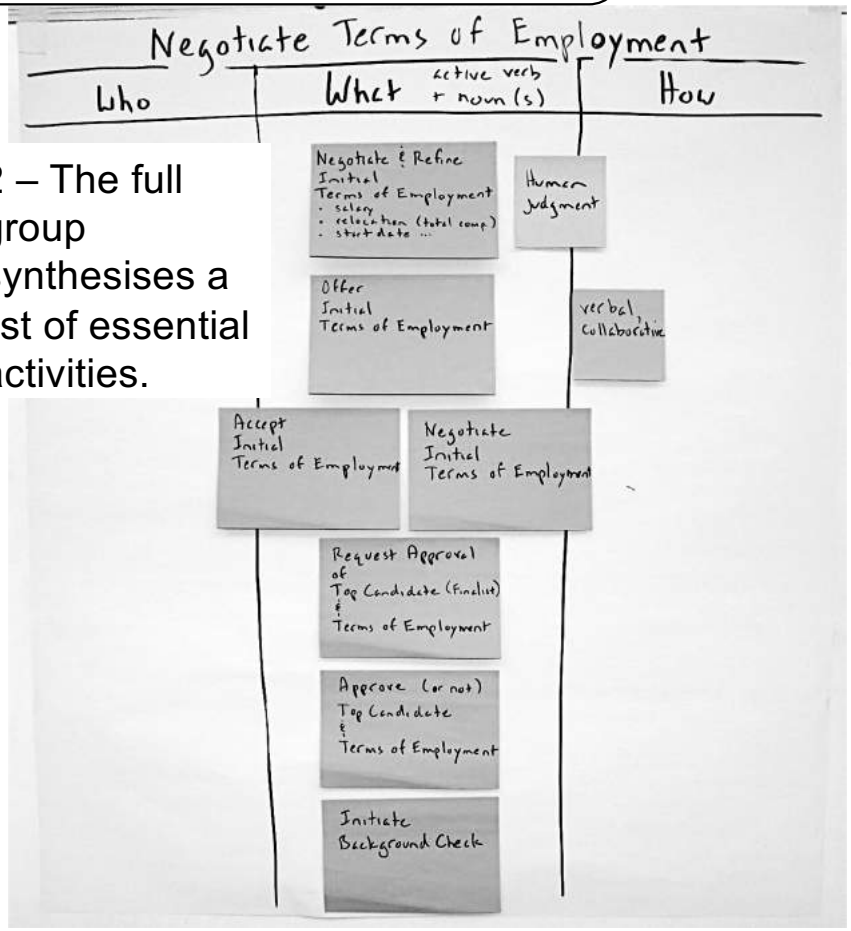
For reference: Design to-be process – Identify essential activities

Recruit, Hire, and Onboard Employee

Prepare to Recruit	Recruit Applicants	Evaluate Applicants & Select Finalist	Negotiate Terms of Employment	Finalise Terms of Employment	Onboard Employee



1 – Two groups brainwrite essential activities. They are "augmenting" the Scope Model.



2 – The full group synthesises a list of essential activities.

Lucidchart version

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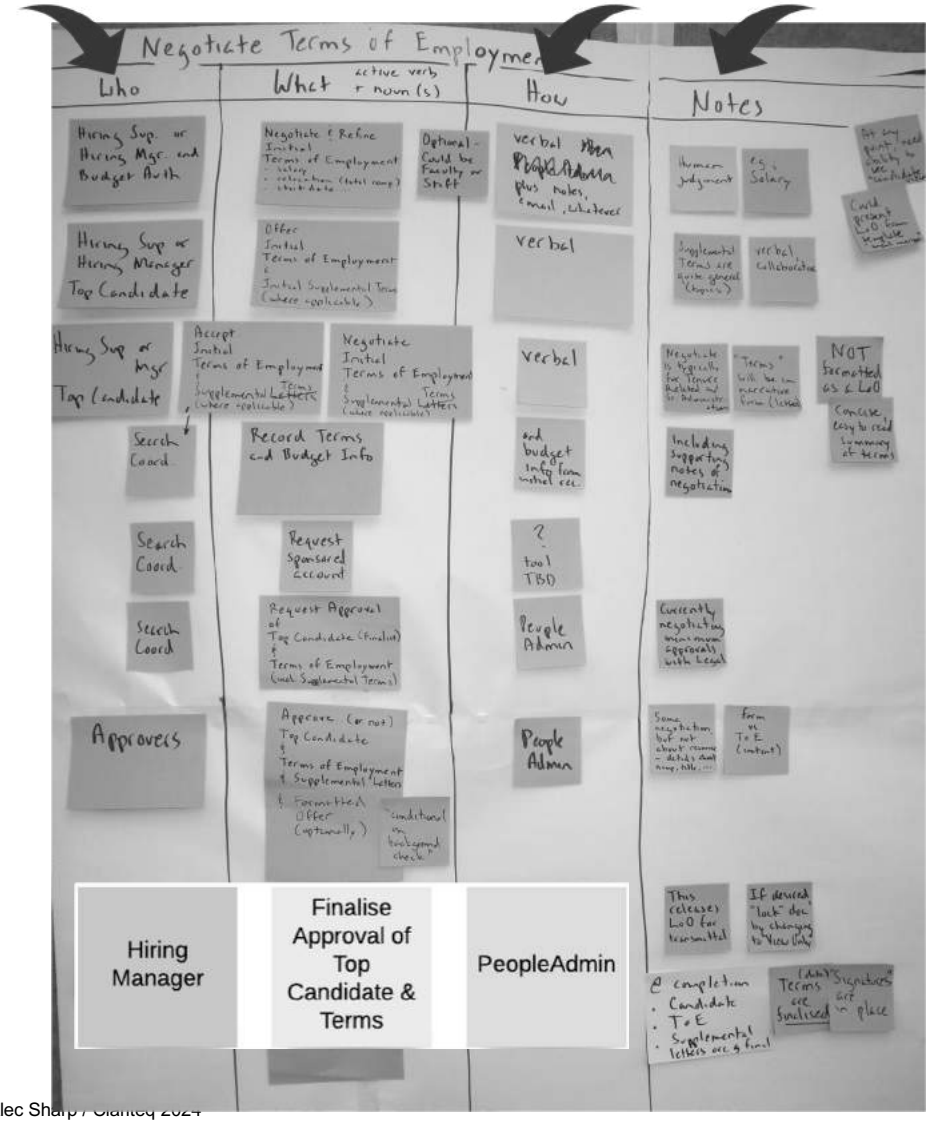
For reference: For each essential Activity, add "Who," "How," and lots of "Notes"



- We have the core of the to-be process design
- Going immediately to a Swimlane Diagram would be *overwhelming!*
- But now, developing the to-be flow model (swimlane diagram) is straightforward – *We Can Do It!*
  We have:
  - actors (swimlanes)
  - steps
  - how the steps will be done
  - sequence
    (approximate, but OK for now)

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Example – is a new process concept viable?

Classroom tech support at major US research university

- Goal: “Uber-style” tech support for classrooms – when an Incident is raised in a Classroom, dispatch it to one or more appropriate Techs (qualified, available, assigned to the appropriate Support Unit) who will bid on it.
- Approximately 20 “assertions” described the planned state:
  - Each Tech may be badged for one or more Service Category Levels, and for each Service Category Level there may be one or more Badged Techs.
  - Each Tech may be assigned to one or more Support Units during a given time period, and for each Support Unit there may be one or more assigned Techs.
    A Tech can only be assigned to one Support Unit at a time.
  - An Incident for a particular Classroom can be raised by either a Customer (the “reporter” – Faculty, Staff, Tech, …?) or an automated Alert raised by an Equipment Unit located on a particular GP Classroom.
  - many more…
- The assertions led to the development of an ERD.
  Note – the complete “Concept Model”
  is the combination of the definitions, the assertions, and the graphic (ERD)

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Example 5 – Assertions. Lots of assertions.

Classroom Support

Assertions, for review and validation:

- Support is provided by different Support Units (organizations) for different Service Levels (tiers) and different Service Categories (Computers, Audio-Visual, Learning Technologies, Networking, Scheduling, and Facilities.) We are concerned with support for Computers, Audio-Visual, Learning Technologies, and Networks. Scheduling is supported by the Registrar's Office, and Facilities is supported by (shockingly) Facilities.
  If we only cared about one Service Category, say "Computers," there would be no need to model the "Support Category / Support Unit" concept, because it would be a given – there would only be one.
- Each Support Unit could support one or more Service Categories. E.g., Sam's Call Center provides Tier 1 support for Computers, Audio-Visual, Learning Technologies, and Networking.
- Support for Department-owned rooms is not within the scope of this initiative; support will be provided by the owning Department's Local Support Unit.
- Support for Classrooms (GPC and non-GPCs) or a Room Block of GPCs will be provided by a Support Unit during a Time Block for a Support Level (Tier.) That is, for a given Room Block (available via the Classroom reporting the Incident) for a given Service Category Level (e.g., Computers – Tier 1) during a particular Time Block, a particular Support Unit will provide support. This concept is represented via the "Support Responsibility" concept, an associative entity which indicates the responsibility of a Support Unit to provide support for a Service Category Level for a Room Block during a Time Block. There are three general possibilities:
  1. Support for the Room Block will be provided exclusively by the Local Support Unit (the Department);
     - this only applies to non-General Purpose Classrooms (Department "owned")
  2. Support for the Room Block will be provided exclusively by the Central Support Unit;
     - Will this happen? Is this a goal?
  3. Support for the Room Block) will be provided by the Local Support Unit during "normal business hours" (a Time Block) and by the Central Support Unit outside of "normal business hours."

Classroom Support

  - Is this the "normal" case?
  - Should it read "after normal business hours?" That is, will Central ever provide support both before and after normal business hours?
- Each Tech may be badged for one or more Service Category Levels, and for each Service Category Level there may be one or more Badged Techs. A M:M relationship.
- Each Tech may be assigned to one or more Support Units during a given time period, and for each Support Unit there may be one or more assigned Techs. A M:M relationship, but will a constraint be that a Tech can only be assigned to one Support Unit at a time?
- An Incident for a particular GP Classroom can be raised by either a Customer (the "reporter" – Faculty, Staff, Tech, …?) or an automated Alert raised by a an Equipment Unit located on a particular GP Classroom.
- The "dispatcher" or "CSR" at Room Support (?) assigns (or routes?) an Incident to the appropriate Support Unit based on the Support Responsibility.

Putting all this to work…

The goal is to automatically route an Incident to one or more Techs. When an Incident is raised, Dispatch will always create a Ticket, and then route it to the appropriate Tech(s) based on Service Category Level (Service Category and Service Level,) Time Block, Room, and Support Unit. Here's how…

- When an Incident is raised, we know the Room Block (via Room,) the Time Block, and the Service Category Level, therefore we know the Support Responsibility, and therefore the Support Unit.
- We also know which Techs are badged for that Service Category Level, and which Techs are assigned to that Support Unit at that time.
- Now we have a pool of Techs the Incident could be dispatched to, for them to "bid on," Uber-style.

Sorry about the fine print. And, no, this was not a simple job. It took some real effort to build the enabling concept model, but *we could not have done it without the assertions* – they made the needs granular!

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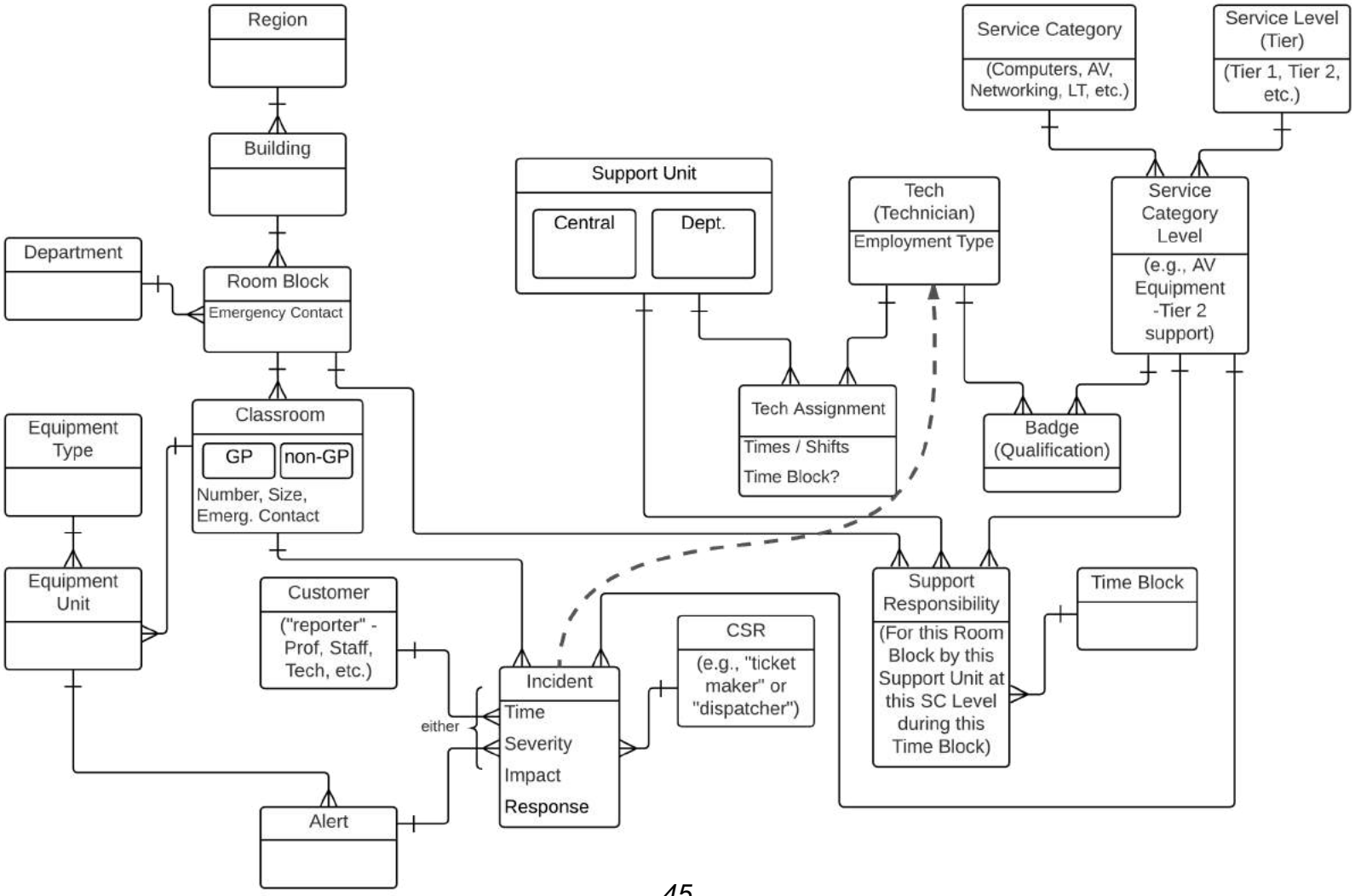
The underlying "Conceptual Plus" Model



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Remember, it all starts with language

- Concept Modelling (Conceptual Data Modelling) is *crucial* to Business Process work

- The “things” you define in your concept model are the things that
  - processes act on
    (in verb-noun process naming, the noun is a “thing” – an entity)
  - businesses want information about
  - applications revolve around

- Businesses needs a *common language*
  more than ever

- Note – works best if you don't begin with a lecture on *Data Modelling!*
  Just Do It! Go forth and model!

“Now! *That* should clear up a few things around here!”

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Thank you!

Alec Sharp, West Vancouver, BC, Canada

If you have questions or comments…
don't be shy, get in touch!

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