Time Slide

00:00 0 – Title
00:25 1 – Outline

- Sampler: architectural representations
  - diverse styles
  - distinct subject matter
- Foundation: formalizing frameworks
  - architectural representation medium
  - rigorous mathematical treatment
- ISO/DIS 19439: framework standard for enterprise modeling
  - enactable models
  - manufacturing environment
- C4ISR: DOD enterprise framework initiative
  - achieve broad model interoperability
  - global service and support
- Compare Features:
  - distinguishing aspects
  - properties desirable for formalization
- Correspondence:
  - relationships among archetype
  - meta-models
  - instances

00:45 2 – Arch. Representations

- just 8 of many possibilities
  - top set showing variety
  - bottom set the presentation focus
- notice distinctive structural metaphors
  - indicative of architecture term use
  - pyramid, sphere, cube, wind chime, tower, grid

01:30 3 – FRAT

- one face for each system view
  - Function
  - Requirements
  - Answers – system description
  - Test – verification and validation
- architectural features
  - stratification with ordered levels
  - connection between levels
  - artifact frequency - metaphorically, detail elaboration adds
    - depth
    - breadth to the system description

02:00 4 – ARC CMM

- spheres of influence for application domains
- application nodes arranged with respect to axial dimensions of significant interest
  - enterprise
    - business thru production
  - value chain
    - suppliers thru customers
  - lifecycle
    - design thru support

02:30 5 – Rockwell Collins

- 3 architectural dimensions
  - abstraction – function, service, support
  - hierarchy – system, subsystem, etc.
  - realization – logical, physical, structural
  - 27 coordinate positions
- note variety of perspectives to accommodate with representation models

03:15 6 – PERA

- 9 phases in project elaboration
  - identification to dissolution
  - the focal dimension
- 2nd dimension is embedded
  - distinguished columns
  - blue depicting mechanized tasks
    - manufacturing equipment architecture
  - green human implemented tasks
    - human and organizational architecture
  - yellow depicting the automated tasks
    - information systems architecture

04:15 7 – GERA

- 8 phase lifecycle in 3 dimensions
  - slices of architecture (sound familiar?)
  - Preliminary & Detailed design
- a merging of PERA and CIMOSA (not shown)
- Instantiation dimension
  - reference architecture
    - generic constructs
    - partial models
    - particular models of an enterprise
- 4 views
  - Function, Information, Organization, Resource
  - necessary and sufficient for the manufacturing domain

05:15 8 – ISO/DIS 19439

- harmonization
  - ISO 15704 (GERA)
  - CEN ENV 40 003 European pre-standard
- 3 dimensions
  - model phase
  - modeling view
  - genericity
- note missing phase in reference catalog
- only particular models actually operate
- 1 of the 3 archetypes discussed

05:45 9 – Zachman

- our proto-typical framework
- early motivation for framework formalization
- note focus our attention
  - on rows distinguished as roles
    - owner, designer, builder
    - characterize human quality of an enterprise
- interrogatives are the considerations those humans manage
- 2nd of 3 archetypes discussed

06:15 10 – C4ISR V2.0

- C4ISR
  - no single graphic to depict its architectural organization of multiple dimensions
- framework specification now in use by largest single enterprise in the world
- became its own architectural metaphor
- figure depicts strong sense of inter-relationships among perspectives on the enterprise
- 3rd of 3 archetypes discussed

07:00 11 – Modeling principles

- move on to Foundation
- just say something about middle two
- model structure, as evidenced by the samples,
  - lot of variety
  - two structures dominate
- ordinant (often called a grid)
  - structural elements
    - few well defined classifications
    - ordered or unordered coordinate positions
    - like a Zachman role or interrogative
- decomposition (often called tree)
  - structural elements
    - result from addition of detail
      - part – subpart – component – element breakdown
  - structural form
    - hierarchical
    - other directed graph
- distinguish scale dimensions
  - concept
    - abstract to concrete
  - scope
    - general to special
  - detail
    - coarse to fine

- example – an ER model (with all attributes, relationships, constraints, etc.)
  - both abstract and finely detailed
  - furthermore
    - specific - it models one enterprise
    - generic - it models an entire industry segment

08:00 12 – Framework principles

- not policy,
  - does reflect an attitude concerning architecture structure
- John provided some critical insight
  - regarding ways to formalize frameworks
- interconnections
  - explicit and meaningful
  - don't want semantics revealed only by navigation
- important to keep names, symbols, labels, etc., in the proper structural context
  - e. g., row vs. decomposition
- an enterprise is a system with a purpose
- framework is a purposeful system representation
- ascribe purpose, e.g., Zachman role, to dimension
  - tells us about connections
    - within and
    - between dimensions
- e.g., - in an ordered purposive dimension
  - all things of a coordinate position are relevant to its successor
- recursion always necessary structural mechanism
- iteration is a useful process mechanism
- some argue view generation is reason for framework modeling
- it should be possible to project same view from 2 frameworks with different purposive dimensions

10:00 13 – Meta-meta model

- structurally
  - 2 basic dimensional characteristics
  - recursion
- connections
  - explicit
  - require trace ability through orderings
    - i.e., preserve ordering
- view mechanisms
  - support more than fixed views
  - must respond to “need to know” situations

11:30 14 – Formal model

- recall principles about
  - modeling medium trade offs
  - artifacts are used by people
- unfortunately, mathematical precision can lose meaning for many
- formalized with relatively little mathematics – it is all here on one slide
- this model concerns
  - structure and
  - connections
- constraints and views complicate the formalism considerably

12:00 15 – Entities in time

- new distinction for most of you
- arises from ontological considerations
  - of things in the enterprise
  - ways we articulate their distinction
- sometimes referred to as
  - 3D and 4D representations or
  - snap and span distinctions
- 3 pairs of statements about the nature of
  - continuants
    - wholly present - all of their parts, past, present, and future
    - potentially incompatible properties at different times
  - occurrents
    - never all together - each part is fixed in time and cannot change
    - parts don't have temporal identify
- consider that anatomy is continuant while physiology is occurrent
- not an easy distinction to comprehend
- useful in considering framework structure and use – as we hope to show you
- use distinction at the meta-level of a framework and not at the level of model instances

14:00 16 – Critical aspects of Zachman

- role dimension coordinate positions
  - owner, designer, builder
  - ordered by dependency relationships
- interrogatives potentially related to each other
- John's repository through product slide of four nesting frameworks is a strong testament for the Framework's recursive properties
- simple model composition
  - attractive
  - but difficult to achieve in practice
    - we tend to build views first rather than last
- and lastly, every role all of the time
- artifact timing is in the when column and not in the role dimension

15:00 17 – ISO/DIS 19439 History

- genesis in European computer integrated manufacturing
- growing to international effort in the 1990's
  - resulting in ISO 15704
- I became involved through ISO revision of European pre-standard 40 003 to comply with 15704 and extend the reach of standardization
- should complete adoption in mid-2003
- note - scope with
  - computer-enactable models
  - model-based operation, monitoring and control
  - i.e., model based automation

16:00 **17a – ISO/DIS 19439 graphic depiction**

18 - ISO/DIS 19439 Model dimension

- I'll use the graphic depiction – you follow handout
- 1st is Model- the purposive ordinant ordered dimension of lifecycle phases
- purpose is development process
  - artifacts are successively created
  - during lifecycle of enterprise
- meaning of enterprise tends toward
  - project or undertaking
  - rather than entire business organization
  - systematic purposeful activity fits well
- begin by identifying a domain,
  - boundary,
  - objectives,
  - basic functionality and
  - capabilities
  - in end-user terms
- then elaborate the domain with
  - business concepts to enable objectives,
    - things like
      - mission,
      - vision,
      - strategies,
      - operations,
      - policies,

  - necessary to achieve functionality and capabilities
  - still very end-user oriented
- follow with definitions of
  - business processes,
  - enterprise activities, and
  - inputs and outputs required
  - enterprise engineers dominate development
- satisfy requirements by specifying
  - detailed manner in which
  - operations are performed including
    - tasks,
    - information, and
    - resources
  - together with management and control functions
- build to the design specification
  - validate and verify
  - then release to production operation
- monitor and control operation execution
- and finally
  - redesign, recycle, preserve, transfer, disband, disassemble, or
  - otherwise dispose of the operational system at the end of its useful life
- note - Model phase arrow has two heads
  - reflects iteration as artifacts are resolved

17:30 19 - ISO/DIS 19439 View dimension

- view dimension as unordered and ordinant
  - unordered
    - dependencies between view artifacts abound
    - even though expected development pattern
      - from Function through
      - Information and Resource
      - to Organization
- four views considered necessary and sufficient by the manufacturing user community involved in this standard's promulgation
- e.g., a projection from the function view of the management and control system is precisely the functional model of the enterprise domain's decision system

18:30 20 - ISO/DIS 19439 Genericity dimension

- 3rd dimension is ordinate known as Genericity
- to left is the generic level
  - primitive constructs,
  - encoded as templates,
  - primitives of enterprise models
- in middle are partial models
  - e.g., logistic services and schedulers,
  - formed from generic constructs
- generic and partial
  - termed the reference catalog
  - have no operational phase
    - incomplete dimension
    - operations are discontinuous
  - reference catalog embodies the “standards” provided by ISO/DIS 19439 compliance
- on right models developed for a particular enterprise
  - including those that are operational
- generic and partial levels have wide detail range
  - from programming language primitives
  - through an unconfigured SAP installation
- expect a well defined set of generic constructs suitable for the manufacturing and process control sectors will emerge
- initially, partial models will be extracted and reused from particular models built from those generic constructs

return to handout slide sequence

20:00 21 - ISO/DIS 19439 & Recursion

- two examples of recursion with 19439
- top - an operational enterprise A uses the artifacts of its domain to create a new enterprise B,
  - e. g., business A builds factory B
- note
  - domain containment relationship
  - A contributes to B only through the Implementation phase
  - B can create another enterprise model instance from its operational phase
- might also be the case
  - B enterprise uses the A domain and
  - adds functionality
  - to enable a different operational phase
- bottom - domain of A is augmented
  - by reference catalog artifacts
  - to achieve new enterprise C functionality or capability

22:00 22 - ISO/DIS 19439 Life History

cover bottom of slide

- life history
  - GERAM concept carried into 15704
  - thus relevant to 19439
- consider the time ordered creation of artifacts through the lifecycle
- note
  - some phase overlap is expected
  - trend is down and to the right with time
  - operational phase is of arbitrary duration
  - decommission is included for completeness
  - use a vertical bar to represent the entire lifecycle
    - stacking the artifacts
    - rather than spreading them in time

uncover bottom of slide

- using singular lifecycle representations
  - depict a life history as linked lifecycles
    - each bar being a point-in-time solution relative to the others
  - remember only operation phase links forward to new enterprise lifecycles

23:30 23 – Life history example

- example from the Globemen project
  - 3 enterprises are shown
    - network - collection of international companies
    - virtual enterprise - means to pool capabilities
    - products - the resulting goods and services
  - time scale goes from left to right
  - lifecycle phases are taken from GERA
- points 1 through 3a concern
  - network management and control setup
- 4 relates to several projects
  - prepare reference models and tools
    - for virtual enterprise use
    - small triangles represent those artifacts
- at 5 network begins operation
- 6 a customer identifies product need
  - initiates the virtual enterprise projects of 7 and 8
  - one of which produces a new model or tool artifact
- operational virtual enterprise
  - creates a new quotation, 9 thru 10, and
  - then shuts down at 11
- accepted quotation starts up virtual enterprise at 12
  - setup the new product at 14 based upon quotation
  - shuts down at 15
- the network does not last forever and terminates at 16
- pay particular attention to
  - small triangle artifacts and

- point-in-time delineation

26:00 24 – C4ISR History

- moving to C4ISR
- efforts by US Dept. of Defense
  - to enhance integration and interoperability
  - throughout world wide defense operations
- present the 1998 version
  - ongoing effort with new versions in draft
  - growing number of practitioners
- presentation is different
  - less concern for content
  - more concern for structural formalization

27:00 **25a – C4ISR Architecture View graphic**

25 – C4ISR View dimension

- architectural views
  - principle organizational dimension of C4ISR
  - although not purposive
- Operational elements consist of
  - functionality and information flows necessary to prepare for and engage an adversary
    - tasks, activities, mission scope, doctrine
  - like other views
    - this is high-level vantage point
    - resolution limited to preliminary design detail
- System elements consist of
  - resources and capability required to support preparatory activities and engagement
  - System view links
    - physical resources to operational requirements
    - use technical specifications
  - highly dependent upon available technology
  - more detail than related operational elements
- Technical view consists of rules for
  - arrangement, interaction, and interdependence of
  - system components
  - presented as profiles of
    - standards, conventions, rules and criteria
    - govern
      - services, interfaces, and relationships for

- particular systems
- relate to particular operations

30:00 **26a – C4ISR Guidance graphic**

26 – C4ISR Guidance dimension

- articulates process for building C4ISR artifacts
- given the ordinate coordinates distinct labels
  - to make the dimension more obvious and
  - convenient to discuss
- C4ISR is devoted to the creation of suitable artifacts
  - directive regarding the construction is purposive
- familiar steps,
  - like ISO/DIS 19439
  - conclusion does not result in an operational state
  - result enables
    - further analysis and
    - decision-making
    - corresponding to specific architectural focus
- critical aspects of creating C4ISR artifact products
  - determining scope for the level of detail and
  - characterizing its extent are
- design in the C4ISR context
  - primarily a selection activity
    - among the established product proto-types
    - using available reference resources
- expected to validate products prior to deployment
  - simulations and
  - trial runs

32:00 **27a – C4ISR Integration graphic**

27 – C4ISR Integration dimension

- complex dimension
  - organization's interactive perspectives are unique
  - conflict resolution among architectures must occur without an assured common purpose for particular representations
  - captures the C4ISR purpose
    - integration across organizational structures
    - sustain global warfighter operations & support
- similar C4ISR products enhance integration
- recognizable hierarchical ordering
  - defense structure
  - geographic dispersion
  - embedded decomposition in organization – echelon coordinates

33:30 **28a – C4ISR Universal Reference graphic**

28 – C4ISR Building Block dimension

- most of C4ISR document devoted to elements of unordered dimension
- one coordinate holds Universal Reference Resources
  - partitioned across the views
  - support product generation (as shown here)
  - some applicable to all views
  - others focused on particular views
- architecture expressed in form of models, i.e. products
  - essential products
    - used for high-level comparisons and
    - budget decisions
    - required to articulate a view
  - supporting products
    - specific intentions or characterizations,
    - included as needed
- additional products not previously defined in C4ISR
  - as needed to complete an architectural articulation
- important aspect of products
  - interrelationship between the product elements
  - provides means for accountability

35:30 29 – C4ISR & Recursion

- depicted here is a Universal Reference Resource providing content for three levels of force integration to produce an integrated descriptive architecture
- at each level the framework mechanism is present
- integration is enhanced by utilizing the common framework products and guidance

37:00 30 – Archetype summary

- 3 archetypes now described
- 9 dimensions describing enterprise artifact arrangement
- Zachman
  - purposive ordered ordinate role with coordinates of context, owner, designed, builder, out-of-context
  - unordered ordinate interrogative with coordinates of what, how, where, who, when, why
- ISO/DIS 19439
  - purposive ordered ordinate model with coordinates of domain, concepts, requirements, design, implementation, operation, decommission
  - unordered ordinate view with coordinates of function, information, resource, organization
  - ordered ordinate genericity with coordinates of generic, partial, particular
- C4ISR
  - unordered ordinate view with coordinates of operational, system, technical
  - purposive ordered ordinate guidance with coordinates of focus, scope, characterize, determine, build, use
  - purposive ordered ordinate integration with coordinates of multi-multi, multi-single, single-multi, single-single

    - unordered ordinate building block with coordinates of Universal Reference Resource, essential, supporting, additional
- note - dimensions of C4ISR are not as crisp as those of Zachman and ISO/DIS 19439

38:00 31 – Proto-type models

- various model descriptions from Zachman
  - interrogative
  - cell
  - another dimension emerges
    - corresponds to similar dimension in others
- each archetypes has two levels of proto-type models
- toward general end of the model scope scale
  - Zachman interrogative models
  - ISO/DIS 19439 constructs
  - C4ISR Universal Reference Resources
  - most general models are
    - differing complexity and
    - conceptual origin
- center of scope scale
  - Zachman cell models
  - ISO/DIS 19439 partial models
  - C4ISR product models
  - more similar than their generalized counterparts
  - in some cases have the same labels attached
  - because of similarity, at this coordinate observers attempt to map one framework's content to that of another

39:30 32 – Formal properties

- evaluate w.r.t. 4 aspects of formal meta - meta model
  - structure
    - observe Zachman is closed under recursive decomposition/composition
      - composing Zachman models yield another Zachman model
      - yields a high evaluation
    - closure greatly simplifies formal treatment
    - recursion for ISO/DIS 19439 is not closed
      - operations on frames do not necessarily yield frames
      - because of way operations are expressed
    - C4ISR has no explicit recursive structure
      - recursion evident in integration dimension
  - connections
    - supported by elaboration along purposive dimensions for each archetype
    - elevated C4ISR because
      - explicit effort to identify connections between products at the structural level
  - constraints
    - none address constraints as a structural aspect
    - each recognizes importance of expressiveness within models to achieve consistency and completeness

- much effort remains to adequately express constraints within a framework

- views
  - ISO/DIS 19439 and C4ISR offer
    - fixed views of the enterprise
    - allude to mechanisms for other views
  - fixed views may not actually support “need to know” capability
  - Zachman’s interrogatives are minimalist views
    - lack mechanisms for projecting views
    - need more utility to support user artifacts

42:00 33 – Detail elaboration

- where's the book John?
- ISO/DIS 19439
  - companion standard - identified as 19440
    - describes set of constructs from which the partial and particular models of 19439 are to be built
    - should go for initial DIS ballot in early 2003
  - also, the EU has funded a Universal Enterprise Modeling Language project
    - focused on the standardization of a new language for building enterprise models
    - began in early 2002 with targets for 2004
  - ongoing efforts to identify and catalog partial models from industrial operations
  - expectation models will become enactable and serve to operate the enterprise
- C4ISR standard detail
  - in products and
  - supporting Universal Reference Resources
  - problem has been the proliferation of such detail
    - made integration more difficult
  - C4ISR objective is to standardize the production of model detail and interaction
    - level of detail is limited
      - preliminary design necessary to support further analysis

43:30 34 – Purposive dimension

- recall slide about continuants and occurrents
  - apply distinction to purposive dimension
- Zachman role dimension is continuant
  - ordering is based upon an idealized dependency
  - rather than sequence terminating at a point-in-time
  - always wholly present
  - has all of its parts
    - explicit
    - implicit
  - changes in time as enterprise evolves
  - characteristics make such a highly suitable for
    - scenario analysis
      - since expression is complete
      - but perhaps not consistent
- by contrast, ISO/DIS 19439 model phase is occurrent
  - life cycle begins
  - accumulates different parts
  - operates in time with those parts
  - terminates
  - realizes operations of the enterprise
  - to change operation
    - begin a new life cycle
    - re-use as many parts as possible
- C4ISR has two purposive dimensions
  - occurrent guidance dimension
    - build operational, system, and technical models

- continuant Integration dimension related to
  - global deployment and
  - support
- one consequence of multi-purpose framework is eventual conflict in use as the now elusive integration becomes more dominate in application
- an entity, like a framework meta-model, can not be both continuant and occurrent
- at this point-in-time the building of product artifacts to C4ISR specifications is the purpose for its use
- as purpose shifts to integration dimension, either
  - occurrent dimension and related aspects will
    - loose utility or
    - will be distinguished as a separate entity – we suspect the latter

45:00 34a – Different life history

cover bottom of slide

- recall lifecycle of ISO/DIS 19439 framework
  - artifacts create an operational solution
  - until decommission
  - a single vertical line for each such occurrence
  - looks sort of like a silo!

uncover bottom of slide

- now visualize a Zachman Framework in time as artifacts are created
  - some might argue that we've just superimposed many occurrent framework instances and in some sense that is indeed the case
  - but more going on than just that overlay and intertwining of artifact sequences
  - new artifacts are added without regard to "phase" ordering as the enterprise evolves
  - the input context becomes richer and the output context becomes denser
  - notice to the right that a frequency distribution of artifacts reveals the pyramid we saw early on
- if ISO/DIS 19439 phase artifacts yield a lifecycle, then Zachman role artifacts yield a never-ending saga

47:00 35 – Taking a snapshot

- now examine possible interaction between frameworks
- on left Z is a Zachman Framework
  - nested frames depicted
  - use meta-meta model concepts
- on right are 2 ISO/DIS 19439 frameworks
- the function T takes continuant frames of Z into phases (and views) of the occurrent framework P
  - no fixed correspondence between the ordering on the role of Z and the phase of P
    - <Z, R2, I1> and <Z, R1, I2> both go to <P1, R>
    - for example
      - designers requirement for active monitoring of stock feed rate results in monitoring capability requirement
      - equity interest in minimal product cost yields a minimum staffing requirement
    - also <Z, R1, I2> goes to <P1, R> while <Z, R2, I2> goes to its predecessor <P1, C>
  - input context of Z, ICZ, contains the domain of both P1 and P2 in this example
  - note equivalence relation when Z has all of that excruciating detail available

50:00 36 – And now the other way

- define a function T-1 in the other direction
  - artifacts created during the model phases of ISO-DIS 19439
  - inserted into a Zachman Framework
  - function may modify the order of placement after the lifecycle phase dependency is stripped
  - expect ordering is maintained most of the time
    - dependency imposed by lifecycle sequence is similar to dependency imposed by roles
    - simply because roles are positively correlated to lifecycle phases
    - but - correlation is not causation
  - note context containment of domain as before
  - however, in this case, equivalence is not possible since Z is much more elaborate than either P1 or P2
  - union of all T-1 for Z
    - may recreate the structure
    - may not recreate all of connections and constraints

52:00 37 – More about T and T-1

cover bottom of slide

- T and T-1 are not simply a function and its inverse
- T imposes partial temporal ordering on components of Z placed into P
  - at least adds the phase coordinate
  - may compose models into view elements
- but going from P to Z involves
  - more than simply removing phase coordinate label
  - when [P1] or [P2] are not primitive models, dependency relationships must be examined
    - to select an appropriate role coordinate
    - to select an appropriate interrogative, complex view must be
      - partitioned or
      - decomposed

uncover bottom of slide

- a constraint we impose on T taking Z to P is
  - any equivalence among the components of Z must also exist among the same components of P
  - this is a weak constraint since equivalent components are uncommon

- it does address an issue regarding the extent of a component that is transformed
  - since an continuant frame is only whole, its extent must go along as well
  - sub-structure issue offers many opportunities for formalization efforts

54:00 38 – C4ISR as composite

- already alluded to the correspondence between
  - ISO/DIS 19439 Model phase dimension and
  - the C4ISR Guidance dimension
  - addition of an explicit decommission phase would probably benefit us all
- Dr. Katie Sowell with MITRE has examined the correspondence between C4ISR and Zachman as well as other frameworks
  - examination focused on artifact contents
  - not focused on properties of frameworks
  - look at a portion of her work and then discuss framework property correspondence

55:00 38a – Zachman/C4ISR mapping

- recall that this is a T-1 example
  - first notice critical C4ISR products do not correspond to entire Zachman Framework
    - most notably motivating why is missing
    - this observation is consistent with our containment expectation
  - second statement about C4ISR Technical View and "rules not explicit in Zachman" indicates difficulty of mapping complex models into simple models
    - rules abound throughout a Zachman Framework
      - are very explicit in the why column
      - but then C4ISR does not address "why"
  - again pointing to the problem of decomposing complex models into simple model representations
    - 19 C4ISR product bubbles actually represent only 13 products with 1 bubble of multiple products
    - C4ISR products often are depicted as overlapping two or more Zachman cells
  - note that the C4ISR views are distributed across interrogatives – except why of course
- in all not a very satisfying correspondence is shown

56:00 38b – Other C4ISR mapping

- top is C4ISR mapped to the Treasury Enterprise Architecture Framework
  - better fit because
    - TEAF views are same as ISO/DIS 19439 views
    - complex like C4ISR views
  - note C4ISR products more spread across row roles
    - similar to Zachman roles
    - e.g., “node connectivity” has three partitions
      - conceptual, logical, physical
      - corresponding to owner, designed, builder
- bottom has
  - Zachman role rows
  - Federal Enterprise Architecture Framework views
    - allusion to Zachman interrogatives
    - actually complex views
    - results in better fit as above
  - shows some pilot model intersections
- all three examples struggle to map artifacts of
  - occurrent framework dimension, namely C4ISR Guidance, into
  - continuant framework dimension – the Zachman role
- exorcism of temporal dependency and explication of composable primitive models is a very difficult functional transformation rather than a straight-forward mapping

- will not be done on a broad scale

57:00 39 – A final observation

- two approaches to managing change
- first
  - use the Zachman Framework to document P for customer C's widget W
    - verify that P actually is producing W for C just to make sure Z is current
  - modify Z for the new process – M maps Z to Z'
  - create the new occurrent framework P' for the new operations to build W for C
- second,
  - take the verified framework P
  - change it to realize new P' operations for making the widgets W for C
  - then document the new P in Z to get Z'
- of course another approach is to
  - just start on P' from scratch – you know –
    - identify the domain
    - define appropriate concepts
    - establish requirements
    - specify the design
    - describe the implementation
    - operate the domain
    - and eventually decommission
  - I have not shown that approach since it is so familiar to all of us

- as a exercise for you to ponder: give two reasons for the 2nd approach resulting in failure
- in summary: to manage change, begin with a Zachman Framework in excruciating detail
- with those words of wisdom, I expect it is time to eat!