

Passing the Torch

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Abstract

Communicating complex design ideas is difficult enough when the details are well understood. Communicating a plan from a concept team to a detail team in just enough detail to make the Plan's intention very clear without handicapping the follow-on team's ability to maximize its own creativity is a delicate process. The "not-invented-here" syndrome must be addressed.

System Elements are vehicles for transferring component ideas of a concept from a concept team to a design team. Careful attention in the System Element format to kinds and forms of information help to clarify ideas, defeat psychological problems of having to share development, and create a basis for a qualitative knowledge base connecting solutions with functions and problems.

Complexity is to be expected. To deal with it, a Communication Structure is constructed to show which System Elements are closely associated and how the entire Plan of many System Elements can be seen as a hierarchical organization of functional layers.

In *First Things First*, I made a case for partitioning the front end of the development process into a concept planning phase and a detail design phase. In effect, this separates the "what" from the "how" in the process of creating and giving form to an idea.

The value of this is multifold:

- It encourages wider exploration—finding the "right" mountain to climb before rushing to the peak.
- It enables alternative concepts to be investigated at low cost before major investment commitments have to be made and while concepts are still malleable.
- It reduces the likelihood of costly revisions forced by insights realized late in the development process.
- It opens the door to broadened strategic planning employing multiple, low-cost concept studies overlapping or in parallel (see the description of Escalator Delivery in *Reforming the Development Process*).
- If the planning teams are formed with members from across the organization, it shares the development process broadly, building organization-wide commitment and the ability to continue to contribute.

With a lot of good, comes a little bad. To achieve these benefits, an important challenge must be met: high levels of inventiveness and involvement need to be sustained across transfers between teams. In a society where competitiveness is highly regarded, the "not invented here" syndrome is a potential killer when serial teams are involved.

The syndrome takes two forms in serial team transfer:

The first affects the concept team. Its members see the subtleties and richness of their carefully thought out system lost in the abstraction required of a specification. The proud parents are reluctant to release the baby without acknowledgment and respect for all that they know about it.

The second affects the design team. In the pure sense of "not invented here", its members are certain they could do a better job of defining the concept (as well as doing the design). Accordingly, they resist the specifications and invest valuable creative time in putting forward alternative ideas validating a different approach.

The result is usually a compromise with all the suboptimizations that frequently accompany political solutions. With the competitiveness of organizational politics, the actual moves are not always visible, but the end product is usually less than optimal, reflecting political wins and losses among players who are competing—when cooperating would further both their and the organization's objectives.

The problem is how to pass the torch from one team to another without compromising either team's contributions and without losing the potential additional contributions possible with continued involved cooperation.

The Plan

The product of planning is a plan. Literature on business plans, organizational plans and various kinds of strategic, marketing, financial and other plans is plentiful, so those wheels for the most part need not be reinvented. For product development, though, there are a few things to note. Information on three important topics should be present early in the process: concept, finance and implementation. The financial component deals with where funding will come from and how it will be spent. The implementation component develops thinking for internal and external operations, product introduction, marketing and sales. Both of these components are critical, but the component of importance in this discussion is concept. This should be the product of the conceptual phase of the development process, prepared for handoff to the design team, but it should also be the *first* element of the overall plan. It is essential for approval of continued development—critical for the formation of the financial and implementation plans. *And*, it can have positive impact on the not-invented-here syndrome!

Surprisingly, until recently, the concept component has received relatively little attention. Most probably, this was because business competition was less about elements of design than issues of producing, marketing, distributing and selling. That has changed. Decision makers today want to know more about what the concept is, what its properties and features are, how it functions as a system, and how it will perform for its users. Competition has turned global and the voices of the users are now being heard.

Today, a concept worth its salt will in all likelihood be complex (but not complicated) rather than simple, will have multiple components that work together systemically, will be adaptive, and will offer values of more than one kind—social, economic, functional, aesthetic. It will need detailed, thoughtfully organized description for full understanding.

Elements of a Conceptual Plan

Figures 1, 2 and 3 show one of 61 elements of a plan for an award-winning Future Living housing system developed in 2009 at the Institute of Design. Its structure illustrates the areas of focus

necessary in transferring complex concepts. Seven sections deal with organizational and retrieval issues typically of concern for knowledge bases: Originator, Contributors, Source, Superset Elements, Subset Elements, Fulfilled Functions and Associated Design Factors. Most of these are self explanatory and, in any case, are not critical to this discussion. Functions are discussed in *Covering User Needs*, Design Factors in *Insight and Ideas*.

The remaining five sections *are* critical. They are the channels that convey the concept. Used well, they transfer ideas at a level general enough to allow the design team creative freedom to explore detail options, yet specific enough to transmit strong guidance from the concept team in matters of direction. Figure 1, the first page of the System Element, contains the first three of these sections.

Description has the most familiar role of the three. Its job is simply to capture the essence of the element in brief—to encapsulate the idea at a level of generality appropriate for overall understanding.

Properties and Features, the next sections, are the "specification". They are similar to the Properties and Features used in Solution Element documents (see *Capturing Ideas*), but should be worked over again carefully to be sure all the properties intended by the concept team to be in the design are covered and all of the features the design is expected to perform are listed. These will be the guidelines for the design team's efforts. They should be treated as specifications with the expectation that their goals will be achieved, but not with the constrictive insistence accorded legal specifications prepared for contracts. Their role is to shine a light, not enforce strict compliance.

To supplement them and fill in the uncertainty that always surrounds abstracted specifications, two more sections, Discussion and Scenario, are included. These sections are very important to the torch passing process. Both are intentionally verbose—in contradiction to Description, Properties and Features. Both exist to allow the concept team to explain in as much detail as it wishes what the ideas are, what forms they might take, and how they would work in a real situation. These sections should be open-ended, mining the ideas the concept team has speculated upon during exploration. In effect, they should be a deliberate message to the

System Element		Status: <input type="checkbox"/> Existing <input type="checkbox"/> Modified <input checked="" type="checkbox"/> Speculative	Title: <i>Short title (one to three words):</i> Guardian System	Element identifier: 20/F12
Originator <i>Original producer (sponsor) of this document</i>	Helen Tong	Superset Element/s: <i>Higher level entity this element belongs to:</i>	Related Elements: <i>Other system elements closely associated with this element in describing the system:</i>	
Contributors <i>Additions and/or changes</i>	13 Nov., 2009 Tanushree Bhat 13 Nov., 2009 Hsin-Cheng Lin 13 Nov., 2009 Nikhil Mathew 15 Nov., 2009 Owen Schoppe 16 Nov., 2009 Jessica Striebich 8 Dec., 2009 Sally Wong	None	Nanosensor Array Adaptive Surfaces Mobility Assistant Nexus Health Assistant All Weather Protection System Neighborhood Watch Plus Interactive Surface Secured Storage Black Box Safe Pod	
Source (if Existing or Modified): <i>Name of producer and product:</i>	N.A. (Speculative)	Subset Elements: <i>Lower level components of this element:</i>		
		None		
Description: <i>Brief description. Should deal with characteristics at a high level; details can be expressed as bullets in the Properties section.</i>				
The center of the home's security system. Utilizes the Nanosensor Array to passively monitor the external and internal home environments and responds as necessary. Communicates to those within the house as well as external parties when applicable.				
Properties — what it must be: <i>Short "bullet" statements highlighting specific characteristics that should be possessed by the system element. Should extend the description above by isolating special components and qualities to be designed. Distinguished from Features by the emphasis on "what it must be" rather than "what it must do". Use noun phrase format : <optional modifier/s> <noun>.</i>				
<ul style="list-style-type: none"> • Embedded sensors inside and outside the home • Materials able to modify their own potentially harmful qualities dynamically • Visualization of internal and external activities • Biometrics, passwords and permission based access • Visible and audible alarms • Communication capability between home and facilities outside the home • Wireless connections to weather services 				
Features — what it must do: <i>Short "bullet" statements expressing what the system element must do. Should bring out the functions performed by the element (with direct application for product description in manuals and advertising). Distinguished from Properties by the emphasis on "what it must do" rather than "what it must be". If feature is tied to a specific property, list the property at the end. Use verb phrase format: <verb> <optional modifier> <object> <descriptive phrase> <(optional specific property)></i>				
<ul style="list-style-type: none"> • Link to other intelligent elements of the home (inventory control, general information storage, energy monitoring, etc.) • Monitor internal activity within the home • Detect abnormal activity inside and outside the home • Evaluate present and impending weather conditions • Communicate to remote mobile devices • Communicate with other Guardian Systems in the neighborhood • Provide visible and audible guidance and alarms to inhabitants • Communicate with external resources when there is an emergency • Provide information to responding officials; replay recorded data and records of incidents 				
Version 5		Date: 8 December, 2009	Date of first version: 2 November, 2009	
				<small>Form: 2/22/2008</small>

Figure 1 **Description, Properties and Features** provide a short, direct description of a **System Element** and equally direct statements of what it is expected to be and do.

design team: "See what we have seen and, if you do not find something better, consider developing these ideas further".

Discussion and Scenario parallel Properties and Features in their focus. Discussion concentrates on the components: what they must be and what characteristics they must have. Components

may be any of physical parts, subsystems, services, processes, policies, activities, events, communications—whatever is necessary to fulfill the functions the System Element addresses. Scenario puts the System Element in motion, concentrating on how it works and how its users work with it. Treating the Scenario as a story

System Element	Continuation page: 1	Title: <i>Short title (one to three words):</i> Guardian System	Element identifier 20/F12
<p>Fulfilled Functions</p> <p><i>Functions fulfilled by this System Element. Include titles, if practicable.</i></p> <p>47. Gather information about potential security threats 49. Create security protocols 50. Test security protocols 51. Refine security protocols 52. Incorporate user monitoring preferences 53. Conduct security surveillance 54. Analyze surveillance data 57. Detect security threat 59. Select appropriate security protocols 60. Coordinate security response 63. Evaluate effectiveness of security 94. Handle health emergencies 178. Detect anomalies in routine 182. Guide emergency response</p>		<p>Associated Design Factors</p> <p><i>Design Factors whose insights contribute to the ideas incorporated in this System Element. Include titles, if practicable.</i></p> <p>D31 Underestimation of Security Threats D32 Ineffective Evaluation of Emergency Protocols D37 Environmental Sensors Fail to Detect D45 Incident Is Not Initially Assessed Correctly D46 Wrong Protocol Selected D47 Lack of Appropriate Protocol D48 Insufficient Coordination D49 Insufficient Resources Available D50 Insufficient Training to Execute Responsibility D51 Response Is Ineffective D52 Effectiveness Is Incorrectly Evaluated D53 Failure to Incorporate Feedback D54 Restoration of Normalcy Is Not Feasible D57 Unforeseen Threats Emerge D157 Emergency Alert Systems Don't Help Enough D160 Non-intrusive Household Safety Features D173 When Inhabitants Live Alone and Have Health Emergencies, It Is Much More Difficult to Get Help</p>	
<p>Discussion</p> <p><i>Thorough presentation of ideas developed in the process of conceptualizing the System Element. This is the section where the team's version of the idea is fully explained. If follow-on teams (or others interested in using the idea) cannot develop a better concept with the properties and features required, they should be able to implement this idea directly. Illustrate when appropriate with drawings, diagrams and/or renderings.</i></p> <p>Houses today are generally unable to respond on their own to external or internal threats or safety problems. The Guardian System allows the home to become more autonomous, providing active assistance and freeing its residents from worry.</p> <p>The Guardian System is central to the home's security system. Utilizing the Nanosensor Array, it monitors the house and its inhabitants passively to ensure that everything is safe and secure. Interior components of the home are constructed of materials able to prevent or reduce harm to residents (e.g., Adaptive Surface floors that soften immediately upon impact to prevent injury from falls). Residents are cautioned about potential crises, and in the event of urgent or emergent situations that could be dangerous, are guided and instructed to prevent or contain the danger. Although the home is designed to be as self-reliant as possible, when external help is required, the system will reach out to the community—family, neighbors, police, firefighters, health services—to enable difficult situations to be handled expeditiously.</p> <p>General Interaction</p> <p>The Guardian System is accessible from any Interactive Surface in the home. Interacting directly with the Guardian System allows residents to stay informed about their environment and, thus, the safety and security of their home. Nexus cloud computing channels data from any source to a variety of computer graphic presentations that visualize the house's structural condition, maintenance status, exterior surveillance, weather effects, and other aspects of interest.</p> <p>Remote Access</p> <p>People can become anxious when they are away from home, especially if they hear of conditions in their home neighborhood that might affect their family or property. Remote access to the Guardian System through the Mobility Assistant allows them to know actual conditions, enabling them to remain at ease knowing that their home is unharmed—or use the information to take action from a distance.</p> <p>Accessed through mobile communication devices, the Guardian System functions essentially as it does when accessed from within the home. Alerts, messages and status updates normally sent to output devices in the home are routed instead to remote devices with the traveling residents. Queries are handled normally except that the device sending queries and receiving answers is remote. As with other intelligent System Elements, preferences are entirely user controlled, and family members can use features, limit them or entirely forego them as they choose.</p>			

Figure 2 Discussion fills in details about characteristics the concept team thinks the System Element should have to achieve its intended effects.

teases out the actions that the concept team envisions, what the system does as its users engage it, what progressions of actions occur. In moving words or moving images, describing the system's use as an event adds another full dimension to understanding. Together, Discussion and Scenario provide static and dynamic conceptions.

Communicating Structure

If there are more than a few elements in a Plan, complexity raises its head again; the elements will have to be well organized for the overall system to be understood. This is quite the normal situation. Almost any development project

System Element	Continuation page:	2	Title: <i>Short title (one to three words):</i>	Guardian System	Element identifier 20/F12
	Discussion (continued)				
Emergencies					
When members of the family are at home and the Guardian System detects an external threat, it initiates a series of actions:					
<ul style="list-style-type: none"> • Communicate the nature of the threat <ul style="list-style-type: none"> – Flood, fire, earthquake, hurricane, etc. – Intruder, attempted breach of security, etc. – Health and injury problems • Communicate the home's physical condition and All Weather Protection System response • Communicate response procedures to residents <ul style="list-style-type: none"> – Attend to medical problems – Stay calm, initiate practiced procedures and await help – Move to the Safe Pod • Communicate with the community <ul style="list-style-type: none"> – Call for help from family, friends and/or neighbors – Call for help from authorities 					
Practice Mode					
The system includes a user-selected mode in which residents can simulate the experience of a weather disaster or other emergency. This ensures that they are knowledgeable about appropriate responses under a variety of circumstances and helps them to be prepared and calm during highly stressful events. The practice mode can draw on the full range of interior communication, education and entertainment media to produce highly realistic simulations. Assistance can also be obtained from the All Weather Protection System , the Health Assistant and Neighborhood Watch Plus .					
Scenario					
<i>Presentation of the concept dynamically. In a manner analogous to the presentation of Features as operational descriptions, the Scenario takes the reader through a real time exposition of its functions. Use present tense to enhance reality.</i>					
Jana is at work, a few miles away from home. Over the last few days, everyone at her office has been talking about the strong wind storms and extensive rainfall they have been experiencing. It is worrisome given the increase in the number of storms that have been passing through their region over the past few years.					
Meanwhile, Jana's son Jack and her mother Lauren are at home. Lauren has been living with her daughter ever since her husband passed away. Physically, she isn't doing so well, so it's nice for her to be in close proximity to family.					
Back at work, Jana's mobile computing device lights up and sounds an alert from the Guardian System . It tells Jana that her mother has fallen					
down. It goes on to tell her that it is now advising her son Jack on what to do to handle the situation. A few minutes later, it relays to Jana that the fall is worse than expected and that her mother may have broken her hip. It asks Jana if she'd like to call in a neighbor or contact the local hospital. Jana opts to do both. All the while, the Mobility Assistant through her device connects her audibly and visibly to her family at so she can communicate with them while she rushes home.					
As if things couldn't get worse, the Guardian System alerts Jana remotely and Jack and Lauren directly that one of their window walls on the second level is in danger of being blown out by the strong gusts of wind. It's a good thing she is already on her way home.					
Before Jana arrives, her neighbor Todd is already there and so are the paramedics from the local hospital. The paramedics were able to access a replay of Lauren's fall and can now relay it to the hospital to better inform the doctors' care. Lauren leaves with the paramedics while Jana selects some preventive All Weather Protection System measures from the Guardian System to strengthen bonding and prevent the window wall from being blown out in the storm.					
Several hours later, Lauren has returned home from the hospital with a support brace for her hip that, thankfully, is not broken. The wind is still whipping through the area, and the rain is not letting up. At least the window wall is still holding. Once the storm has passed, they can have it looked at by the housing company.					
The Guardian System continues to update the family on the weather. The storm has worsened, but they remain calm. They have run many simulated disaster drills, so they are familiar with the protocol that they might need to follow in case of an emergency.					
After another hour, the system informs them that weather conditions have reached a state where it may not be safe for them. It is best for them to retreat to their Safe Pod . The local power grid has gone down but the Guardian System lights the way to the Safe Pod . Its extra-strong construction within the home will provide ultimate protection from the elements.					
The family stays within the Safe Pod for a few hours and the storm finally passes. Even in the worst case—if the storm had become a tornado—the family's important papers and valuables would have been safe in the Secured Storage , and the Black Box would have provided useful information on any structural or functional failures that took place. That would greatly aid reconstruction.					

Figure 3 Scenario considers the System Element from an operational standpoint, describing in narrative form how the concept team envisions its performance in use.

an organization might contemplate today will be complex—not in itself undesirable. To be complicated, on the other hand, is not good, and to prevent that in passing the torch, an appropriate organizing principle must be found to make the plan understandable to the design team receiving it as its Charter.

Figure 4 shows a "Communication Structure" for the 61-element Plan. The System Elements shown in the bottom two layers (offset vertically to make the structure more compact) are in clusters according to which work most closely together. Higher level clusters simply continue the aggregation, using the same organizing principle

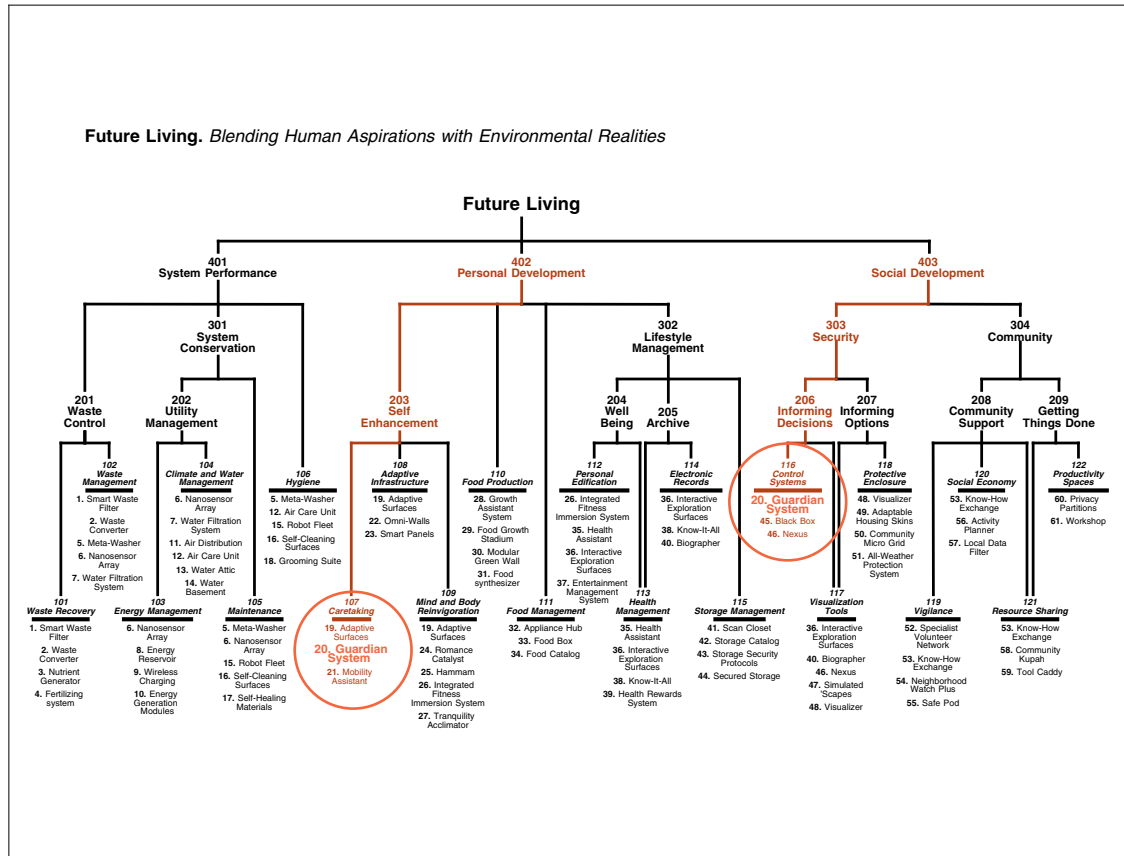


Figure 4 A Communication Structure helps to manage complexity when a conceptual plan contains a number of System Elements that need to be understood as a system.

that System Elements (and now, clusters) are linked or associated if they are strongly related in the performance of tasks.

A Communication Structure is a navigational aid for a conceptual Plan. Close relationships for groups of System Elements can be seen directly in the structure. For any individual System Element, its document lists its strong links to other Elements. Following these, just as following roads to different towns on a map, initiates an exploration of all of its associations. Titles given to clusters based on what their element members do help to map out the overall nature of the system, region by region. And, as towns can belong to more than one higher level organizational entity (e.g., townships, congressional districts, state legislative districts, etc.), System Elements can belong to more than one cluster. System Element 20 (circled), the Guardian System introduced in Figures 1-3, appears in two places in the structure (as do others) marking the structure as a semi-lattice, not a tree, a more flexible kind of structure well-suited to organizing ideas. The hierarchy is best for a birds-eye view, but the graph of all the System Elements and their links

can also be used as-is as the documents and hyper-links for a planning data base.

Knowledge Creation, Transfer and Maintenance

The complexity to be expected in modern products and product/systems only echoes what we are experiencing in life around us. It has become virtually impossible for individuals to work independently on projects of significance. We expect to work on teams, and we expect to have our fellow team members possess expertise different from our own so that together we can articulate the full range of expertise needed.

Increasingly, the tools that we use match the complexity of the problems we address. For development, the single most important part of the process to be improved has been the formulation, manipulation, organization, use and transmission of qualitative information. Available tools in the past did not provide the depth, consistency or capacity necessary for handling complex information, and did not define the basic forms for the

information necessary to build an information processing system capable of dealing with qualitative as well as quantitative information..

The System Element is an information package containing, referring to, and itself one of such information elements. As the form for transferring knowledge about elements of a plan, it demonstrates the kind of qualitative approach necessary to capture relevant background (Associated Design Factors), required functionality (Functions Fulfilled), the components of an idea (Properties and Discussion) and goals for what these components and the concept as a whole should do (Features and Scenario).

Beyond transfer of ideas, the System Element also supports tracking back and construction of a

qualitative knowledge base. For anyone interested, the bases for the ideas described in its Properties, Features, Discussion and Scenario can be tracked back to insights about function performance in Design Factors referenced in the Associated Design Factor section. Additional reasons for the qualities developed in the System Element can be inferred from the Functions it fulfills, listed in the Fulfilled Functions section. The answers to "why" questions stimulated by a System Element are available for the looking. All of this suggests creation and maintenance of a growing qualitative knowledge base built with contributions from a procession of advanced planning projects. Its value can only increase with time.