WHITEPAPER

ARNG-IMS-S
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SUBJECT: Proposal for the Design of a TARC Splash Page

1. Abstract. This document proposes the design of a TARC-wide ARNG splash page to reduce the cognitive, network, and computational loads required to browse the internet. The design is intended to improve the time-to-task (TTT) ratio, decrease reliance on search engines, and improve telework.

2. Background. A splash page, as defined by Wikipedia, is "a simple introductory webpage shown to a visitor before they proceed to the main page." When users within the Temple Army Readiness Center (TARC) access the DOD Information Network (DODIN) from a browser, the Army Knowledge Online (AKO) website automatically populates as a splash page and prompts users to use their Common Access Card to authenticate. If the user does not intend to use AKO, they must use their network resources to download the site, and computational resources to render the page, and cognitive abilities to actively evade the site. There is no means to change the homepage.

3. Initial Needfinding.

   a. Problem Statement. The current TARC splash page provides negative value to users, creates an unnecessary burden on resources, and adds additional authentication requirements which may numb users to proper cybersecurity practices.

   b. Environment. Human computer interaction (HCI) design roles are prevalent in both the private and public sectors. Client or customer-centric interfaces have become the normalized standard, despite the large quantity of legacy or outdated interfaces within DOD. Low-effort solutions for web-design (e.g. HTML, CSS) are still effective for HCI, but user engagement is often low due to their lack of flair, poor implementation, or site placement. Many States-level G-6s have successfully implemented customer-centric splash pages that increase organizational effectiveness. Some States, like North Carolina, have been so successful that their splash page populates in Google.

   c. User Attributes and Categorization. Users of the splash page can be grouped by their attributes, which include the following:

      (1) Browsers. Mozilla Firefox, Microsoft Internet Explorer, Microsoft Edge, Google Chrome, Apple Safari, and other mobile browsing solutions (GlobalStats, 2021).

      (2) Organizational Tenure. Based on the user's position type, their tenure at the TARC can vary drastically. Active Guard Reserve (AGR) and Civilians (CIV) typically have the longest tenure, while personnel assigned by contract, Active Duty Operational Support (ADOS), and One-Time Occasional Tour (OTOT) are only on-site for several years. Building a catalogue of bookmarks and URLs takes many months, and newer personnel are more likely to require public search engines or link repositories to find sites and contents related to their daily tasks.

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Position Type	Tenure
AGR / CIV	30+ years
Contractors	5 years
ADOS / OTOT	3 years

      (3) New Page Frequency. New page usage (e.g. new window, new tab) varies significantly per individual user, but for the purposes of this proposal, users will be divided into three groups: low consumers, medium consumers, and high consumers.

Consumer Type	New Pages per Day	AKO Network Consumption*
Low	0 – 24	0 – 12MB
Medium	25 – 99	12.5 – 49.5MB
High	100+	50MB+

* Values indicated are "per-user, per day"

      d. Intent. Regardless of browser, organizational tenure, or page usage, users should be able to access high-traffic DOD sites quickly using our splash page. The ARNG must create a splash page that is so fast and purposeful that the use of it becomes second nature to TARC employees. Success must be measured to continually adapt the page to the needs of our customers.

      e. Proposal for Design. ARNG-IMS-S proposes the creation of a splash page, comprised only of important links related to TARC or DOD. The page should be public-facing and not require CAC or credential login. Additionally, the file-size and resource requirements should be minimized to the smallest possible.

4. Humans as a Processor. The standard method of analyzing task complexity was developed by Don Norman in 1986, and it is called "cognitive engineering" (Norman, 1986 & 2013). The purpose of the process is to (1) "understand the fundamental principles behind human action and performance" and (2) "devise systems that are pleasant to use." By measuring the time needed to complete an action ("gulf of execution") and the time needed to know that the action was completed was completed ("gulf of evaluation"), we can objectively assess if a system was effectively engineered for human cognition (Norman, 2013).

      a. AKO Splash Page. In the "Human as a Processor" model below, the user's cognition is directly linked to touch (e.g. clicking, moving, and typing) and sight (e.g. reading and observing change in the interface). Although the keyboard and mouse provide immediate computer-based feedback (e.g. "click" sounds, spring-based counter-pressure), the latency of the AKO page creates a significant delay of task-based feedback. In total, users must execute and evaluate at least five tasks before they are able to open a public search engine or empty tab. Each of these tasks involves a computer latency of at least one second, and collectively, they represent almost 20 seconds of delay before the user can visit a different URL. In addition, the cognitive load of completing a CAC login is completely unnecessary to access the internet. Using the TARC virtual private network

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(VPN) connection, the gulf of execution is 20 seconds, and the gulf of evaluation can be as high as 30 seconds – an entire minute wasted just to open a URL.
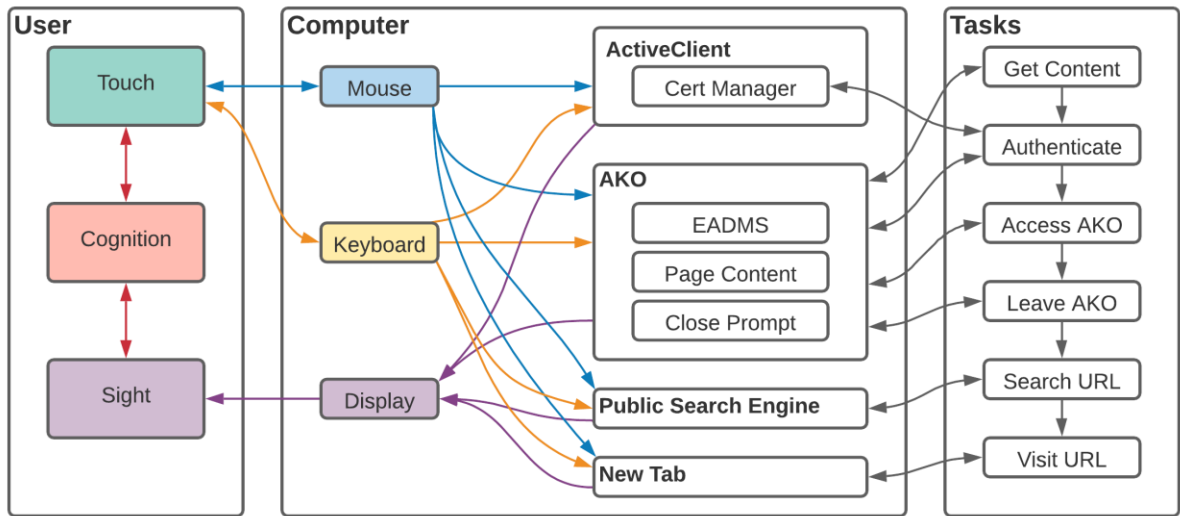

Figure 1 - Diagram of the Processor Model, as applied to the current AKO splash page

   b. User-Centric Splash Page. While the computer-based feedback is the same in the user-centric model, the number of tasks required of the user are reduced to two. Within two clicks, a user can visit a new page. Because of the presence of links on the page, the user may not even need to use the keyboard. Using this model, the user's cognitive load is reduced to a quarter of the load needed for the AKO splash page. The gulf of execution for this model is three seconds, the gulf of evaluation is up to seven seconds –one-fifth of the time AKO requires. Unlike the AKO model, the user-centric model's tasks all support the user's end goal of finding / visiting a URL.
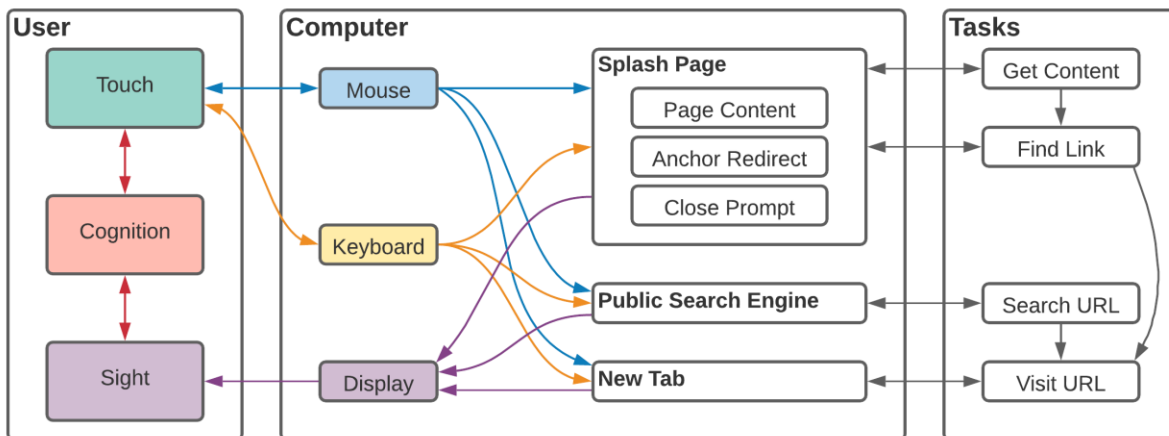

Figure 2 – Diagram of the Processor Model, as applied to our splash page design concept

5. Heuristic Evaluation. Our heuristic evaluation approach is based on Dr. David Joyner's "15 Design Principles and Heuristics." Joyner's model combines concepts from four other existing human computer interaction (HCI) design models (i.e. MacKenzie,

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Norman, Nielsen, Mace, Constantine, and Lockwood) to create heuristic categories for assessment. Using these categories, ARNG-IMS-S identified the essential elements for a successful ARNG splash page.

Category	Norman	Nielsen	Constantine & Lockwood	Mace
Discoverability	X	X	X	
Simplicity		X	X	X
Affordances	X			
Mapping	X	X		
Perceptibility	X	X		X
Consistency	X	X	X	
Flexibility		X		X
Equity				X
Ease				X
Comfort				X
Structure			X	
Constraints	X	X		
Tolerance		X	X	X
Feedback	X	X	X	
Documentation		X		

Joyner's categories as compared with the four standards for HCI design

   a. **Discoverability.** It should be the only home page for all browser types; a feature which is easily enforceable via Group Policy. Additionally, it should be favorited in the browser and clearly labeled "ARNG Splash Page" or "ARNG Splash Page". In the event that Joint Staff or States wish to build their own version of a Splash Page, the Group Policies related to their organization should be updated to accommodate the change.

   b. **Simplicity.** Simply a list of links. The intent is for this page to merely be a steppingstone for the user to complete their task. Announcements, notifications, and banners have no place on the splash page.

   c. **Affordances.** Links should be labeled by purpose, program, or software name – whichever is most recognizable.

   d. **Mapping.** Links are uniquely tailored to Army National Guard resources, some of which are not easily found via search engines. Links are grouped by similar attributes, then alphabetical order.

   e. **Perceptibility.** The link colors should indicate when a link has been clicked, and links should be obviously clickable.

   f. **Consistency.** The site should be ARNG branded, with all fonts being a standardized size.

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   g. Flexibility. The site should work, regardless of what browser type or size is being used.

   h. Equity. Users in a tactical or low-bandwidth environment should have equal access to the resources. The site should be designed to download quickly, with few (if any) graphics.

   i. Ease. The site should automatically populate, without the need for a CAC login or additional tab being open. Users should be funneled to this page, and they should trust it.

   j. Comfort. The site should not feel "busy". Content should be spaced appropriately, even if it requires scrolling on the page. Users should not have to scroll more than once to reach the bottom.

   k. Structure. The page should be designed in HTML5. Styling can be added via CSS, but the page must continue to function, even in the absence of styling. Each script (i.e. JavaScript) added to the page must provide a benefit to the customer, not the G-6, as each added will increase the load time and vulnerability of the page. The benefit must align with one of the 15 heuristic principles listed here. PHP should be avoided, as it creates an unnecessary burden for the hosting server.

   l. Constraints. The page becomes less valuable as more content is added to scroll through. The number of links to be added should be pre-determined. Directorates should be pre-allocated a specific number of links that they are able to dictate for the page.

   m. Tolerance. Each link should open in a new tab within their window, which will allow users to quickly close or ignore the new page if they made an incorrect selection. To prevent issues with cross site scripting, links should not include parameters for PHP or JavaScript functions/variables.

   n. Feedback. Link text should highlight when a user is hovering over it and change color when a user begins to click it. Clicking the link should automatically open the link in a new tab or redirect the user. The user should not have to wait on scripts to run or populate.

   o. Documentation. This concept, along with the site files, must be retained throughout the life of the splash page. The site will be changed hundreds of times over its lifecycle, and the initial intent of the page may be lost as the workforce changes.

6. Interface Design Requirements. These are the critical requirements for the splash page. Without even one of these requirements fulfilled, the splash page concept will fail.
- Important Links
- No CAC or Credential Login Required
- Public Facing
- Low Bandwidth Usage
- Low Resource Consumption

7. Interface Justification. As shown below, the user-centric splash page outperforms all-other solutions.

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Category	AKO	GKO	Google	Bing	Duck Duck Go	Splash Page
Discoverability	High	High	High	High	High	High
Simplicity	Low	Low	High	High	High	High
Affordances	Med	Med	Med*	Med*	Med*	High
Mapping	Med	Med	Low	Low	Low	High
Perceptibility	High	High	High	High	High	High
Consistency	High	Med	Med*	Med*	Med*	High
Flexibility	Low	Low	High	High	High	High
Equity	Med**	Low	High	High	High	High
Ease	Low	Low	High	High	High	High
Comfort	Med	Med	High	High	High	High
Structure	Low	Low	Med	Med	Med	High
Constraints	Med	Med	Low*	Low*	Low*	High
Tolerance	Low	Low	High	High	High	High
Feedback	Low	Low	Med	Med	Med	High
Documentation	Low	Low	Med***	Med***	Med***	High
Heuristic Score	**26**	**24**	**36**	**36**	**36**	**45**

"Low"=1 "Med"=2 "High"=3
* MIL Links are not always trusted, correct, or available
** Low Bandwidth option available
*** Intent of the page is meticulously managed by private industry

8. Evaluation Plan. As with all prototypes, the splash page must be continually evaluated and assessed to improve the user experience. ARNG-IMS-S has identified the following criteria, design, and biases related to evaluating the splash page.

   a. Evaluation Criteria. There are six total evaluation criteria for the splash page:

ID	Evaluation Criteria	Methods of Assessment
1	Are the links selected being used effectively?	Traffic Analysis (Link Click Count)
2	Does the loss of CAC and credential login create the desired effect?	User Feedback
3	Do the benefits of public-facing content outweigh the risks	Traffic Analysis (Threats)
4	Is the page size (kilobytes) small enough to load instantly?	Traffic Analysis & Resource Usage Analysis (Stress Testing)
5	Do the scripts on the page DIRECTLY improve the user's experience? *	User Feedback
6	Do the scripts on the page require additional computation to load?	Resource Usage Analysis

*The feature's benefit should be immediately apparent to the user. Scripts for metrics and analytics only benefit the user INDIRECTLY and should not be included in the Splash page.

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    b. Assessment Design. The assessment will require the following methodologies be implemented.

        (1) User Feedback. Obtain user perceptions using a survey. The link should be promiscuously placed on the splash page.

        (2) Traffic Analysis. The Operations Division should autonomously track the all indicators related to the page in the server's logs, to include: redirects from the page in the form of anchored text, malicious traffic, and stress-testing results.

        (3) Resource Usage Analysis. The Operations Division should continuously assess the computational resources needed to load the page. This involves testing the page on multiple devices to record the CPU, RAM, storage, and network requirements. The page should always load in under one second.

    c. Identifying Biases. During the assessment process, there are inherent biases that may influence the objective evaluation of the design. Assessors should be aware of these biases and implement the following safeguards to prevent them.

        (1) Types of Surveys. The purpose is to understand perception, not functionality. Ask users what links and features should be enhanced, but do not make changes that violate the spirit of the design concept. Survey questions should not lead the user to provide a negative or positive response. An example of a leading question is "*Why do you dislike that the splash page is public facing?*" Instead, use a more ambiguous question, such as "*Are there features of the splash page that you would improve?"*

        (2) Methodology of Traffic Analysis. Do not simply capture how many times the page was served. The logs captured must provide more specific detail, to include redirects information, potential DDOS attacks, and failures of services.

        (3) Vary Browsers and Hardware. Do not simply assess the site on one machine or browser. Some features of HTML and CSS render differently based on the system and browser used.

9. Findings. ARNG-IMS-S identified the following during analysis of the user-centric splash page model:

    a. The new model will reduce the cognitive, network, and computational loads required to open a browser by 80% (1/5th current load).

    b. The new model will significantly reduce the volume of non-essential AKO authentication traffic. Although the levels cannot be quantified at this time, ARNG-IMS-S projects at least an 80% drop in AKO access within TARC.

    c. ADOS, OTOT, and contractor users are the most likely group to benefit from the new model, as it will streamline familiarization, in-processing, out-processing, and telework.

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    d. Public search engine queries for URLs listed on the splash page will decrease significantly, by at least 50%.

    e. The TARC-wide perception of the G-6 Directorate will improve immediately, but the rate of improvement has not yet been determined.

10. References.

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