Südthüringer-Wald-Institut: Knowledge Sharing for the End of the World

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Abstract: Südthüringer-Wald-Institut is an independent, distributed research organization founded in a cave 200m deep below the Southern Thuringian Forest in the former East Germany. Physically positioned as a default site of refuge from the possibly inevitable collapse of the pervasive technological and social infrastructures that scaffold contemporary existence, the conceptual agenda of the Institute is framed by the present luxury of a world where discourse around mitigating unpleasant contingencies is still unhindered by the profound stress of needing to survive them. Embracing the ethos of "hope for the best, expect the worst," the work of the Institute locates the creative potential of technocratic doomsday fetishism within the service of a pragmatic functionalism.

At present, while a resident presence in the cave remains unnecessary, the Institute's member researchers and practitioners throughout Europe, North America and the world collaborate, contribute and share ongoing research through an open, distributed digital architecture, consisting of both an internet-based Archive Platform and a growing number of personal Autonomous Node Devices. Scientific and creative output are maintained online, as well in local archive nodes and replicated to all other members of the institute asynchronously, enabling an organic, cellular propagation of multiple independent archive instances.

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1. The World & The Cave

If we can't reformulate digital ideals before our appointment with destiny, we will have failed to bring about a better world. Instead we will usher in a dark age in which everything human is devalued. (Lanier, 82)

Let's briefly assume you got up tomorrow and the internet all of a sudden wasn't there. For whatever reason, instantaneous worldwide data exchange as we've come to expect over the last two decades simply has ceased to function, and also as a possibly related side effect, the global supply chain linking an unending stream of modestly-priced off-shore-sourced personal technology devices has disappeared into history. Appreciating the irony that the must-have marketing ethos of this season's *last device you'll ever buy* has just become the haunting consumerist epitaph for the last device you'll now ever own, the tendency to reach for this device and share this revelation on your social network of choice is interrupted, as alas, *there is no network*. The device's immediate use value having abruptly vanished, the natural question now becomes what is its exchange value: what else can be done with this sudden technological relic? It is within this hypothetical doomsday that we begin to examine the role of interaction designers in a world where the prevailing maxims of pervasive commodity computing and ubiquitous network connectivity cease to be relevant.

The uncomfortable tendency to link the vanguard of human interaction with the industrial necessity to produce new and ever- obsolescing form factors and product categories has become counter-productive. In the supposed interest of fostering ever deeper and more meaningful connections with others and the world around us, the cybernetic fetish of the new has grown from academic science fiction into a pandemic cultural trope, where actual human interaction is gradually superseded by woefully approximate network-mediated simulacra that grow ever more nebulous with each product-cycle.

Late 20th-century machines have made thoroughly ambiguous the difference between natural and artificial, mind and body, self-developing and externally designed, and many other distinctions that used to apply to organisms and machines. Our machines are disturbingly lively, and we ourselves frighteningly inert. (Haraway, 120)

In the nearly three decades since *A Cyborg Manifesto*, and the birth of what Negroponte affectionately termed the Digital Revolution, these machines continue to grow orders of magnitude livelier, through constantly improving infrastructures for production and networked connectivity, and our interactions with them have become infinitely more complex. We have grown so disturbingly accustomed to this fait accompli that we now generally fail to even notice it:

Its literal form, the technology, is already beginning to be taken for granted, and its connotation will become tomorrow's commercial and cultural compost for new ideas. Like air and drinking water, being digital will be noticed only by its absence, not its presence. (Negroponte 1998) This questionable near-sightedness, of course, has not been helped by the flippant normalization promoted by those cheerleading the notion that 'new media is not new any more' (Manovich, 70). As the once unimaginably difficult has become desensitizingly ordinary with the realization of pervasive computing in its contemporary form, it would seem that everything new is already old again. While this is an admirable testament to the prescient capitalist longevity of Moore's Law, it underscores the fundamental breakdown between consistently exponential technological evolution and true innovation:

I long to be shocked and made obsolete by new generations of digital culture, but instead I am being tortured by repetition and boredom. (Lanier, 121)

In a digital world still smitten with the quaint, if somewhat narrow-minded ideal that anything is possible, we are so enamored of our present and near-term anticipated capabilities that we have become relatively ignorant to the very real limitations inherent to the broader framework that enables them. Our devices become cyclically obsolete, yet our unwavering devotion to the system continually producing and underpinning them remains in stasis. The presently accepted maxim holds that so long as there remains an unending, always-connected stream of newer and faster, innovation will be sure to follow. Unfortunately, in practice the results are somewhat more disappointing:

Let's suppose that back in the 1980s I had said "In a quarter century, when the digital revolution has made great progress and computer chips are millions of times faster than they are now, humanity will finally win the prize of being able to write a new encyclopedia and a new version of UNIX!" It would have sounded utterly pathetic. (Lanier, 121–2)

The ease and comfort afforded by the methodical certainty of the new has made for a passive culture of complacency. When we choose to be ignorant of systemic limitations, or to deny their existence entirely, innovation is arguably stifled.

There are, in fact, some very tangible limitations to the system. This is evidenced by the lingering, romantic mythologies of a simpler, more altruistic fledgling public internet. Although the widely espoused societal belief has been that the network is an infallibly durable, continuously available and quasi-tolerant bastion of social freedom, these fantasies are now being reconciled against the same industrial and political structures that facilitate the enormous undertaking that is the system's ongoing operation.

The original Arpanet was designed to withstand the obliteration of a country and remain useful because of its basic architecture. In other words, it was designed to withstand an A-bomb. Over time, the backbones have been taken over by large corporations and streamlined (to maximize profit) in such a way that the backbones themselves are now vulnerable. For the past decade, it has been doubtful that the Net could withstand that A-bomb. (Dvorak, 2009)

Ironically, the spread of ubiquitous connectivity and virtually continuous uptime has come at the expense of the intrinsic architectural qualities that brought about the internet's very existence: the system's availability now directly correlates to its fragility. As has been demonstrated in recent, smaller-scale geopolitical struggles over the past several years, internet traffic can and will be unilaterally suspended at the first sign of unrest. Despite the internet's engineering pedigree as immune to the unpleasantries of mutually assured destruction, the present reality is that it is susceptible to the whims of a prevailing regime at the touch of a button.

In a culture where the concept of disconnection from the network at large is assumed to be nothing more than an aggravating, albeit temporary nuisance, visualizing the complete and unmitigated collapse of the internet remains a critical and theoretical taboo outside of the context of a truly dire doomsday scenario. Any discussion of the need for systems that function even partially independently of the centralized internet requires invoking imagery of total annihilation punctuated by nuclear winter, although in reality, the wheels could come off with substantially less spectacle.

As such, Südthüringer-Wald-Institut is predicated on the End of the World as a heavy-handed starting point for the sorely needed discourse about what our limitations are, and what can be possible outside of the established canon of pervasive commodity computing and ubiquitous network connectivity. Borrowing from a tradition spanning from the dawn of civilization to the last vestiges of Cold War paranoia, the Institute thrives on a preternatural human condition: when the going gets tough, the tough go underground.



Fig. 1. Südthüringer-Wald-Institut Field Expedition Team, June 2012.

2. The Institute

At present, while a resident presence in the cave remains unnecessary, the Institute's member researchers and practitioners throughout Europe, North America and the world collaborate, contribute and share ongoing research through an open, distributed digital architecture, consisting of both an internet-based Archive Platform and a growing number of personal Autonomous Node Devices. Scientific and creative output are maintained online, as well in local archive nodes and replicated to all other members of the institute asynchronously, enabling an organic, cellular propagation of multiple independent archive instances.

Each node functions as a local collections manager and server, semi-public connectivity access point and interconnect for ad-hoc wireless mesh networking between nodes, providing all essential services necessary to function independently, even without the presence of an external internet. Should the need to retreat underground arise, single or multiple instances of the entire digital holdings of the Institute could be easily be brought beneath, establishing a core technical foundation enabling the research activities of the Institute to continue as normal.

Structured around a tribal model that establishes symbiotic relationships between specialists within a micro-community, the design of the Institute embraces the current privilege of global collaboration afforded by our fortunate status as network users, without falling victim to the perverse mentality of the hive mind. Centered on a small core group of collaborators, the Institute is a purpose-built environment not specifically intended for broad public consumption:

If you grind any information structure up too finely, you can lose the connections of the parts to their local contexts as experienced by the humans who originated them, rendering the structure itself meaningless. (Lanier, 138)

Maintaining an intimate social dynamic intentionally isolated from the relative anonymity of the open internet promotes the implicit operational trust necessary for knowledge exchange to flourish, especially in environments where physical presence must fill the void left by a sudden lack of digital interconnection. As a close-knit transdisciplinary collective, each member can browse and freely copy items from every other member's archive, metering his or her own level of personal engagement while promoting a site for building and sharing dynamic, continually developing libraries of content.

User interaction is guided by a metaphor that blends elements of the Soviet tradition of Samizdat with the distributed computing paradigm of eventual consistency. The active, self-mediating information exchange within the archive serves as a basis for both present-day discourse and future retrospective narrative:

(...) Tracing the various forms of labor that support that life, we should find that Samizdat constitutes an outstanding modern example of textual system, not only because it originates outside a capitalist economy, but because these texts highlight with special force the text's epistemic ambiguity. What was deemed truthful or valuable? How was this determined? The credit of any Samizdat had to be established for each text, and, further, at each phase of the material life of that text. (Komaromi, 4)

As the archive grows and evolves through use, its epistemological relevance advances. In stark contrast to other subterranean archives such as Chauvet, Barbarastollen and the Svalbard Global Seed Vault, which are charged with the task of ensuring the continued existence of a static, historic encapsulation into posterity, Südthüringer-Wald-Institut is actively engaged in the speculation of an uncertain future.

Enlightened designers leave open the possibility of either metaphysical specialness in humans or in the potential for unforeseen creative processes... (Lanier, 52)

3. Architectural Overview

The infrastructure of the Südthüringer-Wald-Institut is designed as a modular, decentralized architecture that can function both inside and outside environments exhibiting internet connectivity, enabling consistent application functionality and user experience across the widest cross-section of client devices possible. Comprised of both a software layer, the Archive Platform, and a complimentary hardware layer, the Autonomous Node Device (AND), the system ensures the work of the Institute can carry on even in the face of significant topological failure.

In the presence of internet connectivity, member researchers and practitioners can access the Archive Platform through a centralized web-based Archive instance, and by extension, each Autonomous Node Device can directly communicate with this system and directly synchronize content. When internet connectivity is not available, each AND ensures users continued local access to the Archive Platform through a choice of nearrange connectivity options, including LAN and ad-hoc wireless. These connections, as well as support for wireless mesh networking, are also employed to establish connections between individual ANDs and allow direct synchronization and replication between devices when possible.



Fig. 2. Architectural Overview: system topology.

4. Archive Platform

The Archive Platform is a browser-based distributed application built on a foundation of open software technologies that allow it to function seamlessly across both the unified online server environment and multiple Autonomous Node Devices, while providing a consistently rich user experience on all supported client devices, from smartphones to conventional PCs.

At the heart of the application stack is Apache CouchDB, a document-based database system authored in Erlang, a fault tolerant programming language and runtime environment originally developed for mission critical telecom equipment. CouchDB is an ideal fit for this project due to its HTTP-based query interface, robust replication, synchronization and version control features. Functioning as both a database and web server, CouchDB has the unique capability of deploying complete web applications from a single server instance combining application logic and storage layers. Additionally, these applications can be easily replicated across multiple server instances and instantly deployed. By design, the system works "with the grain of CouchDB [and] promotes simplicity in … applications and helps… naturally build scalable, distributed systems." (Anderson et al., 11)

Archive and synchronization management is made possible by the CouchDB application framework developed by the Little Library Project. Originally conceived for sharing content libraries across the cloud and personal devices, the customized Little Library framework is assembled and maintained with the CouchApp toolchain, streamlining application prototyping, modification and deployment.

Additionally, the framework delegates presentation-layer tasks including User Interface rendering and event management to jQuery Mobile. This javascript library provides consistent touch-compatible UI elements and behaviors across all current mobile device platforms and desktop browsers.



Fig. 3a. Archive Platform: application stack. Fig. 3b. Archive Platform in operation.

5. Autonomous Node Device



Fig. 4a. Autonomous Node Device: hardware overview. Fig. 4b. AND-FX3a in the field.

Designed as a modular, self-sufficient system, the Autonomous Node Device (AND) provides all fundamental hardware support necessary to operate the Archive Platform independent of the unified online server environment. Anticipating a world of production and distribution scarcities, this architecture functions more as a recipe than a rigid reference design, conceived to be assembled from and maintained with any number of commonplace commodity components. Foregoing esoteric manufacturing procedures, an individual Autonomous Network Device can be easily constructed by someone with basic familiarity with consumer electronics, out of parts and devices likely to be strewn around the wreckage of the average office, studio or living room.

The AND specifications outline the presence and minimum functional compatibility of each module without mandating a vendor- or platform-specific part. Abstracting the individual function sets of each component establishes a rudimentary set of requirements: the power supply module must furnish sufficient electrical power to operate the entire system, the server module must be capable of running an instance of CouchDB, and the network connectivity module must provide some form of basic, local TCP/IP connectivity, either wireless or wired. This approach ensures that the system can utilize the broadest range of hardware combinations possible, from handsets and embedded systems to fullfledged server-class PC hardware.

Early AND prototypes were targeted to fit within a shoebox-sized enclosure, however this form factor presented several issues during the course of development. Originally using repurposed ARM-based hardware running Android, first- and second-generation prototypes simply were not fast enough to reliably support multiple Archive Platform users, and encountered numerous thermal and power management problems. The current third-generation prototype version, AND-FX3A, is roughly the size of a consumer bread machine, and comfortably houses an off-the-shelf lithium-polymer power supply, quadcore application server module and an 802.11g wireless network connectivity module. Production versions derived from the AND-FX3A will begin to be distributed to member researchers and practitioners later in 2013.



Fig 5. Researcher Heino Weißflog evaluates AND-FX3A.

6. A Journey Beneath

On 23 June 2012, members of the Field Expedition team journeyed to the Südthüringer-Wald-Institut Cave Site as part of the Inaugural Evaluation Expedition. Tasked with gathering advance first-hand geographic, environmental and social data impossible to obtain from the comfort of the lab, the occasion also marked the initial underground field testing of one of the first functional Autonomous Node Device prototypes, AND-FX3A.

Several hundred meters below the forest, the team procured crucial baseline data necessary to the future in situ establishment of the Institute's activity following the End of Days, and prognosticated on the relative stability of the location for the next 50 to 70,000 years.

Furthermore, rigorous testing of the AND-FX3A verified the device's suitability for subterranean installation and operation across a spectrum of usage scenarios and client platforms. Although disconnected from external connectivity to the world above, the Archive Platform remained continually accessible throughout the Cave Site as expected, providing access to the entire holdings of the Institute Archive, as well as serving as a real-time repository for field data.

Despite the overwhelming success of the Inaugural Evaluation Expedition, a litany of other unanswered questions remain. As such, preparations by the Field Expedition Team for future research missions are already underway.

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The Little Library Project: Archive management and synchronization platform.

http://github.com/rwadholm/The-Little-Library

Apache CouchDB: Document-based, RESTful database infrastructure.

http://couchdb.apache.org/

CouchApp: Javascript application framework for CouchDB.

http://couchapp.org/

jQuery Mobile: Cross-platform, touch-compatible UI framework.
http://jquerymobile.com/
IrisCouch: Cloud-based CouchDB hosting.
http://www.iriscouch.com/
Mobile Futon: Portable CouchDB installation and administration for Android
http://github.com/daleharvey/Android-MobileFuton
cyanogenmod: Expanded, unencumbered Android hardware support.
http://www.cyanogenmod.com/
OpenWRT: Open Linux-based firmware for wireless hardware.
https://openwrt.org/
OLSR: Wireless mesh networking support.
http://www.olsr.org/

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