Internet of Bio-Nano-Things 1

Note: I asked ChatGPT about my twitter thread. Fluorescence polarization spectroscopy & photochemical programming of bioorthogonal host-guest recognition technology with correlation to nano-networks. Worth the read! Chat #1 (Apr '23) | Chat #2 (Oct '23)

IoBNT: Internet of Bio-Nano Things Based on biological cells, and their functionalities in the biochemical domain, the IoBNT promises to enable applications such as intra-body sensing and actuation networks. Wearables have been developed by Estimote, Microshare & Kerlink (asset tracking). Unique ID's + encrypted codes stored on a secured and centralized database via Low Power Wide Area Network (LoRaWAN).

A body area network (BAN), also referred to as a wireless body area network (WBAN) or a body sensor network (BSN) or a medical body area network (MBAN), is a wireless network of wearable computing devices. BAN devices may be embedded inside the body as implants or pill.

WBAN (Wireless Body Area Network)
Intra-Body Nano-Networks

The packet routing system used is called CORONA
(COordinate and ROuting for NAnonetworks)

Nano-nodes, in the body, triangulate using the THz band (0.1 - 10.0 THz). This model was improved & simplified, allowing packet transmission to more distant anchors, avoiding intermediate steps. Now enhanced with a multi-hop routing scheme based on a distributed cluster, with cluster selection algorithm. (DCCORONA). The protocol is TS-OOK (Time-Spread On-Off Keying) (IEEE 9298084)

Nano Structures & Devices: The demux circuit. Binary-coded signals convert to data packets. The parallel-to-series circuit. Converts different sets of input wire

data and output to different wires, including time output intervals. (QDCA) Quantum dots. Quantum Cellular Automata (QCA) are a quantization of classical cellular automata (CA), d-dimensional arrays of cells with a finite-dimensional statespace and a local, spatially-homogeneous, discrete-time update rule. All-Optical Quaternary Logic Based Information Processing & this is ten years ago.

Bridging the infrastructure gap. WiGig (60 GHz Wi-Fi) refers to a set of 60 GHz wireless network protocols. More specifically, IEEE_802.1ad & "Virtual Networks".

Media Access Control or MAC address. "Layer 2" of the OSI Model, with #1 being the device itself. MAC is, "...a unique identifier assigned to a network interface controller (NIC) for use as a network address in communications within a network segment." **Network Simulator: ns-3** is a discrete-event network simulator for Internet systems.
▼ Details

From the "About" section: "...the ns-3 software infrastructure encourages the development of simulation models which are sufficiently realistic to allow ns-3 to be used as a realtime network emulator, interconnected with the real world and which allows many existing real-world protocol implementations to be reused within ns-3. The ns-3 simulation core supports research on both IP and non-IP based networks. However, the large majority of its users focuses on wireless/IP simulations which involve models for Wi-Fi, WiMAX, or LTE for layers 1 and 2 and a variety of static or dynamic routing protocols such as OLSR and AODV for IP-based applications."

"...also supports a real-time scheduler that facilitates a number of “simulation-in-the-loop” use cases for interacting with real systems. For instance, users can emit and receive ns-3-generated packets on real network devices, and ns-3 can serve as an interconnection framework to add link effects between virtual machines."

It's "...often referred to as the **burned-in address**, or as an Ethernet hardware address, **hardware** address, or **physical** address. Each address can be stored in hardware ...or by a firmware mechanism. The address typically includes a manufacturer's organizationally unique identifier (OUI). MAC addresses are formed according to the principles of two numbering spaces based on extended unique identifiers (EUIs) managed by the *"Institute of Electrical and Electronics*

Engineers (IEEE)" EUI-48—which replaces the obsolete term MAC-48—and EUI-64. *(Source: Wikipedia)* What is the correlation? Watch the BlueTRUTH documentary.

Plasmonic Nano-Antenna for Terahertz Band Communication in Nanonetworks *(IEEE.org)* *Full Article*
Beyond 5G: THz-Based Medium Access Protocol for Mobile Heterogeneous Networks *(IEEE.org)* *Full Article*
i-MAC: In-Body Sensor MAC in WBANs for Healthcare IoT *(IEEE.org)*
▼ Details

First thing fom the abstract, "The application of Internet-of-Things (IoT) technology in modern healthcare environment has given rise to a new paradigm known as healthcare IoT. The wireless body area network (WBAN) is one of the basic building blocks of IoT-based healthcare system, comprising many wearable (on-body) and implant (in-body) sensors placed in or around patient body connected to a hub for physiological signal monitoring."

Modeling the Dynamic Processing of the Presynaptic Terminals for Intrabody Nanonetworks *(IEEE.org)*
▼ Details

Abstract: Experimental evidences show that: 1) the release sites from a single axon have variable release probabilities, even when the axon contacts the same postsynaptic neuron; 2) this variability in the release probability implies a compartmentalization at the level of the presynaptic terminals of the neuronal processing; 3) the specificity of the presynaptic terminal processing is driven by and reflects the complex biophysical mechanisms activated at the axon terminals when a spike is fired in response to a stimulus. Stemming from these experimental evidences, we propose a communication engineering model for capturing the behavior of biological neurons.

Toward 6G Networks: Use Cases and Technologies

...To Be Continued.