Fulfilling the Promise of i3: A Vision for "i4" and the ECC "Operating System"

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NG9-1-1: Progress Made, Many Miles Yet to Go

- NG9-1-1 rollout has finally begun in earnest, though adoption remains uneven and ***definition of what constitutes "NG9-1-1" remains a bit elusive***

- Key drivers to accelerated adoption:

  - **Standards** - ANSI / NENA i3 NGCS specification codified 2011; updated 2016, 2021

  - **Interoperability (and Conformance?) Testing** - 9 NENA ICE tests since 2009; ICE 10 scheduled for 2022; possible USDHS-sponsored Conformance testing program to begin in 2022)

  - **Funding** – US Federal grant funding, $40M in 2009, $115M in 2019, potential $10B in current infrastructure bill have helped drive NG9-1-1 Core Services / ESInet implementation

- Unfortunately, time, effort and money (lots of it) have been spent with mixed success to largely:

  - IP-enable a traditionally TDM call path (with in some cases less reliability than the original system without the promised increase in interoperability, at least "not yet")

  - "Overlay" an interim SMS-text-to-9-1-1 solution on top of the existing voice-centric legacy system

- This is NOT what "NG9-1-1 was supposed to be about when it was conceived at the beginning of NENA's "NG9-1-1 Project" (2003)

- ***Much still remains to be done to reach the "full promise" of NG9-1-1***

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NG9-1-1 "Progress Scorecard" (Grade: C+)

- **Network, IP, and Multimedia Delivery "Layer"**

  - ***Good general progress toward the acceptance of the need to build out a "common, interoperable emergency services network"*** which ultimately will accommodate ALL mission-critical "citizen-to-authority" and "authority-to-authority" emergency communications, but ESInet / NGCS buildout uneven, although PSBN rollout has been aggressive in comparison

  - ***Progress being made towards building out IP-enabled NGCS and ESInets to replace legacy networks***, Selective Routers, and ALI databases, but most legacy gear still remains in place and most carrier origination and aggregation is done using legacy TDM signaling (VERY FEW OSPs doing SIP origination of emergency calls)

  - ***"Location-based routing" almost non-existent***; tabular call routing still predominates

  - ***Virtually no real work done to interwork ESInet and 1st responder public safety broadband networks (PSBN)***, but is slowly starting (e.g., NENA's forthcoming ESInet-to-PSBN Interconnection Standard, National 911 Program EIDO work)

  - Capability to accept multimedia at the PSAP / ECC coming along but few centers actually accept it due to lack of equipment and capability to do so

- **Application, GIS, and Data "Layer"**

  - ***SOME*** progress being made on GIS data set creation (needed for fully functional NG9-1-1) – some states and regions have very accurate and complete datasets – but many others do not, and have not yet started to create them

  - ***VERY LITTLE*** standardized accommodation for "OTT" or other " consumer applications" that wish to interact with emergency services (still seen as a "phone call")

  - ***VERY LITTLE*** preparation for non-human initiated (i.e., IoT, etc.) requests for emergency service, or input and use of SmartCity or other environmental sensor data

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Key to the NG9-1-1 Vision and Beyond ("i4"): Transformation of the PSAP into the ECC

- *The technically advanced Emergency Communications Centers (ECCs) our industry needs will bear only a passing resemblance to today's legacy Public Safety Answering Points (PSAPs), if any at all.*

- *These new ECCs will be the "nerve center," the nexus of NGPS, where all communications in the emergency services workflow converge,* where data is analyzed, assessed, and processed, and where true "intelligence" about emergency situations is "teased out" of disparate data elements using the latest Artificial Intelligence and Machine Learning (AI / ML) technologies before being shared with first responders over broadband wireless networks (PSBN).

- ECCs are the entry point for emergency requests for assistance into the emergency services workflow, be they voice calls, texts, video, images, automatic sensor data, etc. While *the entire downstream public safety workflow is dependent on the first link in the chain, the NGCS functional elements supplying information from the public to the ECC*, *UNLESS* the *PSAP is reconceived as an "advanced ECC," the promise of the NG9-1-1 vision, the "i4 beyond i3, so to speak," CANNOT be realized.*

- *Updated, fully integrated ECC solutions, an integrated, advanced "ECC Operating System" if you will, is what is needed* to fully realize the "holy grail" of better predictive capabilities, full use of supplied multimedia data wherever it originates (human or machine), and richer analytical capabilities that will ultimately lead to the increased situational awareness and better safety outcomes for the general public and first responders driving the formulation of the original "NG9-1-1" vision.

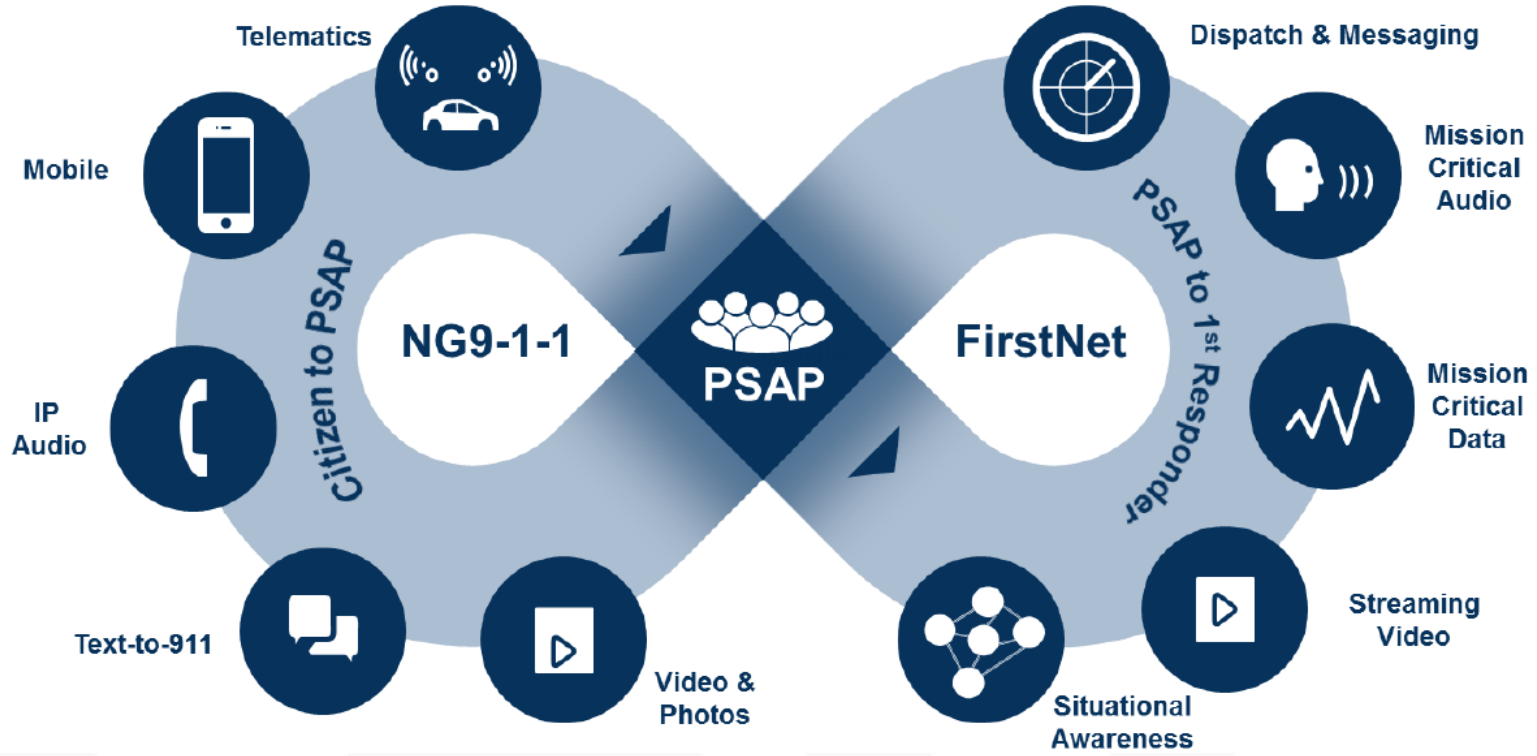# Convergence of PSBN and NG9-1-1: The PSAP Transformed

Figure Source: Frost & Sullivan

The Integrated NG-ECC: NG9-1-1 Transformed

- Network upgrades to IP, replacement of legacy 9-1-1 equipment by NGCS, and provision of multimedia-capable paths into the PSAP / ECC, plus a simple connection to PSBNs "on the other side" is not enough to realize the full NGPS / NG9-1-1 vision

  - *Since the NENA i3 specification and associated standards only covers NGCS and the multimedia data path INTO the ECC, I've chosen to label the "full vision beyond i3" as "i4" (fully "tongue in cheek!")*

- *The "transformed PSAP" will need integrated solutions that employ the latest data integration, analytics, processing, and data transformation solutions to truly deliver on the "i4" vision*

- *The era of "stovepiped" PSAP / ECC applications labeled "Call Handling," "CAD," or "Console" is over*; what is needed is an integrated solution, with common interfaces, data structures, etc., that accepts standard format multimedia FROM NGCS interfaces OR OTT applications, regardless of whether the information originated with a person or a machine, mines it for "intelligence" of value to first responders, and then "reformats" the data for transmission to first responders over PSBNs

- *I have chosen to dub this solution an "ECC Operating System" since it must function just like a computer's OS*, i.e., providing basic capabilities to snap data sources and application logic "in and out" as necessary, provide the necessary data mining and analytics functions that can be easily re-programmed as necessary, and then share these results with field personnel; public safety "futuretech" will resemble military and other critical sector "data fusion" / C4I solutions more than today's public safety operations

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Why ECC "Operating System?"

- A simple definition of an operating system is: *"An operating system (OS) is system software that manages computer hardware, software resources, and provides common services for computer programs."*

- An OS provides the base capabilities to allow all other computer programs to function, operate, and deliver value. It provides all the COMMON functions without which NO program could run and STANDARDIZES how to add new application software (programs) to the computer

- While perhaps not 100% analogous to the NG9-1-1 "i4" problem, it's close enough…so I will use it!

- Like a computer, unless our future ECCs include a STANDARDIZED COMMON DATA INTEGRATION AND ANALYTICS PLATFORM, every time a center wants to bring in new capabilities / data / media and intends to share that with first responders, it will encounter and have to "slog through" a long, complicated data and solution integration process, with no guarantee of success.

- *LESSON LEARNED / BOTTOM LINE: THE OLD WAY OF INTEGRATING DATA AND APPLICATIONS IN PSAPS / ECCs HAS TO GO…OR ALL OF THE NEW MULTIMEDIA DATA FROM HUMANS AND MACHINES WILL NOT ADD ANY REAL NEW VALUE TO THE PUBLIC SAFETY WORKFLOW AND A LOT OF TIME, EFFORT, AND MONEY WILL HAVE BEEN WASTED*

- *THE GOOD NEWS IS…SYSTEMS AND PLATFORMS ALREADY BEING DEPLOYED IN OTHER SECTORS ARE AVAILABLE TO PUBLIC SAFETY…BUT IT WILL REQUIRE A MINDSET CHANGE ACROSS OUR INDUSTRY IN ORDER TO BENEFIT FROM THEM, A CHANGE THAT WLL AFFECT HOW OUR INDUSTRY THINKs ABOUT TECHNOLOGY, PROCUREMENT, AND OPERATIONS…*

- *THE TIME TO GET READY FOR THIS CHANGE IS…NOW!*

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THE WAY FORWARD

- *UNDERSTAND CURRENT INDUSTRY MODELS FOR CLOUD-BASED RAPID DATA INTEGRATION, NORMALIZATION, AND ANALYTICS AND WORK TO APPLY THEM TO OUR CHALLENGES...THE ERA OF SPECIALIZED SOLUTIONS IS OVER...*

- *TECHNOLOGY ABOUNDS, ALBEIT GROWING AND CHANGING ALL THE TIME, OUTSIDE "THE NORMAL CHANNELS" USED TO PROCURE PUBLIC SAFETY SOLUTIONS, THAT CAN ENABLE THE SOUGHT-AFTER CAPABILITIES..START LOOKING FOR ANALAGOUS PROBLEMS AND SOLUTIONS IN OTHER SECTORS...AND THEN BORROW LIBERALLY AND OFTEN...THERE AREN'T MANY WHEELS TO "REINVENT" HERE...*

- *START INVESTIGATING TECHNOLOGIES, PLATFORMS, AND SOLUTIONS DEPLOYED OUTSIDE OUR VERTICAL DEDICATED TO SOLVING THE SAME PROBLEMS...IN AN ALWAYS-ON, IP-BASED WORLD OF HYBRID COMMUNICATIONS (HUMANS AND MACHINES WORKING TOGETHER), PUBLIC SAFETY TECHNOLOGY PROBLEMS ARE NOT UNIQUE...*

- *NEED TO MODIFY HOW WE THINK ABOUT WHAT AN ECC DOES; IT'S NOT GOING TO BE ABOUT ANSWERING CALLS FOR VERY MUCH LONGER AND WILL BE ALL ABOUT ACCEPTING, PROCESSING, ANALYZING, AND SHARING DATA IN ALL ITS FORMS WITH FIRST RESPONDERS, THE PUBLIC, AND ALL OUR STAKEHOLDERS...MOVE AWAY FROM THINKING IN TERMS OF "CALL HANDLING" AND "CAD" AND PUSH VENDORS TO DEVELOP INTEGRATED SOLUTIONS*

- *KEEP IN MIND THE FUTURE IS HYBRID; ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING INCORPORATED INTO THESE ECC "OPERATING SYSTEMS" WILL BE KEY TO PROCESSING THE NEW DELUGE OF MULTIMEDIA AND SENSOR DATA NG9-1-1 MAKES POSSIBLE...THERE'S NO QUESTION OF WHETHER THE FUTURE WILL BE DOMINATED BY MACHINES OR HUMANS...LIKE THE FUTURE OF WORK, THE FUTURE OF PUBLIC SAFETY IS HYBRID!*

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