PARCA

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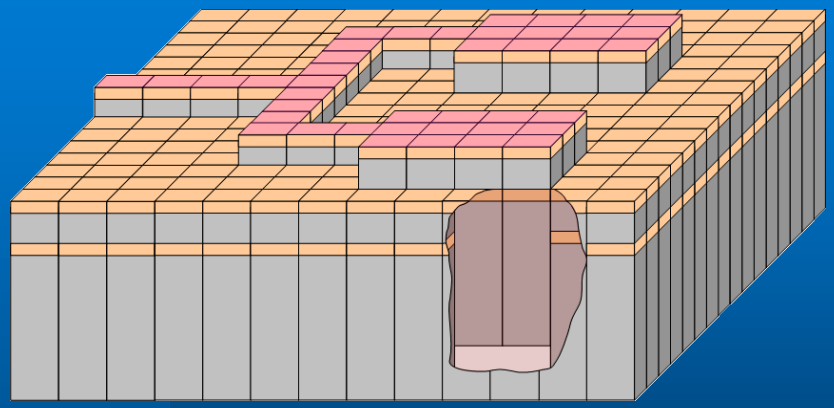
Pixel Addressable Reconfigurable Conformal Antenna



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Limited Antenna Capabilities

- Airborne tactical jamming systems must select jamming transmitters and antennas prior to a mission.

- Current systems are unable to reconfigure to different frequency bands once airborne.
- Current antennas cover a limited frequency range and require specific antennas for specific missions.
- Impacts both mission safety and capability.

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Antennas are Pervasive in DoD

- All Airborne Electronic Attack (AEA)
- The new EA-18G "Growler" aircraft.
- Satcom-on-the-move (SOTM) communications
  - Airborne and ground vehicles.
- Military Ships, aircraft and vehicles that require rapidly reconfiguration or low profile antennas

A Software Defined Radio needs a

Software Defined Antenna™

Multiple Antennas for Multiple Missions

Multiple non-reconfigurable antennas are utilized to meet the various mission scenarios:

Ridge waveguide horns for high frequencies

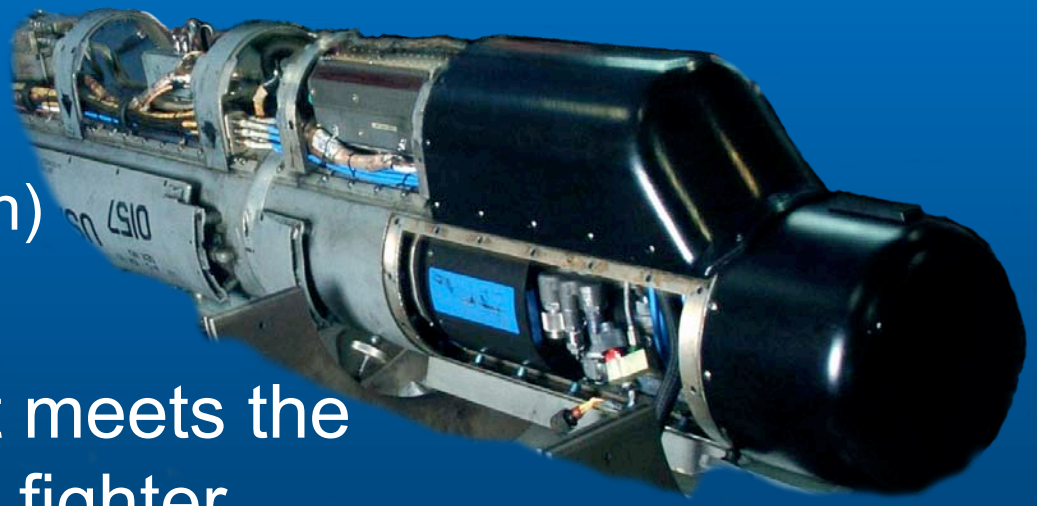
Dipoles for low frequencies

Antennas are changed for each mission

Multiple antenna designs require substantial support, inventory, and maintenance

Desired Antenna

- Ultra Wide-Band antenna system that can transmit 2 KW while dynamically adjusting:
  - Polarization
  - Operating frequency
  - Beam width (i.e., gain)



- Platform agility that meets the needs of a first-line fighter.

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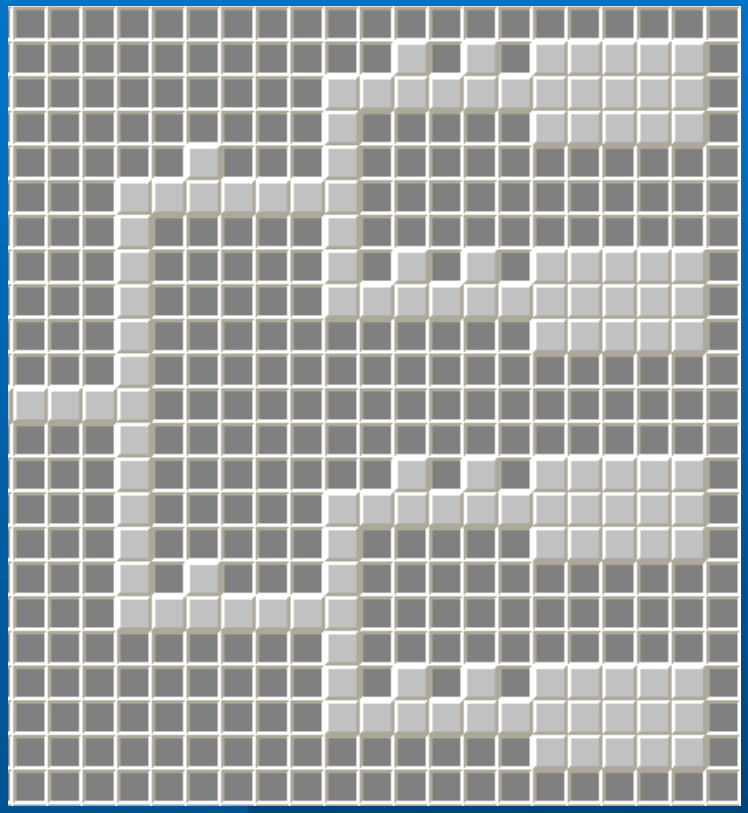
Introducing PARCA



A new Antenna Paradigm…

- An array of Pixels that can be actuated to form planar antenna structures and transmission lines
- Constructed of a sandwich of conductive and non conductive layers
- Pixels patterns are configurable in real time under software control

Software Defined Antenna™

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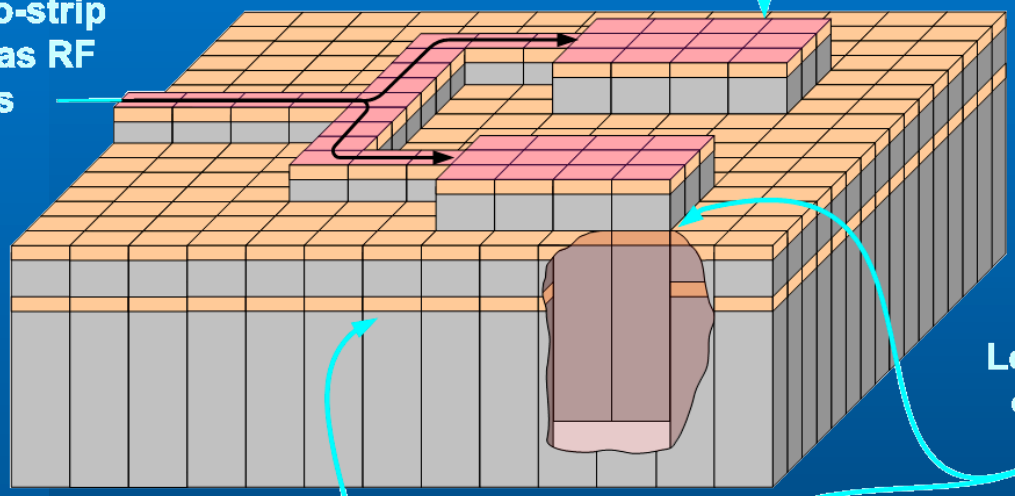

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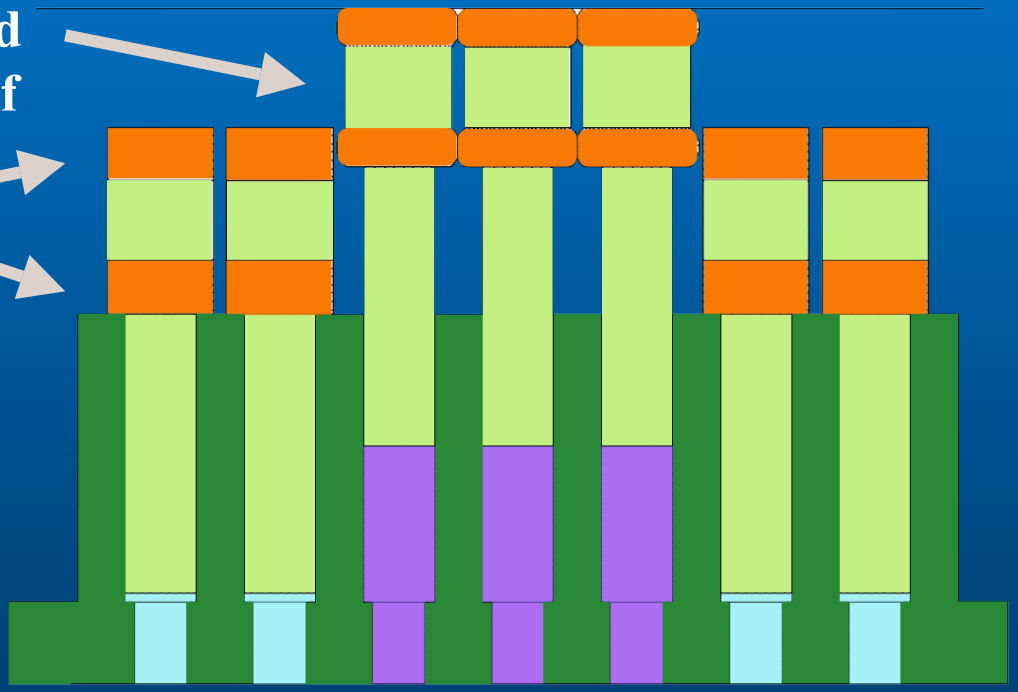
Pixel Addressable Reconfigurable Conformal Antenna

Pixels are fabricated from layers of dielectric material sandwiched between two conductive layers of elastic-polymer.

Pixels are driven up or down en mass pneumatically and selectively held in position by Piezoelectric breaks fabricated into the cylinder walls



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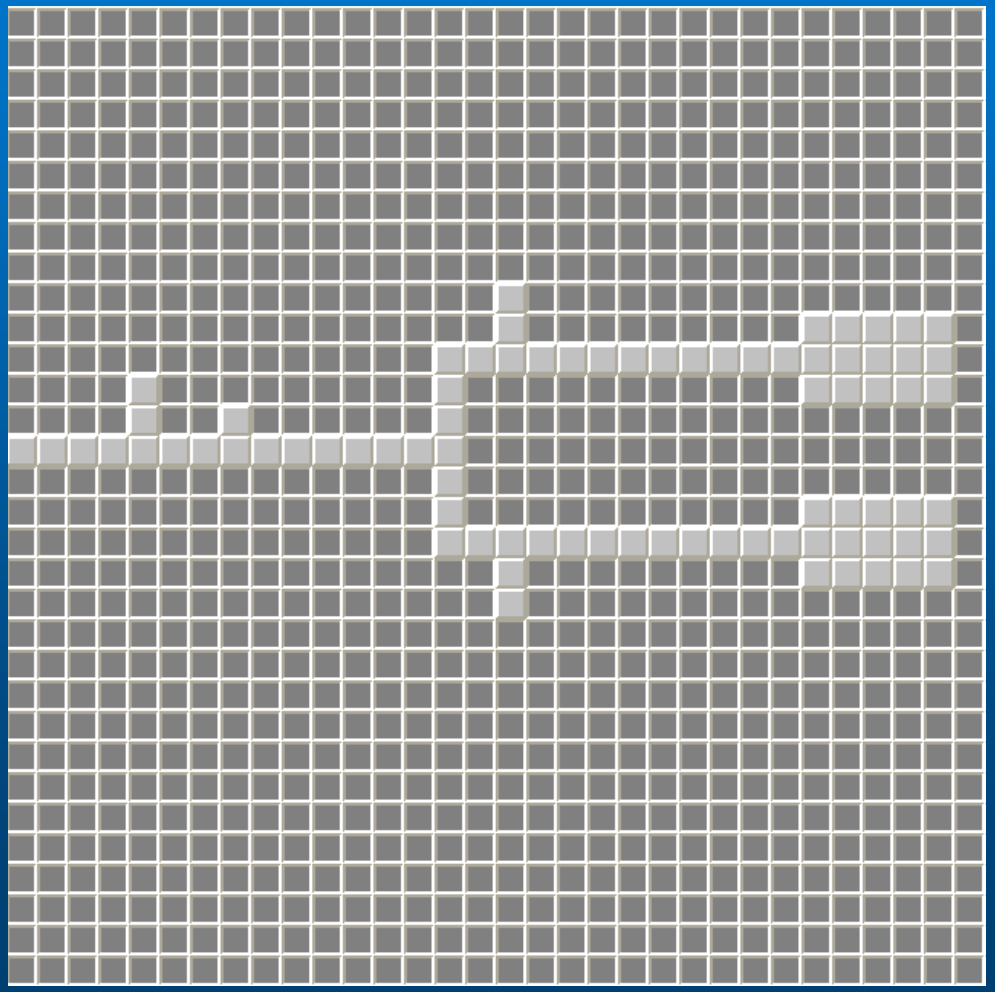
Pixel Addressable Reconfigurable Conformal Antenna

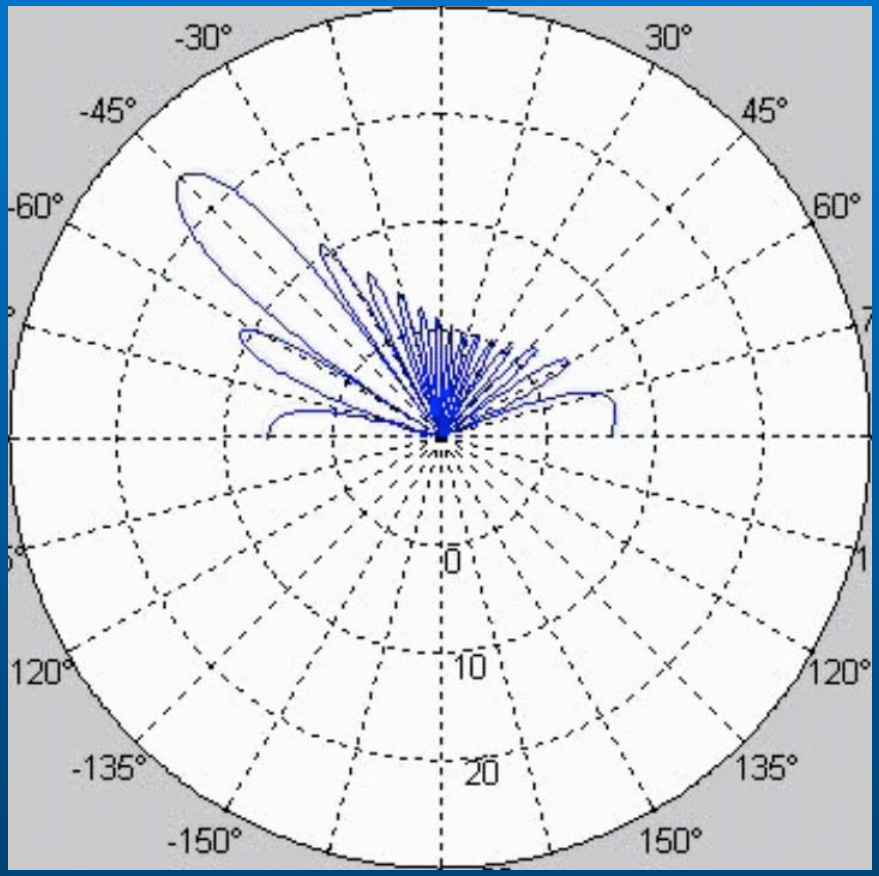
The Software Defined PARCA Antenna can quickly adapt to changes in Frequency, Polarization, Gain, Beam Position, and a variety of other parameters.

PARCA control software is flexible and easily adapted to specific user requirements



PARCA Beam Steering Simulation

Beam steering is easily accomplished by varying the relative delay between individual elements in the array.



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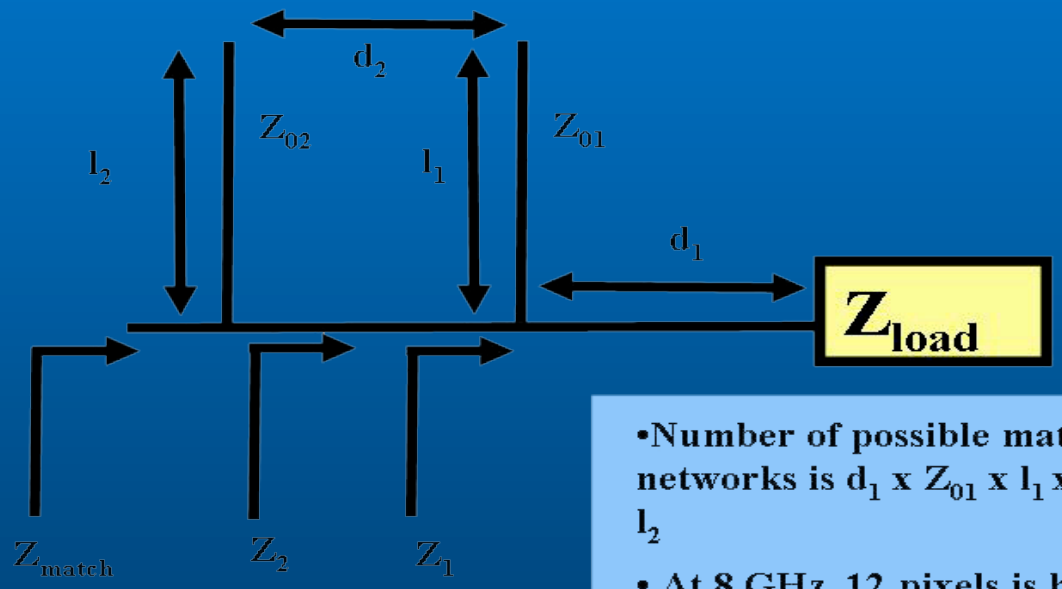
Impedance Matching

Good impedance matching between the transmission line and the antenna matrix can be obtained across extremely wide range of frequencies and antenna configurations through the use of dual stub tuning methods.

Double Stub Matching Network



- Number of possible matching networks is $d_1 \times Z_{01} \times l_1 \times d_2 \times Z_{02} \times l_2$
- At 8 GHz, 12 pixels is half wavelength
- Assume TL width is limited to 4 pixels or less
- 12 x 4 x 12 x 12 x 12 x 4= 331,776

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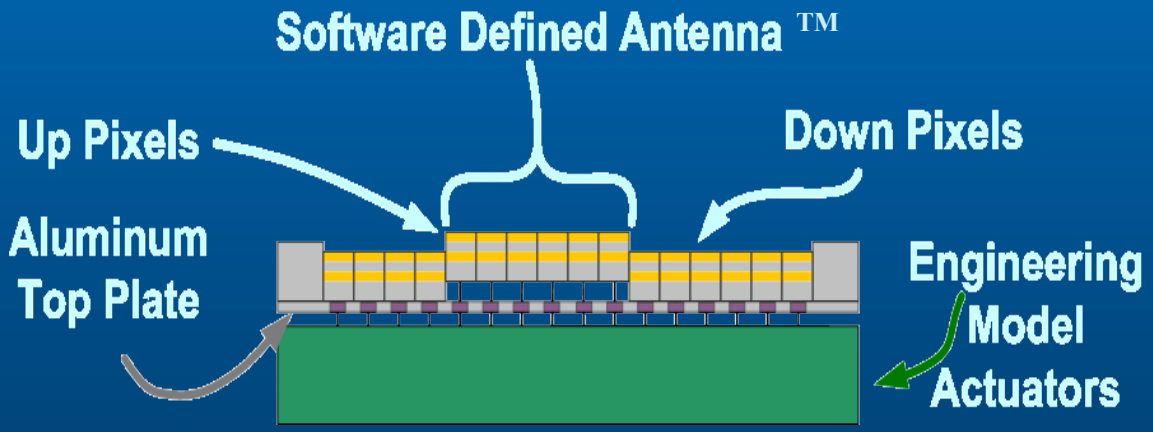
PARCA Performance

Parameter	Prototype	Production
Operating Frequency Min / Max	1.5 – 4.0 GHz	0.5 – 18 GHz
Aperture Gain Min Freq, / Max Freq.	15 – 20 dBi	12 – 40 dBi
Maximum Transmit Power	40 dBm	63 dBm
Beam Steering Range (both X and Y)	± 45 degrees	± 45 degrees
Pixel Size	~6.3 mm	< 1.0 mm
Array Size (Pixels) (mm)	32 x 32 200 x 200	> 100 x 500 < 630 x 3150

Prototype for Range Testing

- Control software has been completed
- Engineering Model is nearing completion
- Antenna range testing is scheduled
- Array size is expandable from 32 x 32 in one axis
- Expansion in increments of 16 Pixels



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The PARCA Payoff

Feature

- Reconfigurable
- One antenna system for all scenarios
- Electrically steered
- Multi-mission capability

Advantage

- Frequency changed mid-mission
- Continuous UWB capability
- Faster steering than mechanical methods.
- Adaptable to new profiles and capabilities.

Benefits to Navy

- Enhanced effectiveness & versatility
- Simplified design & configuration
- Reduced parts
- Increased performance
- Improved life cycle costs
- Cost effective upgrades

Transition to Fleet

TRL	Required Tests, Demos, and next steps	Target date	Estimated Funding required	Organizations to be involved
3	Demonstrate electromagnetic performance; demonstrate pixels	2008	(Already funded)	NAWCWD
4	Demonstrate Phase II PARCA prototype antenna	2009	(Already funded)	NAWCWD
5	Demonstrate full-scale prototype antenna	2011	Consult Syntonics	PMA-265, AEA Prime, PMA-290
6	Demonstrate full-scale preproduction antenna	2012	Consult Syntonics	PMA-265, AEA Prime, PMA-290
7	Flight demonstration of preproduction antenna integrated with next-generation jammer	2013	Consult Syntonics	PMA-265, AEA Prime, PMA-290, Boeing

Types of Partners Sought

- **Participant in Airborne Electronic Attack (AEA) / Next Generation Jammer (NGJ) programs**
  - **Pod integrator or amplifier supplier**
- **Airborne satcom supplier**
  - **Platform integrators**
- **Satcom-on-the-Move supplier**
  - **First or second-tier communications system integrators**

Design, Develop, Test, & Produce

- **Antenna panel design, development and test**
  - **Technology maturation followed by System Development and Demonstration**
- **Control system design, development and test**
  - **Technology maturation followed by System Development and Demonstration**
- **Component supplier involvement prior to production**

Communications Technologies for the RF Domain

- **Founded 1999 as "tech transfer spin-out" of The Johns Hopkins University Applied Physics Laboratory (JHU/APL)**
  - **Owned by its employees and JHU**
  - **ISO 9001:2000 registered Quality Management System**
  - **DCAA-approved accounting system**
  - **DSS-supervised SECRET clearances**
- **Syntonics develops and sells communications technologies for the RF domain**
  - **Fiber Optic Remote Antenna eXtension (FORAX™) system links radios to distant antennas with RF-over-fiber technology**
  - **Handheld Tactical Antennas (HTA) provide lightweight, rugged, communications for handheld tactical radios.**

Thank you! Come see us in Booth 305!

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