Introduction to Atomic Clocks

Szigeti Viktor, Managing Director

2023
The Country we are from

2023
Katalin Karikó
Physiology/Medicine
"mRNA vaccines against COVID-19"

2023
Ferenc Krausz
Physics
"generating attosecond pulses of light"

Neumann János
Inventor of Computer

Puskás Tivadar
Inventor of telephone switch

Ernő Rubik

16 Nobel Prize winners
But what have the atomic clocks ever done to us?
But what have the atomic clocks ever done to us?
But what have the atomic clocks ever done to us?

Universal Time Coordinated
But what have the atomic clocks ever done to us?

Systeme Internationale des unitées SI

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>s</td>
<td>second</td>
<td>time</td>
</tr>
<tr>
<td>m</td>
<td>metre</td>
<td>length</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram</td>
<td>mass</td>
</tr>
<tr>
<td>A</td>
<td>ampere</td>
<td>electric current</td>
</tr>
<tr>
<td>K</td>
<td>kelvin</td>
<td>thermodynamic temperature</td>
</tr>
<tr>
<td>mol</td>
<td>mole</td>
<td>amount of substance</td>
</tr>
<tr>
<td>cd</td>
<td>candela</td>
<td>luminous intensity</td>
</tr>
</tbody>
</table>
But what have the atomic clocks ever done to us?

Positioning systems,

Navigation
Precise time for everybody
Interactive social commuting
Land survey, mapping
Tracking services
Drones
Geological slow motion monitoring

...
But what have the atomic clocks ever done to us?

Worldwide telecommunication systems
- Landline, satellite and mobile
- 2G, 3G, 4G LTE, 5G-t
- High Speed Trading Systems
- Internet of Things
But what have the atomic clocks ever done to us?

5G Holographic Concert Demo
But what else can we use the atomic clocks for?

Precision Agriculture: reduced or zero chemicals
Next generation, computerized farming
But what else can we use the atomic clocks for?

Self driving, social commuting
But what else can we use the atomic clocks for?

Remote medical procedures
CESIUM vs GNSS

Cesium and GNSS

Time, Days

Phase, Nanoseconds

1st Linear Fit: y(t) = a + bt, Intercept = a = -0.23325628e-05, Slope = b = 5.938252e-14
DGNSS testing
PolyNet History

1994
- **Company**
  - Establishment: PolyNet works as an engineering service provider for telecom and power utilities.

1998
- **Sync products**
  - Sync products development: The first Wander Analyzer and PRC Clock are commercially available

2000
- **First Sync Network project**
  - First sync network: First nationwide sync network implementation in Hungary (Invitel)

2004
- **First sync project in Africa**
  - First sync project in Africa: Turn-key nation-wide sync network installation at Safaricom Kenya

2008
- **First MTN sync project**
  - International tender win: PolyNet won its first international sync tender issued by MTN Côte D'Ivoire
PolyNet History

2009
- **First Vodafone project**
  - PolyNet won its first sync system implementation project at Vodafone Group issued by Vodafone Malta.

2010
- **MTN Uganda project**
  - PolyNet won again on international sync tender issued by MTN Uganda.

2011
- **1st Gen PTP Grandmaster**
  - New era in sync
  - PolyNet developed its first PTP-capable clock module.

2014-2016
- **2nd & 3rd Gen PTP Grandmaster**
  - Full 1588 capable PTP Grandmasters
  - PolyNet has developing further its PTP Grandmaster product portfolio.

2018-2019
- **Multiple PTP projects**
  - Multiple contracts win
  - PolyNet completes simultaneously multiple PTP sync installation projects at MTN Uganda, Bofinet and BTC (Botswana).
PCAC1000 Cesium Atomic Clock
IEEE1588V2 PTP Grandmaster/Boundary Clocks Telecom
IEEE1588V2 PTP Grandmaster/Boundary Clocks
Power Utilities
Ptest 5G Synchronization Analyzer and Ethernet/IP Tester
Next Generation Sync Performance Monitoring System
Thank You!