

## Slovak develops unique chip of small size and extremely low power requirements

I wanted to give something important back to the country, said Radoslav Danilák of company Tachyum.



Radoslav Danilák at 2017 GLOBSEC conference in Bratislava.(Source: TASR)

*Read in this story:*

- How they built the world's first "universal processor"*
- What the R&D centre in Bratislava will be responsible for*
- Why Danilák decided to build the centre in Slovakia*

Ever since he immigrated to the United States, Radoslav Danilák has hoped for a day he could repay Slovakia for the contribution it gave him to succeed abroad.

“With Tachyum and Prodigy, that day has finally arrived,” said Danilák, whose Tachyum company has been developing a microprocessor with high performance, low energy consumption and three times cheaper for the operators of data centres compared with the best chip on the market.

In an email interview with The Slovak Spectator, Danilák talks about the developmental stage the project is at and why he decided to place a brand research and development centre in Bratislava.

**The Slovak Spectator (TSS): What are the current challenges with the development of chips? What conditions do the new generation chips have to meet?**

**Radoslav Danilák (RD):** In general, challenges to chip design and manufacturing are largely due to the astonishingly small transistor and wire sizes being used in today’s state-of-the-art fabrication plants, such as TSMC in Taiwan.

Today’s chips are built with transistors and wires that are as small as 7nm wide; for comparison the human DNA molecule is 2.5nm wide. At these feature sizes, a host of new problems arise, including quantum effects that must be accounted for in each design. With these absurdly small feature sizes, chip designers today can easily develop chips with up to 10 billion transistors on them. Verifying the functionality of chip designs has also become extremely complicated for the same reasons. Finally, the cost of developing chip products continues to skyrocket, with 7nm mask sets (just the non-recurring set up cost of the “stencil” used to build the chip) is now at about \$7 million.

The industry is meeting these challenges with improved manufacturing processes, improved CAD tools to aid in automating complex designs, and with advanced verification technologies.

**TSS: In which development phase is the new Prodigy chip?**

**RD:** The Prodigy Universal Processor chip is in the physical design stage of product development. The architecture development and optimisation is complete. The Register-Transfer-Level (i.e. Logic) design of the Prodigy core is more than 90 percent complete. The system integration of the final product is underway, with tapeout to fabrication in 2020. Early in the first half of 2020, Tachyum will release an FPGA-based fast emulation system of the full 64-core Prodigy product, which will replicate all Prodigy functionality and enable early adopters to develop and debug Prodigy software, in preparation for sampling the Prodigy Universal Processor in the final quarter of 2020.

**TSS: What makes this chip unique?**

**RD:** Prodigy outperforms the fastest Xeon CPU at 10-times lower the power and three-times lower the sales price. This is possible because the highly proprietary Prodigy architecture requires only one-tenth the number of transistors required for a Xeon core. With more than 10-times fewer transistors, the average wire length connecting them is more than twice shorter in Prodigy, than on competing products, resulting in faster clock speeds. Tachyum was able to accomplish this unprecedented performance by offloading “heavy lifting” tasks, assisted by hardware accelerators onboard our competitors’ chip products, to Tachyum’s proprietary Smart Compiler where they are handled as software tasks.

Prodigy also outperforms NVIDIA’s flagship GPU (i.e. Turing) on AI workloads. Therefore data centres can seamlessly and dynamically power up unused servers, which comprise most of the data centre server racks - most of the time, since they are powered down to save electricity, during off-peak-demand hours, to form ad hoc AI networks suitable for AI and Machine Learning workloads - with no additional capital expenditures. This, by definition, makes every Prodigy-powered data centre, an AI hub, offering Big-AI at low cost to all.

**New use cases open****TSS: Where can it be used?**

**RD:** Prodigy’s small size and extremely low power requirements open up new use cases, such as provisioning thousands of Prodigy servers on local cell towers to provide low cost, low latency AI to hundreds of thousands of local IoT devices.

Prodigy is the world’s first “universal processor”. It delivers a best-in-breed performance and energy efficiency on data centre, AI and HPC workloads. With Prodigy, the complexities of provisioning multiple disparate types of hardware in data centres simply vanishes. One Prodigy can handle all the workloads data centre operators can throw at it.

While not a primary market targeted by Tachyum, embedded electronics applications for Prodigy are vast: from a bigger, more flexible onboard brain for self-driving cars, to enabling drones to perform onboard sensor fusion, to creating the next generation of intelligent robots, Prodigy’s use cases are virtually unlimited.

**TSS: Have you been negotiating about the commercial use of the Prodigy chip or have you already signed an agreement in this respect?**

**RD:** Tachyum is engaging with several potential early Prodigy adopters, even though general availability is more than a year away.

While non-disclosure agreements prevent us from listing names and specific details, we are seeing interest from hyperscale data centre operators, large automotive and telecommunications corporations, as well as from aerospace and defence firms.

**TSS: How do you plan to finance the finalisation of the chip's development and the preparation of production?**

**RD:** Tachyum will raise additional Series-B equity funds in the first half of 2020 in order to fund chip tapeout, fabrication, verification and packaging, and business development costs.

## Designed in Bratislava

**TSS: Where will you produce the chip?**

**RD:** The Prodigy chip's final design for fabrication (i.e. the mask set) will be produced in Tachyum's Bratislava subsidiary - therefore Prodigy will be a European chip. The chip will be fabricated by TSMC in Taiwan. Tachyum is the only startup we know of, which is contracted directly with TSMC.

**TSS: You received a loan of €15 million from the Slovak government to build an R&D centre. In which planning/construction stage are you?**

**RD:** The R&D centre in Bratislava will be responsible for the tape-out of the final design for Prodigy. In addition, the Bratislava subsidiary will also lead the research and development of advanced AI software solutions optimised to run on Prodigy, supporting the EU goal of "AI for Good, AI for ALL".

## A proud Slovak

**TSS: Why did you decide to build such a centre here in Slovakia?**

**RD:** I'm a proud Slovak national who wants to give something important back to the country and culture that helped enable my success.

**RD: Have you been successful in finding enough experts to build the centre? What are some problems you have encountered during the process?**

**RD:** Identification and recruitment of talented engineers and managers for the Bratislava R&D centre has been a challenge, since the density of qualified personnel in Slovakia is somewhat lower than in Silicon Valley. However, through the use of well-qualified recruiting firms, we are making progress in staffing the Slovak operation. The exciting nature of the work is helping to attract talent from the CEE region to our R&D centre in Bratislava.



Radoslav Danilák received a state decoration from ex-president Andrej Kiska in January 2019. (Source: TASR)

**TSS: You said in the past that the business around Tachyum has the potential to turn Slovakia into a European chip power. Can you elaborate on this statement?**

**RD:** Prodigy will be a Slovak-produced product. Due to its compelling value proposition, Tachyum expects a fairly steep revenue ramp curve in the cloud data centre market, where power and the sales price are important metrics in the purchase decision. Therefore, the Slovak branch is expected to generate hundreds of millions of dollars of sales within the first few years of the Prodigy's production. In addition, the Bratislava operation will be



engaged in advanced AI solutions development, which will create additional revenue streams for Tachyum in Slovakia.

**TSS: You received a state award from ex-president Andrej Kiska in January 2019. What does this mean to you?**

**RD:** I was honoured and humbled to receive such a prestigious award from president Kiska. Born, raised and educated in my native Slovakia, ever since I immigrated to the USA, I have hoped the day would come when I could repay my homeland for nurturing me and contributing to the success I have enjoyed abroad.

With Tachyum and Prodigy, that day has finally arrived. I set up the corporate structure of Tachyum specifically to insure that Slovakia would be in a prominent position to deliver and support the revolutionary Prodigy product, which will disrupt both AI and data centre markets in the EU, and across the globe.

Prodigy will mark Slovakia as a leader in semiconductor design, data centre hardware, and in delivering “AI for Good, AI for ALL”.

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