GROUNDHOG
CONNECTED MINER SOFTWARE

WHITE PAPER

Building Digital Twins using GroundHog Telematics

For Mining and Construction Equipment

An introduction to Digital Twins

So, what is a Digital Twin?

A Digital Twin a digital copy of something real, modeled to behave realistically. A Digital Twin refers to a digital replica of potential and actual physical assets, processes, people, places, systems and devices that can be used for various purposes. This pairing allows firms to model processes, products and services and enables companies to simulate various scenarios, including increasing throughput, preventing downtimes, developing new opportunities and even plan for the future using simulations. Digital Twinning is achieved by combining current data from the subject with its simulation model.

While the concept has been around since the early 2000's, it is only thanks to the advent and widespread use of the Internet of Things (IoT), and highly scalable cloud based analytics infrastructures that it has become cost effective to implement.

75% of organizations implementing IoT already use Digital Twins or Plan to Within a Year

GARTNER STUDY

The Characteristics of a Digital Twin

The goal of building Digital Twins is to model how the object will respond to different inputs that the entity will likely see in the real world – examples are weather conditions, exposure to moisture, different ramp gradients, engine life, life of transmission and oils, etc. Once the primary factors are identified, mining companies can then run for scenario planning and optimization.

To achieve this, the Twin always needs to represent an operational object – all the way from design to decommissioning, and will always reflect that specific object – for example a Shovel or a Haul Truck.

The Twin should also always represent the object's real-world state. This is typically achieved through user input, or sensors – typically through an IoT infrastructure, or equipment telematics, and should be collected over time for further use. Typically data is collected over 2-3 months so there is enough data points to model the Twin and use in simulations.

Digital Twin Architecture

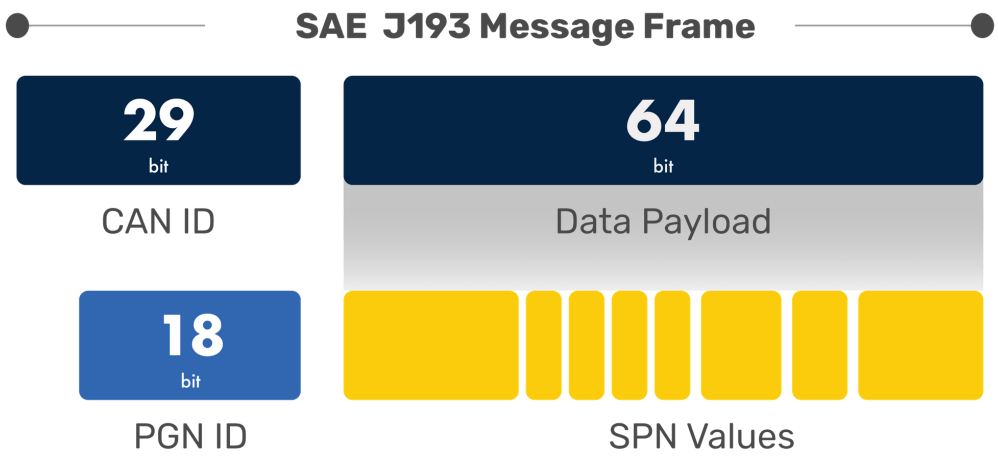
For the most part, Digital Twins are simulations and must represent the real world in some form. Every model will be unique to the object type. It is quite possible to have 1000's of Digital Twins in a large mining operation. So, the tool chain should consider information flows within the system and visualization tools. Companies typically use multimethod modeling environments to simplify development of the model.

On Sensors and CAN-BUS on Heavy Equipment

Today's Mining and Construction equipment come with a multitude of sensors that monitor engine performance, load sensors, temperature, oil quality, air pressure, tire pressure, transmission and many others.

All this sensor data is sent over the CAN-BUS, a protocol standardized since 1983. Almost every piece of heavy equipment now has a standard J1939 port to access the CAN-BUS. Most equipment manufacturers, including all the TIER-1 OEMs of Construction and Mining equipment have adopted the CAN-OPEN protocol.

For all practical purposes, the data is available for everybody to use. The problem, however, is in getting to the data and then operationalizing that data.

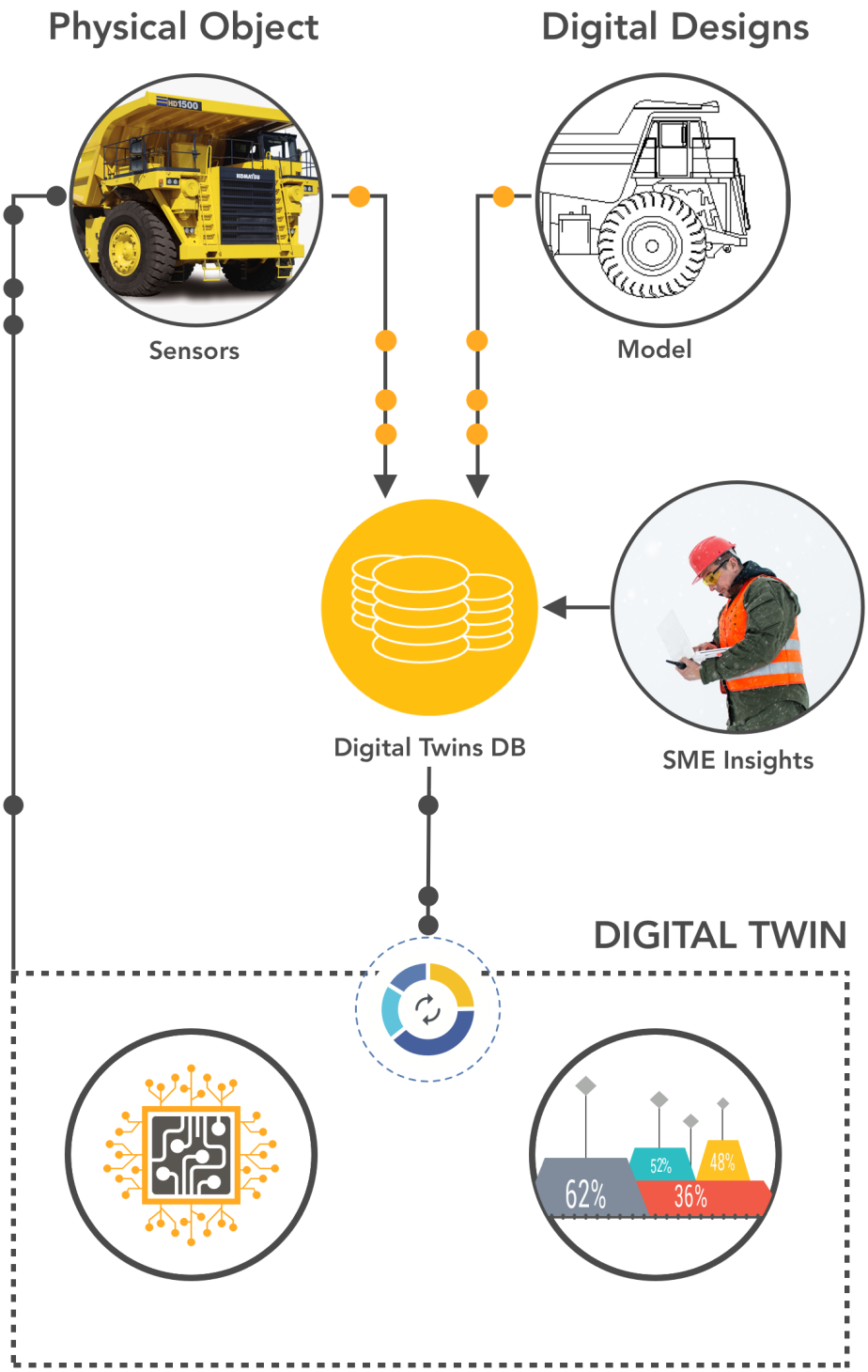


GroundHog Telematics for Digital Twins

GroundHog Telematics, a combination of the GroundHog J1939 dongle and the required software on a standard iPhone or Android phone (or Tablet) to extract data from the CAN-BUS, is easily configured to then automatically push data to a cloud database that is used to model the Digital Twin.

Once a customer has identified a model of equipment, for example a Haul Truck or a Shovel, and has identified all the parameters that affect the performance and maintenance of the equipment, the customer installs the GroundHog Telematics Dongle on the J1939 port on the equipment. The customer also installs an Android Tablet or SmartPhone with GroundHog Telematics on the equipment so it can collect all the information streaming on the CAN-BUS. The customer also configures GroundHog Telematics to an on-prem or cloud instance with the GorundHog Telematics Listener. The Telematics Listener is a wrapper around the Digital Twin's Database connection.

Implementation Architecture for Digital Twins with GroundHog Telematics



If there is an active Cellular, WiFi or Peer-to-Peer network, GroundHog Telemetics synchronizes all collected data with the cloud.

Once there is suffient data associated with the model, GroundHog assists customers to configure the Digitial Twin and run simulations that replicate real object in real-life. Customers can run simulations to find optimal routing schedules, maintenance schedules, and make decisions about their fleet.

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