INDUSTRY: METALS, MINERALS & MINING

Transnet Freight Rail

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"It's like using your GPS…enter start and end destinations and the application will find the shortest route. It's so much better than all those buttons that you had to search through to find a route."

Adenaan Jassiem,
Control System Engineer,
Saldanha Port

Conveyor Routing Optimisation at Saldanha's Bulk Ore Terminal with Help from Wonderware

by Wonderware Southern Africa

Goals

- Greatly simplify the current complex and confusing conveyor routing system;
- Provide a routing system that would cater for current equipment condition;
- Provide a routing system that would cope with expansion and that could be easily updated by the customer;
- Keep track of material locations;
- Record the routes used for material delivery.

Challenges

- Reduce a complex task to the simplest, easiest and minimum user interaction;
- Integrate the conveyor routing system with the port's Material Tracking System.

Solutions and Products

- Wonderware InTouch HMI;
- Wonderware System Platform.

Results

- Dynamic, user-friendly routing system;
- Elimination of invalid route selection;
- Real-time checking of successful delivery while catering for emergency events;
- Scalable and flexible application which allows for expansion and its management.

Saldanha Bay, South Africa - The on-going expansion of Transnet's bulk iron ore terminal at Saldanha Bay has meant that the routing of vast quantities of material from the rail receiving stations to the shipping points had become a logistical nightmare that was expanding exponentially and prone to expensive errors. It was time for a change.

Background

Iron ore is delivered to the port along a dedicated ore railway managed by Transnet Freight Rail (TFR) from the mines near Sishen in the Northern Cape.

Several world records have been set at the Sishen mines including the largest single blasting operation where 7.2 million tons of rocks were broken during a single blast in April 1981. The ore is usually transported to Saldanha by trains 2.3 km long comprising 214 wagons each carrying 100 tons of ore, (i.e. a total of 21 400 tonnes per train). A train with 660 wagons recently set a new world record for the longest train and heaviest load from Sishen to Saldanha with a total load of 68 640 tonnes of ore and a length of over 7.5 kms.

From the rail delivery points, the iron ore is transported by conveyor to stockpiles where it is handled by stacker-reclaimers into fine, coarse and lumpy ore piles and from which it will then be transported onto ships for export on 2.5km-long conveyors.

Figure 1 shows the exponential nature of the routing problem as applicable to one, three and nine conveyors. But the bulk ore terminal has six sources, seven destinations and twenty five conveyors.
The existing system consisted of pages upon pages of hard-wired routes which was totally user-unfriendly, unmanageable and a nightmare to update in view of the continuous expansion of the terminal. For example, the introduction of each new conveyor would result in the possibility of another 40 routes (yet another page of buttons).

Although selecting the appropriate route was an exercise in patience, it could prove useless because there was no guarantee that the selected sequence of conveyors was available for any number of reasons including maintenance, being in manual mode or part of another selected route.

Another consideration is that of the stakeholders. The iron ore is actually the property of various mining houses such as Kumba Iron Ore, Assmang, ArcelorMittal and Sedibeng all of whom need to know about the status of shipments and their location (e.g. stockpiled, loaded onto ships, etc.).

Implementation

What was needed was a dynamic routing system that would cope with the port's expansion and that would allow operations and management to keep track of material and to record the routes used.

The answer to the existing complexity of route selection was a pop-up prompting the operator for the source and destination of the raw material with the system doing the rest after checking for route and individual conveyor availability.

"We designed the module with the intention to integrate with the port's Material Tracking System (MTS)," says Emma Livesey, control engineer at consulting engineering company Hatch Africa. *"The MTS would, in turn, merge the routing information with other data and generate the necessary management reports."*

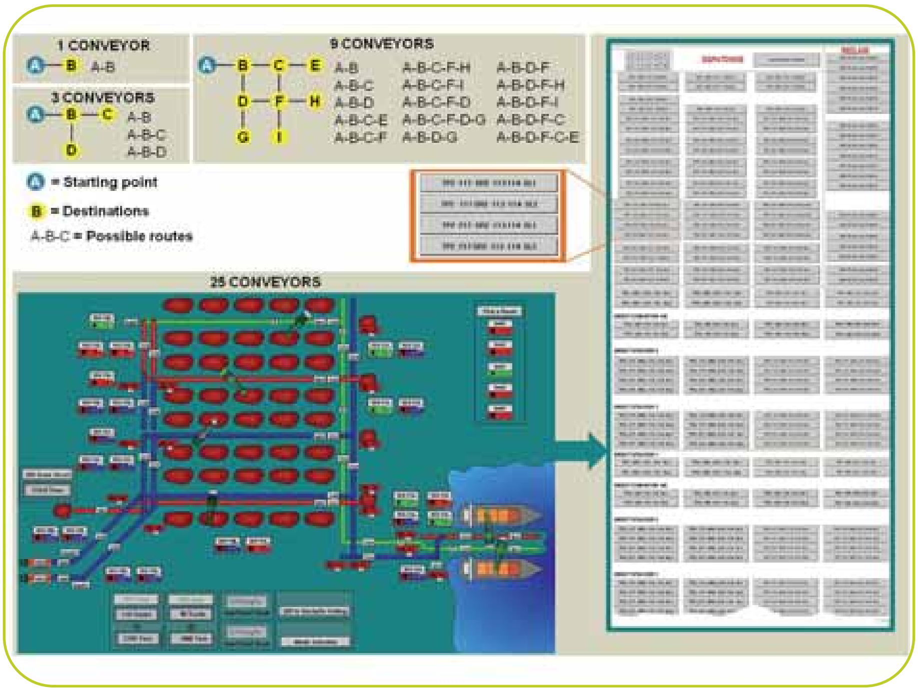

Figure 1: The exponential nature of the routing problem with the increase in the number of conveyors and the impracticality of hard-wired routes.

The port had been using Wonderware products and it was natural to continue with proven solutions but to upgrade the existing Wonderware System Platform and Wonderware InTouch HMI (Human Machine Interface) to their latest releases.

"The Wonderware System Platform, based on ArchestrA's object-oriented technology, allowed us to define standards up-front before developing code. We also defined a toolbox containing our templates," says Livesey.

"We created a conveyor belt template and then created instances of that template each representing a conveyor belt on site. This checks in real-time for the belt being in manual mode, tripped, scheduled for maintenance or already in use – in other words, we check each conveyor's availability. The Wonderware System Platform topology makes adding a conveyor very easy because all the engineering has been done up-front. Additions to the system can be implemented by a technician on site who doesn't need coding experience. This approach saves the client money as HMGJV (Hatch, Mott McDonald and Goba Joint Venture) would not have to be called back to support the system expansion."

The system uses the belt statuses together with the specified source and destination as inputs to a specially-built ArchestrA-object which calculates the shortest possible route.

This is then sent to the '*Unit*' instance (according to ISA-88 standards) which calculates the additional equipment which will be required and the correct placement of such equipment – for example, making sure that the moving head of a conveyor is placed over the correct downstream conveyor.

This information is sent to the PLC where a synchronised start of the conveyor route is initiated.

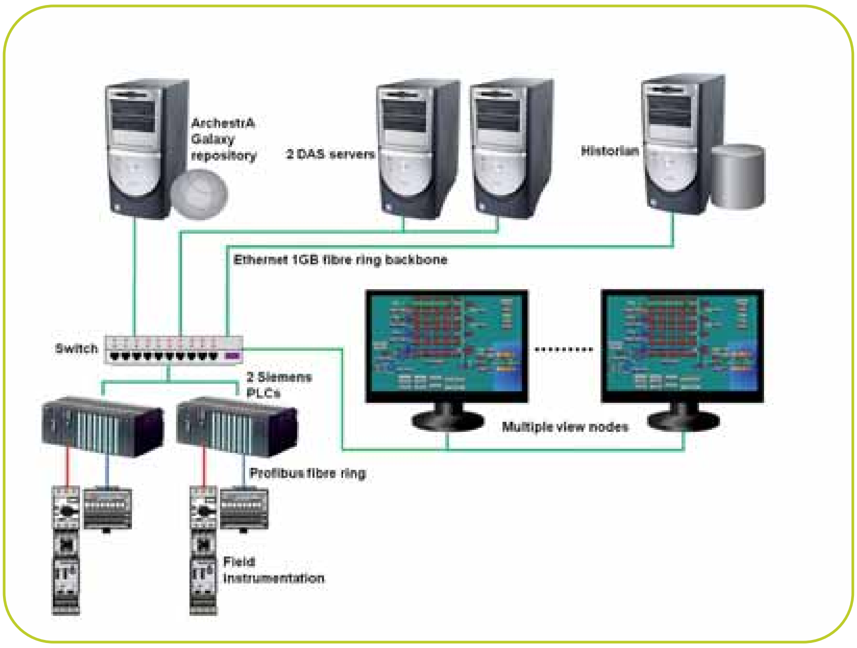

Figure 2: System topology.

Benefits

• Dynamic, user-friendly routing system that can grow with the port and which is in the control of port personnel;
• Elimination of invalid route selection;
• Real-time checking of successful delivery while catering for emergency events;
• A scalable and flexible application which allows for defining increased site functionality and to easily make changes to that functionality (e.g. editing a template and rapidly propagating the change to all its instances) .

Conclusion

Technology is supposed to make life easier and more productive rather than speed-up complexity. This is an example of where existing technology was reshaped to provide a drastically more desirable result through the ingenuity of the system integrator. Quite often, simplifying a complex task to its basics can be the most challenging assignment in any industrial automation application.

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